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Educational Considerations, vol. 3(2) Full Issue

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educational considerations

In this Issue: A special issue on school facilities including articles on capital improvement planning, declining enrollments, energy-conscious buildings, the feasibility of remodeling, financing construction, relating curriculum to physical surroundings, involving the community, and the application of systems techniques to education.

published at kansas state university college of education

viewpoint

This special single-theme issue of *Educational Considerations* presents a coordinated series of invited articles addressing current issues, ideas and trends in educational facility and capital improvement planning. Our editorial frame of reference and intent was straightforwardly conceived and shared from the outset; we wanted to provide practicing school executives with useful information that might contribute to better educational management. We leave the judgment of how well we have accomplished our editorial intent to the reader.

Each article in this issue was specifically written in response to our invitation. In each case we were cognizant of the fact that we were asking busy professionals to rearrange their priority of activities so that time might be given to writing a special article. We take this opportunity to express our thanks and appreciation to each contributing author for a job well done.

Finally, we suggest that while our own primary focus of concern is directed to Kansas education, we nevertheless believe the issues and ideas presented herein are of potential interest to educators throughout the country.

Charles E. Litz
Co-Editor

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Material submitted to *Educational Considerations* can be as brief as a paragraph or as long as, say, 2000 words. All of it, including indented quoted matter and footnotes, should be typed double-spaced. Footnotes should be at the end of the manuscript. Headings should not be underlined. Please submit three copies of each manuscript. The author's complete name, address, and telephone number should be on a separate sheet attached to the original or one copy of the manuscript, not on any copies of the manuscript itself. Photographs, drawings, cartoons, and other illustrations are welcome. Authors should be prepared to provide, if requested, copies of permission to quote copyrighted matter. Queries about possible articles are certainly encouraged; however, a favorable reply is not to be considered a request for the article. For manuscript style other than specified above, be guided by the MLA Style Sheet, 20th Edition, Modern Language Association of America (62 Fifth Ave., New York, N.Y. 10011; May 1978, \$1.25). The editors reserve the right to make grammatical corrections and minor changes in article texts to improve clarity. Address questions about special styles to the Editor.

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preface

school facilities: new solutions to new challenges

During the period from about 1950 to 1970, major questions relating to elementary and secondary school capital improvement planning revolved to a considerable extent around issues of expansion. Questions such as the number of new buildings needed to accommodate increasing student populations and the most appropriate designs for new facilities to be constructed to best meet the needs of a specific curriculum represented the focus of attention in school facility planning. As we moved into the decade of the 1970's, facility planning concerns and priorities have shifted dramatically, primarily in response to decreasing enrollments at the elementary and secondary school levels, and also in response to emerging environmental and energy concerns. The issue of modernization versus replacement of existing facilities is also an item of more serious concern than ever before. Additionally, issues relating to school construction, modification, and capital improvement budgeting which were often not addressed in a systematic fashion especially by smaller school systems are now, because of economic and constituency pressures, having to be responded to in detail by school leaders—often in the arena of public forum. An adequate understanding of new approaches to new challenges in educational facility planning is not a luxury on the part of school managers; it is a necessity.

Demographers are warning that enrollments will continue to ease downward each year into the foreseeable future. The reality of enrollment reductions results in empty classrooms every year in many school districts. Yet, most of these rooms are located in the wrong place within the district. This requires attendance boundary changes, imaginative use of vacated space, and even in some situations abandonment of whole school buildings.

In the realm of energy conservation, we are warned now more vigorously than ever before that energy simply must be conserved. Yet, many old school buildings are replete with energy-robbing inefficiencies, and a great number of those schools constructed in the 1960's reflect little or no attention to conservation of energy. Energy-conscious planning has thus become a guiding theme in constructing new and maintaining existing school buildings.

The cost of construction is continuing to increase—as much as 12 per cent annually—which is auguring against continued effort for construction of new facilities to replace outmoded buildings. This is causing increased attention to the feasibility, both educationally and economically, of modernizing existing facilities.

The rapidity of change in curricular design and instructional methodology is occurring at a rate faster than buildings can be modified to facilitate these changes. The building then, too often, is retarding effective response to important curricular and instructional innovation and change.

Finally, citizens and patrons of the schools are clamoring for more involvement and greater input into educational decision-making relative to school buildings not only at the policy level but at the resultant spending level as well.

In meeting these kinds of facility challenges in the 1970's and in looking toward the 1980's, educational leaders and school executives are being called upon to gain greater technical skill in planning, and also to seek imaginative solutions to facility planning and utilization. Each of the articles presented in this special edition of **Educational Considerations** is responsive to these new orientations and needs in school facility planning.

Samuel R. Keys, Dean
College of Education
Kansas State University

Capital improvement planning provides a regular program for budgeting and fiscal planning. A 6-year plan provides the luxury of reflection rather than stamping out fires in the heat of disaster.

long-range capital improvement planning

By Eddy J. Van Meter and G. Kent Stewart



Eddy J. Van Meter is currently Director of the Center for Extended Services and associate professor of educational administration in the Kansas State University College of Education. During the past 10 years, Van Meter has been principal investigator and director of more than a dozen contracted and research studies, several of which have focused on educational facility and capital improvement planning. Van Meter received his undergraduate degree from the University of New Mexico, and both his master's and Ed.D in educational administration and management psychology from New Mexico State University.

G. Kent Stewart is a native of Indiana where he was a teacher and a school principal prior to completing his doctorate at Indiana University in 1964 where he studied educational administration, specializing in facility planning. For two years following he was director of school facility planning for the State of Delaware. For seven years prior to joining KSU in 1973, he was director of school facilities for the Montgomery County (Maryland) Public Schools where he was responsible for construction of 48 new schools and expansion or modernization of dozens of others. Stewart has done considerable writing and has conducted a number of school building studies in several states including Kansas.

The process of determining needed educational capital improvements can be a regular and orderly planning activity in any size school district through the development of an annual and on-going 5-year capital improvement program. Admittedly, the first such program is challenging and requires a good deal of staff time and effort. Thereafter, however, it is a relatively simple annual task to refine and move forward the next year's program and to add another year to the total plan.

Typically, the 6-year program (annual plus 5 years) is referred to as the CIP—Capital Improvement Program—and is presented to the board of education as a written budget/planning document specifying required capital improvements along with their probable costs and estimated timetables and statements of justification. Ordinarily, the program is based on a fiscal year format extending from July 1 of one year through June 30 of the next. An annual and 5-year program starting with the upcoming fiscal year would appear as follows:

1. Fiscal Year 1977—July 1, 1976-June 30, 1977
2. Fiscal Year 1978—July 1, 1977-June 30, 1978
3. Fiscal Year 1979—July 1, 1978-June 30, 1979
4. Fiscal Year 1980—July 1, 1979-June 30, 1980
5. Fiscal Year 1981—July 1, 1980-June 30, 1981
6. Fiscal Year 1982—July 1, 1981-June 30, 1982

Responsibility

The program (budget) document originates with the superintendent of schools, or in larger school systems at his direction and is presented to the board of education by the superintendent. It is the superintendent's recommended program to the board and upon approval annually becomes the board's CIP to be administered by the superintendent of schools or his designee, usually an assistant superintendent or director of school facilities or perhaps the director of buildings and grounds. The board of education may find it within its wisdom to amend the overall plan annually at the time it reviews the recommended annual plan and the recommended projected 5-year program.

The advantages of moving to a 6-year program are to some extent self-evident. Such a guideline for needed capital improvement expenditures provides the local board with information that permits discussion and board action on a regular, future-oriented and planned basis, thus minimizing potential for capital improvement discussions to become *ad hoc* reactions to emergency situations. A 6-year program also facilitates continuity and stability during board of education

changes by providing the community, including prospective board members, with a capital improvement plan of action that continuously receives public input and scrutiny. The 6-year planning concept also facilitates an orderly process for capital improvement financial planning, wherein school business officials can look toward future expected capital improvement expenditures, rather than being confronted with sudden and too often unanticipated financial obligations. And, finally, the 6-year CIP permits time for reflective judgment and modification, a luxury not often afforded when capital improvement planning is done in an atmosphere of heated debate and usually under pressure of unrealistic time constraints.

Design

The actual 6-year CIP document should be designed to meet the unique and individual needs of each school district. It is typically divided into three major sections as was noted earlier—recommended projects, cost and time estimates, and rationale. These three interrelated parts can be combined into a single narrative relating to each recommendation if the planner finds such a format more concise and presentable. In some instances, cost estimates and timelines for implementation can be displayed in a more precise manner by the use of a standard detail sheet which provides specified information about each recommended project in the total document. A completed example copy of such a detail sheet is presented in Figure 1. The use of a detail sheet of the type presented gives board members and other interested readers a rational basis for comparing recommendations and also provides an easy-to-use method for rearranging projects as changes of priority in implementation are decided upon.

Preparation and Timing

In introducing the 6-year program concept within a school district, it is usually necessary and certainly advisable to conduct initially a rather systematic evaluation for all educational facilities owned by the school system. Such an evaluation may be carried out by district personnel, although with the exception of large districts employing specialists in facility planning, it is usually advisable to contract for such services with a recognized facility consultant or consulting organization. The written report prepared at the culmination of this evaluation of facilities serves as a data-base on which to make the initial set of 6-year recommendations. As each year progresses and an additional new year is moved into place in the continuous program, it naturally becomes necessary to update the evaluation and review. As a practical matter of planning, a district should look toward a rather comprehensive educational capital improvement study approximately every 10 years, while during the intervening period relying primarily on the latest comprehensive study report plus annually revised population and enrollment data as compiled by district personnel.

