DOCUMENT RESUME

ED 207 298 EC 140 040

AUTHOR Chambers, Jay G.; Hartman, William T.
TITLE A Cost-Based Approach to the Funding of Educational Programs: An Application to Special Education.
INSTITUTION Stanford Univ., Calif. Inst. for Research on Educational Finance and Governance.
SPONS AGENCY National Inst. of Education (ED), Washington, D.C.
REPORT NO IFG-81-A4
PUB DATE Apr 81
GRANT OB-NIE-G-80-0111
NOTE 82p.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Classification; Cost Effectiveness; Costs; *Disabilities; *Disadvantaged; *Educational Finance; Elementary Secondary Education; *Financial Policy; Models; *School District Spending; Vocational Education
IDENTIFIERS *Categorical Aid; *Limited English Speaking; Resource Cost Model

ABSTRACT

The paper reviews state categorical funding programs to serve special need populations among school age children (including handicapped, educationally disadvantaged, bilingual, and vocational education students); examines the literature on costs of categorical programs; and presents an alternative framework for addressing the problem. A cost based funding approach is advocated which would provide equal access to educational resources across local districts serving similar student populations. The model also makes provisions for systematic differences in access to resources to districts serving special populations. It is explained as an approach which gives policy makers a basis to examine cost savings in trade offs among resources and programs. Applications of the resource cost model are presented along with a section on the step by step process of constructing a cost estimate in a hypothetical school district. A final section addresses equity and efficiency issues of the model. (CL)

IFG

Institute for Research on Educational Finance and Governance

SCHOOL OF EDUCATION STANFORD UNIVERSITY

Project Report No. 81-A4

A COST-BASED APPROACH TO THE FUNDING OF EDUCATIONAL PROGRAMS: AN APPLICATION TO SPECIAL EDUCATION

Jay G. Chambers and William T. Hartman*

April 1981

*Dr. Chambers is Associate Director and Senior Research Economist at the Institute for Research on Educational Finance and Governance, Stanford University. Dr. Hartman is Associate Professor at the College of Education, University of Oregon.

The research for this report was supported by funds from the National Institute of Education (Grant No. OB-NIE-G-80-0111). The analyses and conclusions do not necessarily reflect the views or policies of this organization.

INSTITUTE FOR RESEARCH ON EDUCATIONAL FINANCE AND GOVERNANCE

The Institute for Research on Educational Finance and Governance is a Research and Development Center of the National Institute of Education (NIE) and is authorized and funded under authority of Section 405 of the General Education Provisions Act as amended by Section 403 of the Education Amendments of 1976 (P.L. 94-482). The Institute is administered through the School of Education at Stanford University and is located in the Center for Educational Research at Stanford (CERAS).

The research activity of the Institute is divided into the following program areas: Finance and Economics; Politics; Law; Organizations; and History. In addition, there are a number of other projects and programs in the finance and governance area that are sponsored by private foundations and government agencies which are outside of the special R&D Center relationship with NIE.

Abstract

Over the last 15 years, the federal government and many states have established a variety of categorical funding programs to serve the various special need populations among school-aged children (e.g., disadvantaged, non-English speaking, and handicapped). There has been little, if any, coordination at the federal and state levels with regard to service delivery or funding of these various programs. Concurrent to the development of these categorical programs, there has been an independent movement to reform school finance.

For the purpose of improving the equity of school finance systems and increasing the efficiency with which educational funds are distributed and services delivered, a more appropriate strategy would be to consider the development of categorical programs and the reform of school finance systems within the context of a common conceptual framework. It is the purpose of this paper to offer such a common framework that could provide the basis for funding educational services and to demonstrate how that framework might be applied specifically to the funding of special education services. We are proposing a cost-based-funding approach that provides equal access to educational resources across local districts serving similar student populations and also provides for systematic differences in access to resources to districts serving students with specified differences in programmatic needs.

Introduction

Over the last 15 years, the federal government and many states have established a variety of categorical funding programs to serve the various special need (e.g., disadvantaged, non-English-speaking, and handicapped) populations among school-aged children. Each of these categorical programs has generated its own state and federal level bureaucracies in order to provide the mechanisms for funding and service delivery to local educational agencies. There has been little, if any, coordination at the federal and state levels with regard to service delivery or funding of these various programs.

Concurrent to the development of these categorical programs, there has been a growing movement to reform state school finance systems. Efforts in the courts and the legislatures have focused on reducing or eliminating the effects of variations in local property wealth on the patterns of local spending for education. More recently there has also been attention devoted to determining ways of adjusting state aid distributions for differences in the purchasing power of local educational dollars due to differences in the prices of school resources across local school districts. Despite the fact that the development of categorical programs and the school finance reform movement have occurred concurrently, each has developed independently of the other.

For the purpose of improving the equity of school finance systems and increasing the efficiency with which educational funds are distributed and services delivered, a more appropriate strategy would be to consider the development of categorical programs and the reform of school finance systems within the context of a common conceptual framework. It is the

purpose of this paper to offer such a common framework that could provide the basis for funding educational services and to demonstrate how that framework might be applied specifically to the funding of special education services. We are proposing a cost-based funding approach that provides equal access to educational resources across local districts serving similar student populations and also provides for systematic differences in access to resources to districts serving students with specified differences in programmatic needs. That is, the model we propose addresses differences in educational costs arising out of both differences in pupil needs and differences in the price paid for educational resources.

The first two sections of this paper set the stage for analysis by reviewing state categorical funding mechanisms and the previous literature on need-based cost adjustments in education. Section III provides a conceptual framework for addressing programmatic cost differences, while Section IV presents an empirical application of the model to special education funding. Section V offers some policy implications and concluding remarks.

It should be emphasized at this point that conceptual framework proposed for funding educational programs is not limited to special education. It can readily be generalized to all types of educational programs and could be developed into a comprehensive educational funding system.

I. A REVIEW OF STATE PROGRAMS FOR NEED-BASED COST ADJUSTMENT

Five basic types of programs that employ need-based cost adjustments are found across the states:

- Special education--programs for handicapped and gifted students.
- Compensatory education--programs for educationally disadvantaged students.
- Bilingual education--programs for non- or limited-English-speaking students.
- Vocational education--programs for training students for employment.
- Grade level differentials--different funding levels for different grades of otherwise regular students.

These programs focus on specified categories of students and funding is usually separate from funds for regular school programs. Their characteristics include the following: they serve a specific, limited population whose educational needs are felt to be different from the regular school population; the delivery systems (in terms of the types, organization, and mix of resources) used to provide these services vary from the regular school programs; because of their differing characteristics, these programs generally cost more than the regular school program due to the special resources employed and/or due to the smaller class sizes; and to compensate for these legitimate cost differences funds are earmarked specifically for these programs through various categorical funding arrangements. The differing technologies for these programs arise out of differing programmatic needs of certain students. Since the composition of such programmatic needs of pupils is beyond district control, funding adjustments are required to account for these programmatic cost differences.

A variety of different categorical funding approaches are used by states to provide the programmatic cost adjustments (see Thomas, 1972, and Bernstein, et al. 1976). These include:

1. Pupil weighting. The funding amount is based on a multiple of the regular per pupil funding amount. The weights vary by type of program or type of pupil (e.g., compensatory education, educable mentally retarded, visually handicapped, non-English speaking.

2. Flat grants. These are fixed per pupil funding amounts provided for specific categories of students. The categories may be broad (e.g., handicapped, Title I, low achievers) or narrow (e.g., educable mentally retarded, trainable mentally retarded).

3. Units. The funding base is a defined teacher unit or unit of instruction where specified numbers of students define the unit. Funding is to cover all or a portion of the costs of the unit. (e.g., teacher salary, aide salary, benefits, instructional materials and equipment, maintenance and operation). The costs may be either standardized or actual.

4. Personnel. In this approach, direct funding is provided for special kinds of approved personnel associated with the categorical programs. By funding only personnel, this approach is a specific case of the more general unit funding approach.

5. Excess costs. The excess costs are those which are above and beyond the costs of educating regular students. This funding approach provides a reimbursement for all or a portion of these costs.

6. Percentage. With this approach, a specified percentage of program costs are reimbursed. The percentage may vary by type of program and the cost base may be last year's, current, or projected expenditures.