Budget Document Outline

Following is an outline for a capital improvement program budget document. It can be adjusted to meet local conditions and requirements, but for the most part serves quite adequately.¹

¹ Council of Educational Facility Planners. *Guide For Planning Educational Facilities*, The Council, Columbus, Ohio, 1969, p. 160.

The Annual and Five-Year Capital Improvement Program

Title Page
Letter of Transmittal
Table of Contents
Educational Philosophy and Goals
Program of Recommended Capital Improvements (Upcoming Fiscal Year)
Including Detailed Statements of Projected Justification
New Schools
Additions to Schools
Alterations and Renovations
Furnishings and Equipment
Related Facility Needs Not Including Land
Land (Site) Acquisitions
Program Statement of Required Expenditures
Program Statement of Income or Revenue
Anticipated Projected Five-Year Program of Capital Improvements*
Appendix**

Budget-Making Calendar

The budget-making calendar is a function of state law and of the size of the school district—the larger the district, the longer the process. There are three stages in the budget-making calendar. The preparation phase, the review and adoption phase, and the implementation phase.

The preparation phase, especially for the first CIP, lends itself nicely to overall needs assessment and delineation of priorities. Once this has been done, the recommended projects by fiscal years can be entered into the total program and the costs estimated, with their justifications developed.

The review and adoption phase is a function and responsibility of the superintendent of schools and the board of education. The budget document is presented to the board, examined in detail, possibly reduced or otherwise adjusted, and formally adopted. Greatest concentration is spent on the upcoming fiscal year, but careful attention is also given to the five-year projection. Hopefully, the board of education will finally adopt the total 6-year program with the understanding that review and program adjustment will occur annually.

The implementation phase is perhaps the most important because it represents the culmination of weeks or months of planning effort. Also, this phase reflects the skill of the person or persons who assembled the budget in testing their accuracy in cost estimating, project timing, and political finesse in justifying capital improvement project requirements.

Project Timing

The most critical task in effectively implementing an approved capital improvement project is to assure that the timetable is accurate and the project is phased so that

*The rapidity of change in educational facility costs requires that only approximate costs be listed in this section of the budgets. Cost estimates for projects in the upcoming fiscal year should be very accurate.

**The content of the Appendix will vary widely with the size of the school system and the resulting complexity of the budget document.

Figure 1. Detail Sheet for Describing Recommended Capital Improvement Projects.

FISCAL YEAR 1977 ESTIMATED COST \$920,000 PRIORITY 1
 SCHOOL NAME New Northwest Elementary School
 DESCRIPTION OF PROJECT A 12-room, 325-student capacity, Grades K-6 elementary school to be located on an 8-acre, already owned site in the northwest portion of the school district.

ESTIMATED COST

General Construction	\$ <u>421,600</u>
Electrical	<u>154,400</u>
Mechanical	<u>151,200</u>
Furniture and Equipment	<u>65,000</u>
Architect/Engineer Fees	<u>47,500</u>
Other Costs (Inspection)	<u>8,000</u>
Contingency	<u>42,850</u>
Total	\$ <u>.890,550</u>
Site Development	<u>29,450</u>
GRAND TOTAL	\$ <u>920,000</u>

TIMETABLE

Program Requirements to Architect	<u>Apr., 1976</u>
Schematic Plans**	<u>May, 1976</u>
Design Development Plans	<u>June, 1976</u>
Construction Drawings	<u>Aug., 1976</u>
To Bidders	<u>Aug., 1976</u>
Receive Bids	<u>Sept., 1976</u>
Award Contract	<u>Sept., 1976</u>
Complete Construction	<u>Aug., 1977</u>
Occupy	<u>Sept. 1977</u>

**Referendum—

Breakout of Cost by Cash Flow Requirements Per Fiscal Year.

Total Estimated Cost \$ 920,000

Cash Requirements by

Fiscal Year	FY <u>1977</u>	\$ <u>740,000</u>
	FY <u>1978</u>	\$ <u>180,000</u>
	FY <u>--</u>	\$ <u>---</u>

Date Sheet Prepared March 10, 1976

scheduled completion is realized. The larger and more complicated the project, the more difficult this task becomes. For example, to build a large high school may require three years of planning and construction effort. Sometimes it is profitable (especially in non-referendum projects) to budget planning funds one year, construction funds the next year and perhaps even defer equipment funds until the third year. This technique requires careful budget timetable planning but results in savings when one considers that it is difficult to re-invest bond monies to realize a return greater than the interest payments, especially considering the

relative short term of investment and the necessary hold back of monies to meet cash flow requirements.

Conclusion

School district enrollment and population, financial ability and effort, condition of buildings in relation to curricular change, and cost of construction are critical areas of concern in capital budgeting. Continual study of these variables blended with active public involvement in decision-making represents the keystone of effective annual and long-range capital improvement planning.

The superintendent of a suburban school district explains how his community plans for declining enrollments.

schools in a time of declining enrollments

By Arzell L. Ball



Arzell L. Ball has served as Superintendent of Shawnee Mission Public Schools since 1967. Prior service includes Deputy Superintendent, Lincoln, Nebraska Public Schools, and secondary principal in Wichita. He has a Bachelor of Science Degree with major in social studies from Southwest Missouri State College, a master's degree from the University of Arkansas, and a Ph.D. in school administration, George Peabody College.

As in most other school systems across the country, the enrollment graph for the Shawnee Mission School District has peaked and then fallen after decades of relentless upsurge. Our projection is for continued decline in student population at least through the mid-1980's, and this trend will contribute substantially to profound changes in how we run our schools and what we require of them.

In 1922 the first high school opened its doors in Johnson County, then a sparsely populated rural community on the western outskirts of Kansas City, Mo. It had an enrollment of 187 students in grades 9 through 12, and a published budget that first year of \$22,490. Since that time, however, and especially post-1940, the community has experienced rapid growth, sprawling suburbs, and increased demands for taxpayers' support of new community and educational services.

Today, Shawnee Mission is a modern suburban community, typical of many in the United States, expecting modern education and modern school facilities. It has traditionally supported its schools, and now is served by a "unified" school district providing a progressive educational program for almost 41,000 students in 64 schools. Those numbers have declined, however, from over 46,000 students in 1970 and 66 schools in the 1974-75 school year. It is, as the expression goes, "a new ball game."

For the 1970's and beyond we face, broadly speaking, three key areas of challenge—educational, demographic, and political. We need to give the students we have the most incisive and comprehensive education we can; to adjust our facilities and boundary lines for the most effective service of those students, and to combat public complacency and engender community support in the face of declining enrollments, shifting boundaries and evolving programs.

Educational Challenges

On the educational front, providing adequate school facilities to instruct *all* students in a comprehensive program is paramount. The term "comprehensive" is important, also, because it counters the assumption that a decline in student enrollment necessarily results in surplus space. The impact on school facilities of this transition from the "Three R's" into "comprehensive education" already can be seen, for example, in the following areas:

- The development of learning centers, providing space for special diagnostic teams to work individually with gifted students, underachievers, learning disabled, etc.

- The evolution of libraries into "multi-media centers" which require additional space for equipment and instruction.

- The arrival of sophisticated "instructional technology," again requiring additional space for such items as computer terminals, reading machines, video and audio recorders, etc.

Title IX mandates for "equal opportunity" between the sexes also will have their impact on school facilities, and will further consume space vacated by declining enrollments. We must make room for more girls in shop and more boys in home economics, and we must provide adequate facilities to accommodate the greater number of girls participating in competitive athletics. In the Shawnee Mission District, for example, we now have 19 senior high school competitive sports—10 for boys and 9 for girls—compared with a total of only 4 in 1969 (none for girls).

Girls and boys must be provided with equal access to such facilities as tracks, football/volleyball/soccer fields, and gymnasiums, and to such equipment as whirlpool baths and gymnastic devices—necessitating duplicate equipment where "coeducational" participation is prohibited. In the overall area of extracurricular activities, in fact, involvement by all Shawnee Mission students has increased from about 30 per cent in 1969 to about 68 per cent today. Again, more space is needed.

The integration of previously segregated special education programs into K-12 school systems also has required additional facilities. In one of our elementary schools, 10 classrooms serve between 12 and 20 multiply handicapped children, while special education resource rooms in other regular schools provide supplemental instruction for the deaf student and the blind student.

A pupil-teacher ratio of 10 to 1 is mandated by law for emotionally disturbed and severely mentally retarded students, and this entails more classroom space. Additionally, although integration of all students into the regular classroom is the ideal, our district has set aside one entire school building for youths who require an alternative education program.

Another impact area is in the expansion of career education, with career guidance centers in each high school, and more space needed for vocational programs such as agri-industries (construction of a greenhouse), food service (availability of adequate space for a restaurant setting), etc. Thus, as our conception of the function and scope of public education expands, and as our expectations increase, we will continue to need more space per child to fulfill enhanced expectations of performance.

In light of these and other developments, the educational leadership in a community will need to reassess the neighborhood school concept and answer some key questions. For instance, what is the minimum number of students who must reside in a given area before it becomes "affordable" for the community to construct a neighborhood school? Should the board of education have some firm expectations as to the length of time that a given area will be populated with school-age people? How important is the neighborhood school concept to the achievement and social growth of students?

Along these same lines, it is proving financially unfeasible to continue the neighborhood concept on the junior and senior high school levels, and for this reason the notion already has been discarded in the S-M district. We also may need to expand the 1-mile radius now generally used to define the area served by a neighborhood school, perhaps to a mile and a half. Educationally, then, emphasis during the 1970's is shifting from providing more space for more children to making room for new programs, services and approaches.