7. Approved programs. The costs of approved programs for special populations are reimbursed in full or in part under this approach. In operation, this method requires the submission and review of a program application specifying the expenditures for reimbursement.[1]

In each case, the formulas provide additional funds to districts because of the greater educational needs of students in the categorical programs. To match the funding levels with the necessary cost increases due to these programs, it is necessary to identify the composition of the

programs in terms of the resources that go into them.. That is, the cost of each program is determined by the selection, quantities, arrangements, and prices of the various resources which it utilizes. Therefore, to calculate the costs of the categorical programs and consequently the cost adjustment for programmatic need, it is necessary to specify the resources that comprise the programs. This can be done explicitly by program (as in the unit formula approach), in aggregate for a total program (often the case with excess costs), or implicitly (as in pupil weighting where an outside calculation based on needs, resources, and prices is used to arrive at the weights). In any case, the estimation of the costs of meeting the educational needs of students in these programs is done through the specification of the input resource configurations of the programs.

Note, however, that these approaches do not include cost adjustments for variations across local districts in the supply prices of school resources. (Supply price means adjusted for differences in resource characteristics.) For a thorough correction, it may be necessary to combine the programmatic and resource price adjustments for these programs. The programmatic adjustments will account for the effects of student characteristics that are beyond district control, while the resource price adjustments will do the same for the prices of the various resources used in the programs.

In general, a fundamental problem in establishing programmatic cost adjustments is determining the basic level of services to be provided or the appropriate outcomes of the special programs. For example, it is especially difficult to determine objectively or scientifically just what a handicapped pupil "needs" to attain a level of educational quality comparable to that of regular students. We could set a standard of attaining

the average reading level of regular students and evaluate the costs of reaching this goal for a physically disabled student. But such a goal may be unreasonable, perhaps impossible, for a mentally handicapped student. What is the appropriate set of services for the latter student in the reading area, if programmatic funding were to be this specific? Moreover, even comparability of educational "quality" between the regular and physically disabled student quickly loses its meaning when one considers the other than intellectual dimensions to the preparation of the two kinds of students for their respective places in the labor force or other aspects of life. Studies that have attempted to address some of these issues in determining appropriate cost adjustments for funding these programs are reviewed in Section II.

II. A REVIEW OF PREVIOUS LITERATURE ON COST DIFFERENCES

The empirical studies of the costs of categorical programs tend to be of three types: an examination of the average per pupil expenditure patterns (cost per student); determination of supplemental, replacement, and common costs of the program; and the specification and costing out of the components that make up the program (resource-cost model) (Hartman, 1979, Chapter IV).

The cost per student approach has taken several different forms. First, the average dollar cost per student has been calculated by simply (a) summing over all the costs directly associated with programs for a particular type of student and those indirect costs that may be allocated to the programs and (b) dividing the total program costs by the number of students involved. An example of this approach is found in a study by Kakalik, et al., (1973) in which the average reported costs by category of handicapped student were determined. While providing summary per pupil expenditure data, this approach has serious limitations on the use of the results for analytical or funding purposes. The average cost by type of student masks a significant variation among individual student costs; in fact, another recent study of special education has shown that there is less variation in the cost-per-student by the type of delivery system (e.g., special class, resource room, itinerant instruction) than by type of handicapped student (Hartman, 1980b). The use of the average cost figure also obscures the cost differences due to educational need. The differences in selection, quantity, and organization of resources that cause the programmatic cost differences are not specified and their effects are unknown.

Another, and perhaps most prevalent, form of the cost-per-student approach has been the development of "cost factors" for categorical and grade level programs. The general procedures in the cost factor approach were used in the special education component of the National Education Finance Project (NEFP) by Rossmiller, et al. (1970), in 1968-69. A cost factor, which is the ratio of the cost per student of a special education program to the cost per student of the regular education program, was calculated for each special education program. A ratio greater than one indicated the degree to which the estimated total cost of a special education program was greater than that of the regular education program. The overall cost index averaged about 2.0 for all special education students, but there were wide variations among categories within a single district and among districts with similar categories.

The cost factor approach, however, presents a number of problems for cost analysis and funding applications. Rossmiller has noted some of the primary limitations to using these "cost factors."

> A cost index generally is expressed as either a statewide average or a median....Provision must be made...to deal adequately with the fiscal needs of individual districts which deviate from the state average for good and sufficient reasons....They reflect only what is currently being done, not what could be done (or should be done) in the way of educational programming for specific pupils....Cost indices show the relative cost of educating pupils in special programs compared with the cost of educating pupils in regular programs....It is possible that a given special education program could be offered to an equal number of students, could provide the same educational services, and could cost the same amount per pupil in two school districts but the cost indexes in the two districts could differ because of differences in the cost of the regular program in each district....A cost index which lumps together all programs for educating a particular category of handicapped children without regard to the way in which educational services are delivered to such children will mask a great deal of cost variation within these programs....Finally... for a variety of reasons, costs will vary between districts for

> identical programs,...the cost of transporting pupils involved in special programs,...pupil/teacher ratio,...difference in salaries and in the cost of educational supplies and materials,...and these differences will be reflected in educational program cost and in cost indices (Rossmiller, 1974, p. 14).

Subsequent to the original NEFP study, there have been many individual state studies conducted using the cost factor methodology; these have included studies in Delaware, Florida, Idaho, Illinois, Indiana, Kentucky, Mississippi, South Dakota, and Texas (respectively, Rossmiller and Moran, 1973; National Education Finance Project, 1973; Shrag, 1974; Sorenson, 1973; Jones and Wilkerson, 1972; National Education Finance Project, 1974; Governor's School Finance Study Group, 1973; National Education Finance Project, 1973; Busselle, 1973). Additionally, cost studies using this approach have been reported by Bentley (1970), Snell (1973), McClure, et al. (1975), and Clemmons (1974). These studies followed the specific cost factor methodology developed by the NEFP study and they generally found the same results--and overall median index of approximately 2.0 with much variation among districts and among categories.

A second methodology that can be used to recognize the costs of programmatic needs of categorical programs focuses on specifying the supplemental, replacement, and common costs for the overall programs. The analytical emphasis is on specifying which activities, resources, and costs are appropriate for each classification and making the subsequent adjustments to the regular and categorical program costs to reflect these changes (Marriner, 1977).

Supplemental services and costs are those that are in addition to the regular education program (e.g., special education resource room, vocational education counseling). The students who receive supplemental programs and

services obtain the bulk of their educations from the regular education program. The supplemental programs and services can be considered completely additional since the students receive them while also attending the regular education program. Therefore, the costs of these programs are totally in addition to those of the regular program.

Replacement costs are for those programs and services that, in whole or in part, are substituted for the regular education program. The general procedure for determining these costs is to total the direct costs of the replacement education programs, but then to deduct the costs of the regular education programs and services that are replaced. This net cost is then the additional cost of the programmatic needs of students served by these programs. Such deductions may include only the instructional component (for a separate categorical program classroom within a school) to the entire regular education cost (for programs provided by other agencies). The common costs for general services that are provided to all students (e.g., district administration, [illegible] service) are generally allocated to all students or programs in a district on a pro rata basis.

The major difficulties in this approach to cost adjustment are with the replacement costs. The supplemental costs are additional by definition and would need to be included in any adjustment. With the common costs, care must be taken not to double-count (including them in both the regular program and in the cost adjustments for special programs) or omit them (not including them in either program costs). The initial and non-trivial problem with calculating replacement costs is deciding specifically which program components and services are being replaced in the regular program. Further, deduction of the average per student replacement costs can be a

misleading calculation. Many of the costs on a classroom level are fixed over the range of a few students per class and the reduction of several students would not appreciably change the costs of that regular classroom. Similarly, schoolwide and districtwide service costs are not greatly affected by the reduction of a relatively small number of students. Rather than deducting the average costs per student of these components (which are relatively easy to calculate from student and financial records), the marginal costs per student would be the correct deduction. Unfortunately, marginal costs per student are generally unknown since they are not collected or reported by financial accounting systems in education. They will, however, certainly be much smaller than the average costs per student.

The final cost methodology used in studies of categorical programs is that of the resource-cost model (RCM). The focus of this approach is on the specification in programmatic terms of the educational program to be provided--i.e., the total special education types and numbers of students to be served, definition of programs in terms of resources, allocation of eligible students to various programs, student/teacher ratios, etc. Consequently, the program costs are explicitly derived from the structure of the educational program. It is this resource cost model that is more fully developed in the next section.