Demographic Challenges

Despite this, however, there is no doubt that in some cases existing schools will have to be closed and that in others new ones will have to be built. But if an older school must be closed, at least three major considerations should be kept in mind. First, the closing must be accomplished without violating the neighborhood school concept. In other words, if at all possible area residents should not be deprived of a neighborhood elementary school unless very few children are involved.

Second, such a closing should be effected only when there is sufficient demographic evidence to show no projected return or influx of school-age children. For example, our district co-funded a demographic study by the Johnson County Community College which clearly projected an overall enrollment decline through the 1970's, although some areas within the district actually will grow in enrollment during that period. The study was designed to predict population characteristics within the county, taking into account possible future social, economic and political factors which could affect migration patterns as well as birth and death rates.

Finally, any new use of a school building closed as an enrollment center should enhance, and definitely must not detract from, the quality of life in the community. In one instance, after an old school building in our district was torn down, the vacated land was converted into a public park and recreational area. In the case of another elementary school, closed due to enrollment decline, the building was purchased by the University of Kansas Endowment Association and will be used for college extension classes.

Shifting of school boundary lines is another crucial issue, and any such changes must be done as part of a long-range plan for facility needs so as to achieve sufficient use of underpopulated schools and relieve problems in overcrowded areas. They also must be done equitably, with decisions made based on hard data, not personal bias. To this end, in November, 1973, the Shawnee Mission School Board appointed a joint committee of patrons and administrators to develop short-, mid- and long-range recommendations on boundaries and enrollment. After almost a year of deliberations, their proposals were filtered through a gamut of board meetings and public hearings before final acceptance in modified form.

The construction of a new school is an equally sensitive undertaking. It must be initiated only after gaining community consensus on the neighborhood school concept and the educational benefits to be derived therefrom; it must be shown to be "cost effective" to the school district and

community, and it must allow for increased community use of school facilities.

Political Challenges

This last notion is a vital "political" consideration as well. Increased availability of the schools for community use will become essential to prevent growing public complacency in the face of declining enrollments. In maturing neighborhoods, space for senior citizens to congregate and interact also must be provided. In addition, a compromise must be reached between student and community access to sports facilities such as tracks, baseball diamonds, gymnasiums, etc.

As usual, however, a central "political" factor will remain, very simply, dollars. Modernization of present facilities and construction of new schools eventually will require public support of a bond issue. But this bond issue can be requested only after the board of education demonstrates significant efforts in changing boundary lines, closing older schools and insuring budgetary efficiency. Such a bond issue also must support "comprehensive" facilities improvements throughout the district, and not simply relieve short-range or provincial needs.

Increasingly, board members, educators and the community alike will be called upon to operate the schools more like "community centers" rather than as simply educational facilities.

The Future

The challenges of the next thirty years will spawn problems no less imposing than those which faced educators from 1940 to 1975. More and more, both new legislation and greater community pressure will require schools to provide broader services than in the past. Extracurricular activities among students will expand and the schools will be made more available to the general public for educational, recreational, and cultural purposes. Construction of new schools will not be permitted without first providing for these expanded services and clearly establishing a long-range need for the building as primarily an educational center for students.

With the prospects of continued economic hard times, watchdogs in the general public and teacher organizations alike will place more pressure on boards of education to make efficient use of community schools. Administrators will need to bolster themselves against extremes advocated by special interest groups who would seek to expand extracurricular activities at the expense of community access to school facilities, or to curtail community use and extracurricular activities to create more dollars for employees' salaries. Such a formula, in the long run, would be severely detrimental to educational opportunity for students and community support.

Finally, the Board of Education will need to constantly remind school district residents that good school programs and good school facilities contribute to the educational, cultural, recreational and social vitality of the community.

the interest is there

In a research survey of the learning preferences and experiences of adults conducted for the Commission on Non-Traditional Study, sponsored by the College Board and Educational Testing Service, we found that 77 percent of the people between 18 and 60 in this country would like to learn more about something.

The New Learners. K. Patricia Cross.
San Francisco: Jossey-Bass. 1972. pp. 71-72.

We no longer have a choice about energy-conserving facilities. Necessity has replaced preference as a motive for eliminating wastefulness.

energy-conscious schools

By Dwayne E. Gardner



Dwayne E. Gardner obtained his Ph.D. degree from the University of Nebraska in 1961. He spent several years in the U.S. Office of Education as a school facility specialist. In 1971, he became executive director of the Council of Educational Facility Planners, International. Gardner is also an assistant professor and co-ordinator of field services at Ohio State University.

To regard the current high costs and scarcity of energy as temporary inconveniences is delusory. To regard these same conditions as problems for others to cope with is irresponsible. And yet, as we now prepare for a third winter in which the energy crisis will be a big ecological and economic issue, unless one is immediately and unpleasantly affected, it is all too easy and human to ignore the problem. Nevertheless, the somber reality persists in rising fuel costs, cutbacks and rationing. Schools, as major consumers of energy, must begin or continue to conserve in earnest.

The purpose of this article will be to provide an overview of the following issues:

- how did schools arrive at this predicament
- why is conservation in schools imperative
- what measures can schools take to conserve energy

Schools and Energy Use

That schools are consumers of massive quantities of energy is certainly not a unique institutional trait. Because we as a nation have become adjusted to plenty of everything, and have traditionally used more than we have needed, the careless and wasteful consumption of energy in educational facilities—while a distinct problem—is representative of widespread practices and attitudes.

Until recently, frugal energy use was a low priority concern for school planners. They were preoccupied with providing enough space for anticipated numbers of students and with designing the types of space to best support educational programs. Size and program considerations were reconciled with financial capability, and design decisions were made. Interestingly, the initial building cost—rather than long-range cost—was a predominant consideration. Rarely did anyone investigate how much the operation and maintenance of the plant would cost. This emphasis on first cost has proved troublesome because it has resulted in the construction of building shells and installation of equipment that use excessive quantities of energy and are expensive to operate.

An additional contributor to the predicament is the inefficiency with which schools often operate their equipment. The resultant waste is due to inadequate understanding of sophisticated equipment by the operators. The complexity of some HVAC systems, for example, can be

Susan K. Gwynn collaborated with Gardner in producing this article. She is a full-time research associate for the Council of Educational Facility Planners in Columbus, Ohio.

confusing and unintentional maladjustment of controls is not uncommon.

Finally, the energy crisis in schools—and elsewhere—has been aggravated by the absurd expectations we have developed regarding the built environment (it is silly to expect instant and constant thermal comfort), and our alienation from nature (we don't always make full use of natural light, heat and cooling sources in planning buildings).

The Importance of Conservation

Energy conservation in schools is vital for a variety of reasons. Primarily, the energy sources we have carelessly plundered are finite. Developing energy consciousness and effecting changes in the design and use of schools has ceased to be a matter of choice. Moreover, whether we consider ourselves to be the losers in games played by profit-seeking industries or antagonistic oil-producing nations is quite irrelevant. Since necessity has replaced preference as a motive for eliminating wastefulness, national attention is clearly focused on avoiding escalation of the energy crisis. Schools can play a significant role. If responsible educational policy makers proceed with extensive energy-conserving practices, their efforts will serve as an encouraging model to others.

The built environment (its construction, use, and replacement) consumes approximately 30 per cent of the energy the nation as a whole uses. Because schools constitute approximately 7 per cent of the built environment, they represent a significant user category. (Stein: 73) Therefore, when schools develop their full energy conservation potential, it will indeed make a difference in terms of the nation's resources and the economy of school operation.

How Schools Can Conserve Energy

Others have written extensively and informatively about ways schools can conserve energy. It is not possible to reiterate those concepts here. However, several points should be emphasized.

It has been demonstrated that 10 per cent decreases can be made in the estimated 25-50 per cent energy waste in schools (statistic verified by the National Bureau of Standards) with no capital investment. This 10 per cent reduction can be achieved simply by changing the way the building and equipment are operated, i.e., by turning off unneeded lights, setting the thermostat for moderate temperatures, lowering illumination levels, properly servicing equipment, and so forth. These modifications will not inconvenience users because they simply entail the elimination of habits which serve no beneficial purpose. For instance, students in the United States work with a recommended 70 foot candles of illumination whereas in England the average school lighting level is 10 foot candles! It is difficult to believe that the

intellectual development of British children is being thwarted by lower levels of illumination; perhaps a change in our own practices is suggested.

In order to effect additional energy reductions, schools can make further environmental changes: improve building insulation, recover waste heat, convert to fluorescent lighting, and refine HVAC systems to mention only five. Such projects would require capital investments, but the expenditure can be justified in terms of dollars saved and the merit inherent in well-managed energy use. The prudence of investing in conservation is easily supported by life-cycle costing calculations.

In the case of new construction, enormous economic benefits are possible. A report by the Educational Facilities Laboratory (1973) states, "with the clearly stated goals of energy conservation and life-cycle costing in the architectural program, a school building's energy consumption can be reduced by up to 50 per cent compared with a conventionally designed building."

If well-managed and consistent, conservation need not result in the curtailment of programs or, as occasionally happens, prevent full use of the facility. To react to high energy costs by closing a school to community groups (for instance, to make a gymnasium unavailable for rental or to eliminate adult education programs) seems ill-advised, especially now when the potential of educational facilities as community resources is being recognized. Every attempt should be made to preserve the integrity of the school's program.

Coping with the Crisis

Given the facts that schools can do a lot to help themselves and that expertise is available to them on highly technical matters, conservation should be accepted as standard school design and operating practice. However, there are activities which would assist energy conservation in schools which lie outside the responsibility of school district policy makers and the design professions. For example, there is no federal program which offers substantial assistance to schools hard-pressed by the economic impact of the crisis. Research and development of new energy sources has not been undertaken on a large scale. Support for demonstration sites should be made available to illustrate the capacity of schools to efficiently use energy and to utilize new technologies. As these activities proceed, our capacity for coping with the energy crisis will be enlarged.

Richard Stein, August, 1973, *CEFP Journal Special Report 9, Energy Conservation, A New Challenge for Education*.

The Economy of Energy Conservation in Educational Facilities, 1973. New York: Educational Facilities Laboratories, Inc., p. 48.

Each year buildings are remodeled which should have been razed and buildings are razed which could have been remodeled economically. It all adds up to wasted tax dollars.

the feasibility of remodeling

By G. Kent Stewart



In 1973, G. Kent Stewart joined the educational administration faculty at Kansas State University after spending 18 years in public education in Illinois, Indiana, Delaware and Maryland. He holds degrees from Indiana State University and the University of Illinois; and in 1964, received his doctorate at Indiana University. In addition to teaching and a secondary school principalship, he has spent the past 13 years specializing in educational facility planning. During a 7-year tenure as director of school facilities in the Montgomery County (Maryland) Public Schools, he was responsible for constructing 48 new schools and modernizing and expanding dozens of others.

Feasibility studies are defined in a variety of ways. As far as this brief treatise is concerned, they are studies done by architects and/or engineers to determine whether it is better educationally and financially to remodel or to replace existing school buildings. While the question has important financial implications it is amazing that many school superintendents and their boards of education are reluctant to have a good feasibility study done in their districts. One reason is that some superintendents do not have the time or the staff personnel to instruct the architectural-engineering team; and secondly, some school boards are reluctant to spend the money necessary to have a feasibility study done. The problem is *not* unique to Kansas—it is nationwide; and each year, buildings are remodeled which should have been razed and buildings are razed which could have been remodeled economically. It all adds up to wasted tax dollars in a time of intense public concern over the cost of education.

Suppose an existing building is ready for either modernization or replacement. Suppose further that the estimated cost of replacement is \$2,600,000 and the estimated cost of modernization is \$1,000,000. Usually, the community and the Board of Education split on which alternative should be chosen. In spite of the apparent soundness of the debate and rhetoric which follows, it is doubtful that any of it is based on sound analysis backed up with factual data. Feasibility studies can help avoid these kinds of conflicts.

The Keystone of a Good Feasibility Study

The key to a good feasibility study is to prepare a precise set of instructions to architects and/or engineers describing exactly what is to be studied. School executives often overlook the importance of this first step and the architect is left with the question of just what he or she is to study the feasibility of! To state simply that the building is to be remodeled is a grossly insufficient instruction. A feasibility study should raise questions such as the feasibility and cost of: new heating equipment, air-conditioning, heavy-up of electrical services, replacement of energy-robbing window sash, removal of certain classroom partitions, expansion of the library, renovation of physical education and athletic facilities, modernization of specialized instructional areas, re-equipping of the kitchen, carpeting for floors, lowered ceilings, new lighting, roof and flashing repairs, meeting fire code requirements and improvements to the site and outdoor game areas. These questions must be included in the charge

of the instruction to the architect. For example a portion of the charge might read . . .

"You are to determine the feasibility of expanding the library into the adjacent small classrooms on the north and south thereby generating space sufficient to transform the library into an instructional media center. If the transformation can be accomplished, the main reading room will need to contain some 1,200 square feet of space with auxiliary spaces consisting of 150 square feet for a conference room, 400 square feet for a combination workroom and storage room, and 200 square feet for storage of audio-visual and other electronic teaching equipment. The total area would amount to some 1,950 square feet of floor space. The ceilings are to be lowered, the new space to be re-equipped with modern library furnishings and cabinetry and the room re-lighted in accordance with current standards. The floor is to be carpeted in the main reading room and the conference room and because of projected summer use, the expanded facility is to be air-conditioned."

The above example shows the kind of detail the architect and engineer must have to make sound technical judgments about the feasibility and cost of effecting the proposed changes.

If the superintendent of schools does not have the time or the range of experience with facility projects necessary to prepare such detailed instructions, then it is advisable to retain a consultant to write the program of project requirements. Facility consultants familiar with this type of programming can perform the service rather quickly. Even with extensive input from teachers and community leaders the project can still be programmed in a matter of only a few actual days of effort.

The Cost of a Feasibility Study

Feasibility study costs range in direct proportion to the size and requirements of the project being studied and particularly with the availability of architectural and engineering drawings of the original facility. The older the building, the less likelihood there is of having a complete set of drawings from which to initiate study.

From the author's own experience with a wide variety of feasibility studies over a number of years in three states, the cost will usually range from 2 to 3 per cent of the estimated cost of the modernization project. If the project would amount to \$1,000,000, then the cost of the feasibility study might range upward to \$30,000. This sounds like a great deal of money, but it is money well spent if the results of the study show that it is feasible to remodel at a cost of \$1,000,000 while replacement might cost \$2,600,000. If the decision is to replace, the money for the study is well spent because a costly boondoggle has been avoided. If the decision is to remodel, the money is also well spent because the architectural sketches (schematic drawings) and much of the engineering work is completed which materially reduces the architectural fee (by 2 to 3 per cent) providing the same architect is used for the total project.

Formulas to Aid Decision-Making

For many years architects and facility specialists have grappled with the problem of developing formulas and

guidelines for adding credibility to decisions concerning remodeling versus replacement of school buildings. One such formula suggests:

if $\frac{C_e + C_h + C_s}{(L_m) (I_a)}$ is less than $\frac{R}{L_n}$ then modernization is feasible.

Key:

C_e = Cost of educational improvements, like carpeting
 C_h = Cost of health improvements, like better ventilation
 C_s = Cost of safety improvements, like fire detectors
 L_m = Estimated life of the modernized building
 I_a = Index of educational adequacy (0.1 to 1.0)
 R = Replacement cost not including cost of a new site
 L_n = Estimated life of a new building

Experts in the field are in general agreement that the useful life of a new building will approximate 50 years; however, the estimated life of a remodeled building and the index of its educational adequacy—that is, its adequacy in relation to a new building—are both items of conjecture and here lies the inherent weakness of this formula. Nonetheless, it represents one important tool to aid in decision making.

Suppose architects and engineers had completed a feasibility study on a 1,000-student-capacity high school according to program requirements prepared by an educational facility planning consultant and the estimated cost figures were substituted in the formula as follows:

$$\text{if } \frac{400,000 + 200,000 + 120,000}{(20) (.6)} \text{ is less than } \frac{4,000,000}{50}$$

$$\frac{720,000}{12} < \frac{4,000,000}{50}$$

$$\$60,000 < \$80,000$$

it would be feasible to remodel because \$60,000 is less than \$80,000.

Another formula used widely is based on an estimated unit cost of value per year. This formula suggests:

$$\text{Per Pupil Cost Per Year} = \frac{\text{Estimated Cost of the Facility}}{\text{Number of years of estimated life} \times \text{Number of pupils per year}}$$

Using the above example, the per pupil cost per year for remodeling would be:

$$\text{Per Pupil Cost Per Year} = \frac{720,000}{(20) (1,000)}$$

$$\text{Per Pupil Cost Per Year} = \frac{720,000}{20,000}$$

$$\text{Per Pupil Cost Per Year} = \$36$$

For replacing the same school, the formula would yield the following data:

$$\text{Per Pupil Cost Per Year} = \frac{4,000,000}{(50)(1,000)}$$

$$\text{Per Pupil Cost Per Year} = \frac{4,000,000}{50,000}$$

$$\text{Per Pupil Cost Per Year} = \$80$$

The conclusion again is that it is more feasible to remodel than to replace this particular school. (Remember that site costs were omitted from these formula considerations.)

Two other rules of thumb are used in helping determine whether to remodel or replace a facility. First, when remodeling equals or exceeds 50 per cent of replacement cost, replacement should be considered; and secondly, when any two of the following building component systems require replacement, serious consideration should be given to abandoning the building as a school and replacing it entirely. These are:

1. The plumbing system.
2. The heating system, especially if air-conditioning is to be added.
3. The electrical system including lighting fixtures.
4. Complete roofing, flashing, and guttering.
5. Complete fenestration (doors and windows).

6. Structural problems (deep wall cracks, sagging floors, sagging roofs, deep foundation cracks and extensive required tuck-pointing).

Conclusion

The rationale for modernizing schools is threefold—first, to improve the building's functionality in relation to teaching and learning; secondly, to improve health, safety and comfort; and thirdly, to improve appearance. Yet, the overriding question is always money. By having a good feasibility study done supported by sketches and cost estimates, and by using the formulas and guidelines presented herein, a more rational decision can be reached about remodeling versus replacement.

Castaldi, Basil. *Creative Planning of Educational Facilities*. Rand-McNally and Co., Chicago, 1969, Chapter 15.

Council of Educational Facility Planners. *Guide to Planning Educational Facilities*. The Council, Columbus, Ohio, 1969, Chapter 12.

Bales, Harold. *Step By Step to Better School Facilities*. Holt Rinehart, and Winston, New York, 1965, Chapter 18.

the final answer

A student attended his first economics class. "Dull," he said and cut every class after that until examinations. The professor smugly okayed his request to take the final. The student was faced with a multiple essay question: Explain how the fishing territorial rights in the Atlantic Ocean affect Iceland, the United States, Finland, and Russia. What is the impact on trade and commerce, the political arena and society? And lastly, how will it affect the fisherman, manufacturer and consumer? The student's first line was "I will answer from the viewpoint of the fish."

"What will you be doing in 1985" by Gus Merkel
in **Journal of Organizational Communication**. 4:3. p. 6

How can the physical environment hinder or facilitate the teaching/learning act? The facility should be flexible and complement the variety of teaching methods.

relating curriculum to facility planning

By Gerald Douglass Bailey



Dr. Bailey, an assistant professor of Curriculum and Instruction at Kansas State University since 1972, is particularly interested and active in competency/performance-based education, inquiry behaviors and techniques, and teacher-student interactions. He earned his bachelor's, master's and Ed.D. degrees at the University of Nebraska at Lincoln.

Few school personnel would disagree with the importance of a comprehensive curriculum in a school system. Likewise, few people would disagree that adequate physical facilities are necessary for a school to function effectively. Paradoxically, schools across the nation often reflect a situation where physical facilities and curriculum are not complementary and are even in opposition to one another.

Historically, there are probably a variety of reasons for this state of affairs. Some of the more widely accepted reasons are:

1. Educators in the school hierarchy have either discounted, underestimated or misunderstood the importance of the relationship between curriculum and physical facilities.
2. Architectural structures have been planned and constructed with little or no reference to school philosophy or the established educational goals.
3. Those people most involved in the daily formation and translation of curriculum have not been directly involved in the various stages of school planning and construction.
4. Of late, school structures have been constructed to facilitate a distinct and/or single teaching-learning methodology rather than to provide for varied methodological approaches.

Engendering broad solutions to these problems is not an easy task. The interfacing of curriculum with physical facilities is a laborious and complicated enterprise. The following suggestions should not be viewed as solutions in themselves but rather as individual steps in a process to solve the problems associated with the curriculum/environment relationship.

Educators within the school system need to become more aware of the relationship between the learning environment and curriculum. While this step of awareness may manifest itself in a variety of ways, it may simply begin by having educators (administrators and classroom teachers) ask themselves the following questions:

1. What am I attempting to do?
2. Do I have the support facilities to carry out my objectives?
3. What are the advantages and limitations of the physical environment?
4. How are other disciplines functioning within the existing physical structure?
5. What are other schools in the school district doing to establish an effective relationship between the environment and curriculum?

6. How are other schools across the nation attempting to coordinate their physical environment with the curriculum?

An increased awareness level may also be accomplished by organizing school-related interest groups or by initiating faculty meetings which focus directly on the curriculum/environment issue.

A more harmonious relationship between the school curriculum and physical facilities will result when educators become more involved in solving their problems associated with physical facilities. The foundation of an effective school begins with attaching significance and priority to physical facilities and their relationship to curriculum. However, cognizance of the relationship between curriculum and physical environment is not enough. Both administrative and teaching personnel must encourage and facilitate formal and informal research endeavors relating to the school facilities and curriculum offering.

Formal research involves the trained educational researcher who is interested in finding out how the physical environment acts to hinder or facilitate the teaching/learning act. This type of research can help fill a void concerning the psychological effect of environmental conditions on student achievement and attitude. An equally important kind of research can be conducted by those directly responsible for classroom instruction. Action research* is a less rigid form of scientific investigation which can help teachers solve the immediate problems associated with support facilities and the curriculum offering. Too often decisions which relate to how teachers utilize physical facilities are based on visceral level feelings rather than on data gathered through a systematic problem-solving approach. Results drawn from action research can be invaluable when planning for new physical facilities or renovating existing structures.

A school curriculum with a complementary physical facility can only be achieved when architects as well as educators recognize that classroom instruction can and does involve more than one teaching method. Any attempt to build new physical facilities or modify existing structures will necessitate the acknowledgment of this principle. The myth still prevails that classroom teachers utilize only one basic method of instruction. In reality, teachers utilize a wide variety of teaching methods including lecture, discovery, inquiry, gaming/simulation, small group, tutorial study and independent study. The axes depicted in Figure 1 show the possible interaction patterns between teacher and student.



Figure 1. Classroom Instructional Interaction Axes

Physical facilities need to provide the flexibility of moving from one axis (mode of instruction) to another with ease and

*The process by which practitioners attempt to study their problems scientifically in order to guide, correct and evaluate their decisions is called action research.

minimal confusion. Equally important, the physical environment must allow these methods to occur simultaneously. (For example, a teacher may have students engaged in small group discussion while at the same time, another group of students may be watching a film). Almost without exception, current architectural structures do not provide the necessary visual and audio isolation required in multiple and varied instructional strategies.

School districts seeking to make decisions about physical facilities need to gather comprehensive information about the needs of the existing curriculum and the demands placed on current physical facilities. Establishing this type of data base should include systematic information gathering involving a broad base of people in the operation of the school.

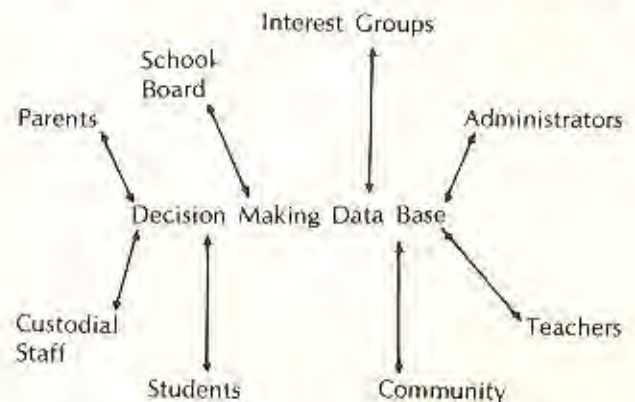


Figure 2. People Affecting School Operation

Soliciting information from these people may be accomplished through formally prepared questionnaires and personal interviews or informally through interest group meetings. While it is logistically difficult to gather information from different population segments affecting the school, it is extremely important that these people feel a part of the decision-making process.

School districts interested in producing a complementary working relationship between school facilities and curriculum should be cautious about building physical facilities which accommodate only one methodological approach. A number of schools have been built to facilitate innovative educational concepts (i.e. team teaching, open education and competency-based education). While these architectural activities may be laudable, they can be a costly error to the school district if (1) the educational innovation proves to be nothing more than a passing fad, (2) the majority of participating teachers are in opposition to the philosophic tenets of the innovation, or (3) teachers involved in the innovation have not been adequately trained to operate with the methodological approach. Any one of these program characteristics can present a serious challenge to the physical facility/curriculum relationship.

School districts need to remain cognizant of the demand for facilities which are flexible and can adjust to more than one instructional approach. Those environments which

(Continued on page 18)

School financing must escape the constraints of the property wealth and bonding position of the local school district. This article reviews alternative financing methods.

financing school building construction

By William E. Sparkman



William E. Sparkman, assistant professor of education in Administration and Foundations at Kansas State University, is primarily interested in public school finance and the economics of education. He has four earned degrees from the University of Florida: B.A., M.Ed., Ed.S., and Ph.D. During graduate school, he was an E.P.D.A. Fellow and a research associate with the Institute for Educational Finance.

Financing school building construction traditionally has been the responsibility of the local school districts in all states except Hawaii. (Hawaii has no local education agencies and provides full state funding for all public education expenses including capital outlay.) However, recent socioeconomic factors have compelled educators to suggest alternative methods for financing school facility construction that do not rely on the property wealth or bonding position of the local school district.

A continued high rate of inflation with a concomitant rising cost of construction, higher interest rates, and an increasing burden of state and local taxes are causing taxpayers to reject school bond referenda in increasing numbers. The school finance movement also has prompted renewed interest in devising more equitable methods for financing school building construction.

The concept of fiscal neutrality that has emerged from recent school finance court cases logically should be extended to encompass capital outlay and debt service expenditures of local school districts. Fiscal neutrality has meant that a child's education should not be a function of the wealth of the local school district. Since school facilities have such a vital role in a child's education and since, in most states, the local school district is the primary source of funds for school building construction, a strong case could be made for shifting the financial burden of school construction to the state.

Alternatives for Financing

Historically, local school districts have had few alternatives available from which to finance needed school buildings. The pay-as-you-go method wasn't entirely satisfactory as immediate needs generally outstripped the availability of building funds. This method also was limited by the fact that prices often increased faster than the school district's ability to save. The sinking fund or building reserve method suffered similar defects.

The most common method for financing school building construction has been the sale of general obligation bonds by the local school district. The fact that these bonds were supported by the "full faith and credit" of the district and the fact that the districts had to make an additional tax levy on local property to service the debt meant that the financing of school construction was tied directly to the property wealth of the school district and to the "moods and aspirations" of the taxpayers who had to approve the bond issue. Bond referenda are often subject to various political and emotional

pressures since they usually must have the approval of the local citizenry. The bond referendum is one of the few times in local government when the people have a direct voice in school affairs and, oftentimes, their frustrations or lack of understanding of the school system or school board are taken out in a negative vote.

Weaknesses of the property tax have been a problem of the local fiscal support of school construction. The property tax has been criticized on the grounds that it is regressive, it is no longer a valid measure of wealth, and it involves poor assessment practices. The fact that property wealth is not distributed uniformly across a state means that there is considerable variation among school districts in their relative fiscal abilities to support school building construction.

Some states have hampered local school construction by establishing unrealistic limitations on local debt. Although this has been done to protect the taxpayers from excessive public debt, the effect has been to force some school districts to rely on school building authorities for financial assistance in school construction. Such school building authorities were created for the purpose of selling revenue bonds to finance needed school construction. The school buildings were leased to the local school district and the rent money was used to retire the indebtedness. When the debt was retired the buildings became the property of the school district.

Although a few states began to consider assistance to local school districts for school construction during the early years of the twentieth century, it wasn't until after World War II that the most rapid development in state support began. The early programs of state support typically were grants or loans to the local district for school building purposes. A national study in 1970 indicated that 40 states provided some assistance to the local school district in the form of grants for public school capital outlay or debt service, state school construction loan programs, and state school building authorities.¹ It should be noted, however, that the local school district still provides nearly 83 percent of the total capital outlay costs in the United States (1.27). Although most states make some provision for supporting school building construction, the local school district bears a disproportionate share of the fiscal burden.

Although public school enrollment is beginning to stabilize after almost three decades of growth, there is an ever present need for new facilities as older buildings have become obsolete and other buildings must be remodeled to accommodate new programs. The mobility of the general population has created enrollment imbalances in some districts that often necessitate the construction of new facilities in high growth areas.

New Methods of Financing

Given the current problems in terms of the need for additional school facilities and in the need for more equitable approaches in the financing of school buildings, new methods of financing school construction have been explored. The National Capital Outlay Project, a satellite research project of the National Educational Finance Project, conducted a nationwide survey of capital outlay needs and practices of the several states in 1969. The project studied existing capital outlay models and developed new models

that would provide a more equitable basis for the financing of school building construction. Eight models were suggested by the researchers as alternative to traditional practices.

These models included the following (1.241-266):

1. Variable grants computed on recognized project cost
2. Combination of grants and loans based upon recognized project cost
3. State and/or federal loans for recognized project cost
4. Variable incentive grants computed on locally determined cost of project
5. State and/or federal assumption of school building cost
6. Grants and metropolitan area financing for recognized project cost
7. Variable grants computed on the basis of pupil or instructional unit
8. Equalized grants for recognized debt service programs.

The fiscal models suggested by the project all involved increasing the role and level of support of the state and federal governments in the financing of the capital outlay and debt service requirements of the local school district.

Several states have adopted new methods of financing school construction that have increased the states' fiscal role. Delaware has provided assistance in financing the capital outlay needs of the 26 school districts in the state. Vocational facilities in the three county vocational school districts and special educational facilities have been funded entirely by the state. The level of state support in financing the approved cost of new buildings in the 23 school districts has been at the 60 per cent level for many years. The state has assumed 60 per cent of the approved project costs of school construction with the remaining 40 per cent raised by the issuance of general obligation bonds by the local district.²

In 1971 Maryland adopted a program of 100 per cent financing of the cost of all school building construction and 100 per cent of the cost of retiring outstanding bonded indebtedness existing on July 1, 1967.³ Illinois has enacted legislation creating a state school construction bond fund that went into effect at the beginning of the 1974 Fiscal Year. This fund allowed state funds to be made available to finance local school construction and the debt service on outstanding local bonds.⁴

Kentucky has provided for the financing of public school construction through a minimum foundation program which allocated \$1,400 per classroom unit to local school districts during the 1973-74 school year. Participation in the foundation program required the local school districts to levy the required tax rate. The local districts, however, have supplemented the foundation program allocations with various local taxes.⁵

As part of the Florida Education Finance Act of 1973, the state of Florida assumed a much greater role in the financing of school building construction and debt service. State funds are provided to the local school districts on a formula basis. The amount of state funds allocated to each district is determined by (1) the dollar cost of a district's unmet capital outlay needs (as determined by the state) minus (2) the district's portion of the constitutionally earmarked receipts of motor vehicle license sales. The program also provided for

the state to assume future debt service on local bond issues and allowed credit for voted millage over the 10-mill school board levy that was used for capital outlay purposes during the previous five years.⁶

After a study of capital outlay financing in South Dakota in 1973, Hudson recommended equalized variable grants from the state computed on the basis of state recognized project costs for financing local school buildings. He also recommended an equalized debt service grant program that would recognize prior effort of the local districts for the fiscal support of school construction.⁷

More State Involvement

Based on several existing programs and recent studies of school facilities funding, it is apparent that the trend is toward more state involvement in the financing of school building construction. Such programs recognize the superior revenue generating capacity of the state governments. They also recognize the fact that the local property tax base in many school districts is being strained beyond its relative capacity to support additional demands made upon it.

Since education is fundamentally a state responsibility, local school districts should not have to bear the complete fiscal burden of financing school construction. This statement obviously raises the question of the potential loss of local control in the operation of the capital outlay program of the school district. However, underlying the trend toward more state support in the financing of school building construction is the larger question of equal educational opportunity for the children of the state and taxpayers equity in the financing of needed school facilities.

NOTES

1. W. Monfort Barr, K. Forbis Jordan, C. Cale Hudson, Wendell J. Peterson, and William R. Wilkerson, *Financing Public Elementary and Secondary School Facilities in the United States*, National Educational Finance Project, Special Study No. 7 (Bloomington: Indiana University, Bureau of Surveys and Administrative Studies, 1970), p. 139.
2. William K. Dickey, Jr., "Identification of Variables Associated With Local School District Debt Service Needs in Delaware," Diss. University of Florida 1975, pp. 2-3.
3. Alford R. Carey, Jr., "The Maryland Experience: Full State Funding of Capital Outlay," in *School Finance in Transition: Proceedings of the 16th National Conference on School Finance*, (Gainesville, Florida: National Educational Finance Project and the Institute for Educational Finance, 1973), p. 146.
4. G. Kent Stewart, "Methods of Financing Public School Construction in Seventeen Central States," Kansas State University, Special Study (Manhattan, Kansas: The College of Education Center for Extended Services, 1974), p. 7.
5. Salvatore Matarazzo, "Financing Capital Outlay," in *Financing the Public Schools of Kentucky*, ed. Kern Alexander and K. Forbis Jordan (Gainesville, Florida: National Educational Finance Project, 1973), pp. 194-240.
6. Marshall A. Harris, "The Florida Education Finance Program Act of 1973: An Overview and Analysis," (Tallahassee, Florida: Office of the Governor, 1974), pp. 6-8.
7. C. Cale Hudson, "Financing School Construction," in *Financing the Public Schools of South Dakota*, ed. Kern Alexander and K. Forbis Jordan (Gainesville, Florida: National Educational Finance Project, 1973), pp. 155-80.

(Continued from page 15)

provide the teacher with opportunities to utilize various instructional strategies will be the classrooms for today's innovation as well as tomorrow's innovation.

Physical facilities of the future need to reflect the development and concern for the well-rounded child. While controversy still exists about the kind of competencies or skills that a student needs to possess to function in society, our future schools need to project a concern for the academic and physical, as well as the emotional development of students.

Building schools for today as well as for the future is a Herculean task. There appears to be no single way to strike a permanent working relationship between curriculum and physical facilities. However, one of the most important steps in solving this problem lies in coordinated efforts between school architects and educators. Educators can no longer

depend on these outside experts to provide them with all the information needed to construct physical structures which are compatible with the school's curriculum. An architect's responsibility is to understand, interpret and present solutions to the educator's environmental problems.

In the past, educators have not collected sufficient information to communicate their architectural needs. The suggestions proffered in the preceding paragraphs are initial steps to increase that knowledge base. Together the architect and educator must work to build schools which are a reflection of how students best learn and how teachers most effectively teach. In this manner schools will be able to achieve a greater consistency between their philosophical stance and the actual implementation of those educational beliefs.

A Kansas school district involves the community in the planning of a facilities study. The district found that community involvement is a valuable asset.

involving people in school planning

By Max O. Heim and Virginia Elliott



Max O. Heim has spent nine years in the superintendent's office, either as superintendent or assistant superintendent in Hutchinson, Independence, Olathe, and Manhattan, Kansas. He also has been a principal in both high school and elementary schools. Heim received his bachelor's and master's degrees from Fort Hays State College and his Ph.D. from the University of Kansas in administration and curriculum.

Virginia Elliott is the Public Information Coordinator for the Hutchinson Public Schools. In this capacity, as well as that of a concerned patron of education, she is vitally interested in school-community relations. Elliott received her B.S. from Sterling College and has completed graduate courses in journalism at the University of California. She taught communications in the Hutchinson district four years before assuming her present responsibilities. Elliott is a member of the Kansas School Public Relations Association and the National School Public Relations Association.

The 6-square-mile Hutchinson, Kansas public school district includes three old junior high buildings which demand attention, a definite lack of space in physical education facilities, undeveloped land owned by the district close to the border of a neighboring school district, no bus system, and 236 acres of grounds reserved for the Kansas State Fair. To compound an already complex situation, the district has experienced a steady decline in enrollment over the past several years, which is expected to continue during the immediate future.

This is the situation which prompted the USD 308 Board of Education to contract with an outside consulting team to conduct a facilities study. The rationale for this step taken in November of 1974 was simple: You can't face facts until you know them.

The Board of Education not only wanted the facts, they also wanted some expert opinions on what school facilities are needed in Hutchinson. Having a team of experts on school facilities conduct a comprehensive survey seemed the best way of gaining both objectives.

However, the study team, in itself, did not allow for all the expert opinion available to the Hutchinson Board of Education. The ideas and opinions of the various factions which comprise a community are as important to the final decision on the facility needs of a public school district as the ideas and opinions of people who work with school buildings—especially if that decision involves a referendum.

People in a community have ideas—often practical, valuable ideas. They ask questions school officials will have to eventually answer in initiating a building program. They state opinions which influence final decisions and certainly prepare school officials for opposition to a referendum. Also informed people in a community can become a school district's best salespeople if a bond issue should be necessary.

How do school officials utilize this resource? The Hutchinson Public Schools formed a Lay Advisory Committee of community representatives. School administrators thinking about the use of this approach should be aware of several stock criticisms before forming such a group.

First, the criticism of "tokenism" should be recognized; the committee was just formed as a "token gesture" toward interest in the community. The committee will not really influence the Board's decisions. Of course, we must assume this is not the case. An involved, active community offers too many advantages to ignore. A word of caution here: publicity following the Board of Education's decisions on facility needs

should emphasize the influence of the advisory committee's recommendations. If that influence is not obvious the committee will fall into the category of "token gesture" in the eyes of the community.

School administrators should also be wary of the criticism of "politics"—only members of the "power structure" were chosen for the committee, therefore the school district does not want a true representation of the community, just a sure thing in case of a bond issue. In selecting members for an advisory committee, school administrators should watch for this situation and avoid leaving the committee open to this criticism.

If a Lay-Advisory Committee is not formed to supplement a facilities study a district is left open to the most damaging criticism of all—no involvement—the district is not interested in what the community thinks, feels, or does.

The point, in short, is think ahead. Every school administrator knows community involvement is a necessary and valuable part of a referendum. So why not make it a necessary and valuable part of a facilities study which might lead to a referendum?

Even if the facilities study does not lead to a referendum, a school district has not wasted time and effort in creating a Lay Advisory Committee. The schools will still gain from a more informed, involved, supportive community.

It is necessary to clarify one point. Community involvement in school concerns should not be an "on again, off again" procedure to pass bond issues. Ideally, a Lay Advisory Committee for a facilities study is a supplement to the continuous, built-in community involvement effort in a school system. However, this article is directed toward the specific advantages of community involvement in a facilities study.

Once the decision has been made to form a Lay Advisory Committee, the difficult job begins of pulling people together, finding satisfactory meeting dates, and keeping discussion moving.

In forming the Hutchinson Lay Advisory Committee, after a briefing session on the requirements of a community advisory committee and possible groups to be represented on the committee, each of the Board of Education members was asked to recommend six candidates for the committee. These candidates received a letter of invitation to participate. The letter also included the reason for the facilities study and a brief outline of the responsibilities of the group.

In the Hutchinson school district experience described here a committee of 28 resulted from these initial steps.

Several points warrant careful consideration when selecting members of such a committee. Again, including only the "power structure" of a community should be avoided for reasons mentioned earlier in this article. Consideration should also be given to insuring the group is comprised of both "leaders" and "followers." All of either category will result in a group which cannot function as a group. Finally, if school administrators are aware of community people who

would probably oppose the schools' position, the administrators should consider trying to involve these people in the committee. Such opposition might be avoided if the potentially opposing opinions are aired before final decisions are made.

Members of a committee might include representatives of the following groups: staff, students, PTA, major community employers, news media, service clubs and lodges—beware of too many taxpayer associations, athletic booster clubs, art-music-cultural associations, band boosters, chamber of commerce, retired persons associations, and junior colleges.

A Lay Advisory Committee has now been formed. What is the next step? Information! Members of the committee must be in command of all available relevant data. Therefore, the committee should hear all preliminary reports and the final report of the facilities study team.

It might be wise to offer such a committee some guidance after they hear all the facts gathered by the study team and the recommendations of the team—particularly if the district's situation is complex as was the case in Hutchinson. Too much at one time could overwhelm an advisory committee and make members feel inadequately prepared for their task or feel the situation is impossible. Perhaps the administration, being more aware of the total picture, could place items to be discussed by the committee in order of priority, giving the committee task direction and scope. This should be done without "dictating" to the committee.

The committee might function more efficiently if organized into subcommittees. The following are some possible categories for subcommittees: (a) current facilities, needs and inadequacies—they can prepare tables and charts to substantiate; (b) taxation—could chart current and anticipated taxes; (c) enrollment and population studies; (d) program and curriculum problems and needs; (e) development of campaign materials; (f) coordinating committee.

Every committee, of course, must have a chairperson. Since this person will set the tone for the group, careful consideration should be given to this part of organizing the committee.

The Lay Advisory Committee is organized, it has at its disposal relevant facts and recommendations of the study team; what now? Recommendations to the Board of Education. This is where all of the "considerations" in forming and organizing the group bear fruit. Discussions, argument, brainstorming, frustration—the members of the committee will probably become familiar with all of these. Group interaction takes place. All the administrator can do at this point is supply requested information, wrestle with meeting dates, and let the committee do what it was formed to do.

If in forming the group, the administrator considered leadership, included followers as well as leaders, kept the group informed, and provided direction and scope, the committee will serve as a valuable asset to a facilities study.

Educational planners can use systems analysis techniques to deal with the problems of finances, unlimited demands for limited services, inventories, and planning facilities through simulation.

systems techniques in education

By Robert P. Grobe



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Today's school administrators often face financial and other crises. If the basic problem of public schools is to maximize the flow of educational services from the limited resources allocated for this function, then the system-analysis approach can be particularly remunerative.

Systems techniques have been employed with great success in many areas; medicine, space technology, defense, transportation, and communications. A logical extension for these techniques is careful application in an educational system. In 1968, a group from the National Security Industrial Association (Task Group IV, 1968) examined military and space technology for application in the field of education. The group formulated eight basic points which they felt characterized the typical application of systems analysis to training problems. This group further suggested that the extension of this approach to education could help significantly in improving public education.

In a very simple analysis one can consider that an educational system has two inputs—finances and students. Obviously, little can be done to change the kinds of students; but something can be done, via the systems approach, to optimize allocation of dollars and maximize returns for dollars expended.

Thorough systems analysis can identify general problem areas, such as finance and organization. Once such problematic areas are identified, solutions can be devised through more specialized operations research (OR) techniques, such as linear programming, queuing theory, inventory theory, simulation, various network analysis models, and statistical and probability theory. At present these powerful OR techniques have only limited application in the educative process, because of the inherent multiplicity of objectives and goals. However, they can be used to reduce costs or maximize services in such supportive processes as maintenance, transportation, and food services. Definitions and possible application for systems analysis and some of the OR techniques are presented in the following paragraphs.

Systems Analysis

A diagram in one report (Introduction to Systems Analysis, 1968) illustrates the dynamic way in which systems analysis typically operates. This diagram (Figure 1) reveals that systems analysis involves continual examination of each step, feedback to previous steps, and consideration of various capabilities and limitations which influence the decisions made at each point.

THE SYSTEMS APPROACH

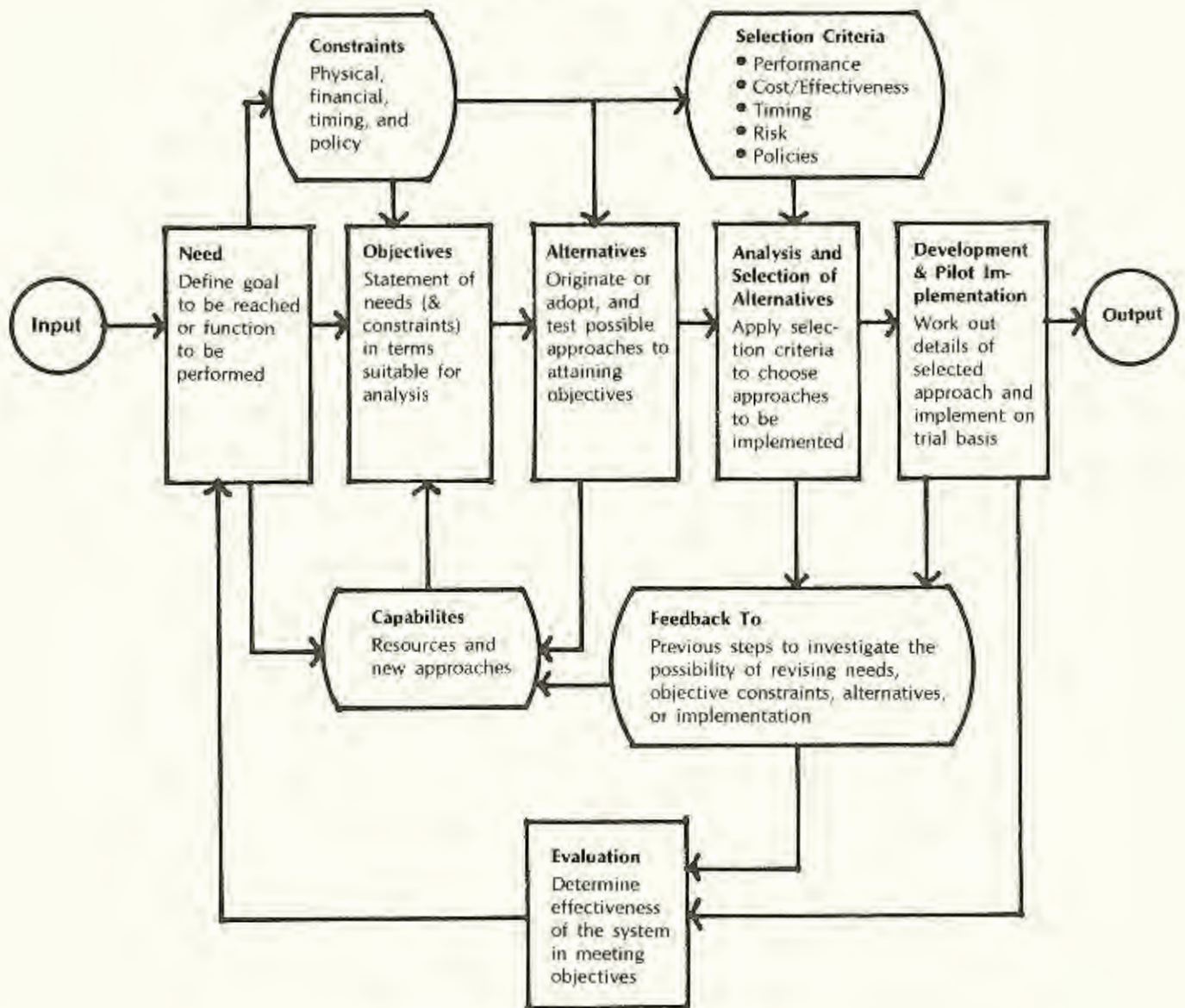


Figure 1: A flow chart of a typical systems approach.

For some purposes the systems analysis approach outlined here is too general. When this situation occurs the more specific OR techniques may be incorporated within the framework of a systems analysis.

Linear Programming

Linear Programming involves the planning of activities in order to obtain an "optimal" result. Stated another way it is a mathematical technique of allocating limited resources among competing activities in an optimal manner. Allocation problems occur whenever selection must be made among certain activities competing for certain scarce resources necessary to their performance.

The current trend of limited monies and the desire to maintain a high standard in education make linear programming's optimal allocation of limited resources increasingly valuable to educational managers. The technique is very versatile and adaptable to many situations. For instance, it can help maximize the amount of educational service for a fixed number of dollars or minimize costs while keeping the level of service constant. Already the technique had been used experimentally on a rather limited scale in the supportive areas of education, such as business administration, transportation, and maintenance.

Bruno (1970) presented an interesting paper using linear

programming to allocate monies in a school district's salary schedule. One possible application of this mathematical model was to design a salary schedule so as to maximize the highest teacher salary. This model could be used to build a salary schedule that would act as an incentive for experienced teachers to remain in the district. Another possible linear programming function is determination of the optimal number of machines or people to keep available in a maintenance system.

Queuing Theory

Queuing theory involves the mathematical study of waiting lines. Queues, or waiting lines, occur when the demand for service exceeds the servicing agent's capacity to provide that service. Providing too much service results in excessive costs; not providing enough servicing capacity results in queues of excessive length. A servicing agent wants to achieve an economic balance between the cost of supplying a service and the cost associated with waiting for a service. The latter may result from various causes, such as, loss of customers who refuse to wait in a long line or loss of time resulting from a long wait. In education there may be a need to redefine these costs.

If the formation of waiting lines creates a problem in a school, then queuing theory would be an appropriate choice to help find a solution. It can help determine an optimal solution for school cafeterias where costs are too high or lines too long, for instance. The queuing technique requires the collection of data to determine the cost of students and teachers waiting in line, the cost of service, the distribution of service times, and the distribution of arrival times. From the financial point of view it should be noted that a trade-off develops: the gathering of data for the queue approach necessitates added expense, but the statistics yielded by this method allow administrators to make very accurate decisions which minimize expenses incurred by queue formation.

Another area where queue formation often presents a problem is in the paper flow of the system. Processing increased numbers of requisitions at certain times of the year is a common phenomenon which often leads to unwieldy paper queues. Queuing models can be used to analyze this phenomenon and determine the optimal number of personnel to process the paper flow.

Inventory Theory

Inventory theory is a relatively new quantitative technique that has been applied to the problem of determining inventory policies. An inventory in an educational system can be defined as a stock of goods held for future distribution. Since inventories constitute an alternative to future production or purchase expenditure the choice among policies depends upon the total cost incurred for each. Each total cost includes: (a) the costs of ordering or manufacturing, (b) holding or storage costs, (c) unsatisfied demand or shortage penalty costs, (d) salvage costs, and (e) discount rate.

The area of materials and supplies provides for a natural application of inventory theory. Some school districts purchase a full year's complement of materials and supplies at the beginning of the year and then distribute most of it to their schools shortly after its arrival. Advantages of this procedure are the discount rate allowed for large orders and

savings due to inflation. Saving might possibly be increased, however, by ordering half the complement at the beginning of the year and investing the remainder of the funds until they are needed to purchase the remainder of the year's supplies. Inventory theory could compare these two procedures as well as other alternative models to determine the optimal policy.

Wynn (1968) used an application of inventory theory with the food services of a school system. Obviously, a cafeteria director would be interested in discovering the optimal amount of hamburger to be purchased, as well as the optimal length of time between purchases. Inventory theory can determine these values.

Simulation

The technique of simulation, with the advent of the high-speed digital computer, has become increasingly important to operation researchers. Simulation is nothing more than the technique of performing sampling experiments on a model of the system to be examined. The experiments are performed on the model rather than on the real system when the latter would be too inconvenient, expensive, or time-consuming. Simulation is often applied to problems that are too complex for analytical solutions using queuing and inventory theory. However, because of the expense involved in simulation, the analytical approach is generally preferred whenever possible.

Today's educational system offers many areas where application of simulation can be valuable to administrators. It can be useful in designing new schools, choosing new personnel, developing financial budgets, and designing new curriculum. In designing new schools, for example, simulating the traffic flow or the assignment of classrooms can determine which design yields optimal conditions. Dusseldorf (1970) reported on a project which involved the simulation of a school building, the staff, curriculum, and students. The object of the project was to determine the building facilities needed for 200 junior high students under a flexible schedule. Reportedly, the rooms needed in the building—number, size, and type—were accurately determined.

Simulation games can be developed to help train personnel officers to choose qualified personnel. One such game was developed by Gunnell (1970) as an instrument for training university and college department chairmen to make more realistic and effective decisions regarding the recruitment of faculty members. In this development variables important in recruitment decisions were identified, weighted, and programmed into the game. An administrator playing this game manipulates certain variables pertaining to environment, compensation, and other job-related factors. Upon completion he receives a department chairman recruitment score and comments relative to his score.

Simulation may become increasingly important in the areas of budgeting, as management attempts to get the optimal curriculum for the available funds. In 1970, the Western Interstate Commission on Higher Education (1970) developed a budgeting game for a university setting based upon PPBS principles. The numbers of departments, full professors, and associate professors, as well as salaries for each academic level, and monies for materials and library expenses within each department are some of the parameters that may be altered. The output of the game is broken into

eight reports which include such analyses as the total budget, the budget of each department, and the monies associated with each degree program.

Network Analysis

Network analysis is one of the more widely used of the OR techniques in educational systems. The planning and control of research and development projects is a problem which has been attacked by a network analysis technique known as PERT (Program Evaluation and Review Technique). Educational managers can utilize PERT to plan and develop projects in the educative process and its supportive functions. PERT can, for example, facilitate planning a summer maintenance project, a bond issue strategy, or a curriculum development project (Handy & Hussain, 1969). Teachers might use PERT to plan the long-range organization of a course into basic units to be covered.

Another educational system problem for which network theory is applicable is choosing a set of connections that provides a route between any two points of a network so as to minimize the total length of these connections. Such application can be useful in transportation, where the object would be to minimize the total distance required in the busing procedure.

Statistics and Probability Theory

Statistical models are widely used and well-known in the educational environment. They will only be mentioned as the most widely used OR technique in education.

Summary

Systems techniques have been employed with great success in many areas and can be applied successfully in educational systems. In the conventional systems approach, systems analysis is utilized to determine general problem

areas; then the more specialized operations research (OR) techniques subserve efforts to discover rational solutions. To increase the effective utilization of systems power in educational systems, educators must be informed of not only the existence of these techniques, but also of the scope of their applicability and their immensely pragmatic and valuable potential.

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facility planning assistance for local schools

The Center for Extended Services of the College of Education at Kansas State University is organized for the specific purpose of providing assistance and services to local school systems throughout the state of Kansas and the Midwest geographic region. Conducting educational facility planning studies is one of several services offered by the Center. Usually such a study is initiated by a school system wanting to obtain a professional outside evaluation of existing facilities plus a study of potential alternatives for needed facility expansion or improvement.

On being contacted by a school system, a representative of the Center will under normal circumstances visit with the local Board of Education at a regularly scheduled Board meeting, to provide an overview of the specific kinds of facility evaluation and planning activities which might be appropriate to that school system situation. At this initial meeting an opportunity is also afforded to clarify in general terms the facility issues in question, and to thus establish a working understanding of the goals and objectives of the district. After this initial meeting, the Center for Extended Services staff will prepare a contract which specifies in detail exactly what services will be provided to the district by the Center. This contract is subsequently signed by the President of the Board of Education, the local superintendent of schools, and by appropriate personnel from Kansas State University.

A complete facility study will usually include an evaluation and examination of all buildings owned by the district, a review of building sites that are currently owned by the district, a determination of new sites which might be needed, and a determination of student population characteristics and future trends which provide an indication of building needs.

A written report is prepared and submitted to the local Board at the conclusion of the study. This report usually sets forth a series of facility recommendations which are incorporated into a comprehensive 5-year Capital Improvement Program plan for the district. A final meeting is scheduled by a Center representative with the local Board of Education to discuss and review the study and recommendations.

For information about this service, contact Eddy J. Van Meter, Center for Extended Services, College of Education, Kansas State University, Manhattan, KS 66506.