III. A CONCEPTUAL FRAMEWORK FOR ADDRESSING PROGRAMMATIC COST DIFFERENCES IN EDUCATION

Equity and Cost Adjustments in School Finance

In recent years policy makers have come to believe that school finance equalization should not be limited to improving the distribution of nominal differences in school spending, but rather should be directed toward improving the distribution of "real" educational services. Indeed, from this perspective, some nominal variations in school spending may be justified on the basis of uncontrollable variations in the prices of school resources, differing needs of student populations, variations in the scale of school district operations, and variations in other locational, geographic or demographic characteristics of school districts that affect the organization, coordination, and allocation of school resources. This justification for allowing differences in school spending suggests a concept of equity in school finance that extends beyond the more narrow conceptualization which has focused on distributions of general fund aid to local school systems and the relationship of this aid to fiscal and cost disparities for regular education programs. The extension involves consideration of all sources of differences in educational costs simultaneously, whether they arise out of differences in resource prices or differences in pupil needs, which have traditionally been addressed through the development of categorical programs.

This section presents a systematic approach to the determination of the variations in the costs of providing educational services to different kinds and numbers of children. The analytical framework set out below may be used to examine differences in costs associated with serving students

from different backgrounds, with varying language capabilities, with various handicapped conditions, of different grade/age levels, or with different vocational or educational aspirations. The model should permit a systematic approach to costing out special education, compensatory education, vocational education, and bilingual education as well as elementary versus secondary education programs. In addition, the model provides an explicit mechanism for making adjustments for the systematic differences in the prices paid for school resources employed in these various programs. Moreover, the approach adopted below provides policy makers with a framework within which to examine the cost savings associated with different trade-offs among resources as well as a basis for considering trade-offs among programs. (Policy makers in this context generally refers to state and federal level legislators or administrators unless otherwise indicated.)

Although the model is general, many of the examples used to illustrate the various elements of the model focus on special education, and the empirical example presented in Section IV will develop more explicitly how the model could be used for costing out special education programs for funding purposes. A more formal algebraic specification of the model is presented in the Appendix.

The Resource Cost Model (RCM)

Conventional wisdom suggests that different kinds and combinations of school resources will be required to provide educational services for pupils with varying educational needs. Unfortunately, the assessment of differences in educational costs associated with serving various student populations is not straightforward. If one could measure educational quality (outcomes) easily, and if the concept of educational quality were identical across the different student populations served (e.g., regular versus special education), there would be no difficulty in assessing

educational cost differences across programs or across local school districts. However, neither of these conditions is easily satisfied. Educational quality is not easily measured and is likely to differ substantially across student populations served. The questions that need to be addressed in assessing the programmatic cost differences are:

1. What characteristics of students reflect different educational needs?
2. How do we objectively identify these characteristics among populations of students?
3. How do we translate these educational needs of students into the resource requirements that define the programs necessary to ameliorate the particular problems?
4. How do we determine the variations across local school districts in the prices of the resources of which these programs are composed?

Because of the difficulty in making any kind of objective comparison of the relative merits of these different pupil needs from the point of view of the larger society in which we live, some judgment will be necessary on the part of educational policy makers as to the relative priorities that these different student needs shall be assigned. Moreover, it is likely, given the state-of-the-art in understanding educational input-output relations, that there will be a considerable element of judgment by policy makers in determining what educational programs will look like. It is the purpose of this model to set out a conceptual framework that will facilitate the kinds of decisions that educational policy makers will have to make regarding the nature of educational programs directed toward different student populations.

There are three components in specification of RCM:

1. Assessment of student needs and program assignment;

2. Specification of the input configurations corresponding to: (a) instructional programs and program units; (b) instructional administration and operation of programs; and (c) general administration and operations; and

3. Determination of resource prices and total district costs.

School decision makers begin with an exogenously determined set of pupils to serve. This set of pupils is exogenous in the sense that both their numbers and their compositions with respect to certain observable characteristics are outside the control of the local school district. The objective of the school district in these circumstances is to assess pupil needs in some fashion (e.g., through testing or observation of behavior) and to determine some scheme by which to assign these pupils, classified according to some set of observable characteristics, to educational programs that meet their individual educational needs. There is not necessarily a one-to-one correspondence between the set of observable pupil characteristics and the combinations of programs to which children might be assigned, and any one pupil might be assigned to more than one program.

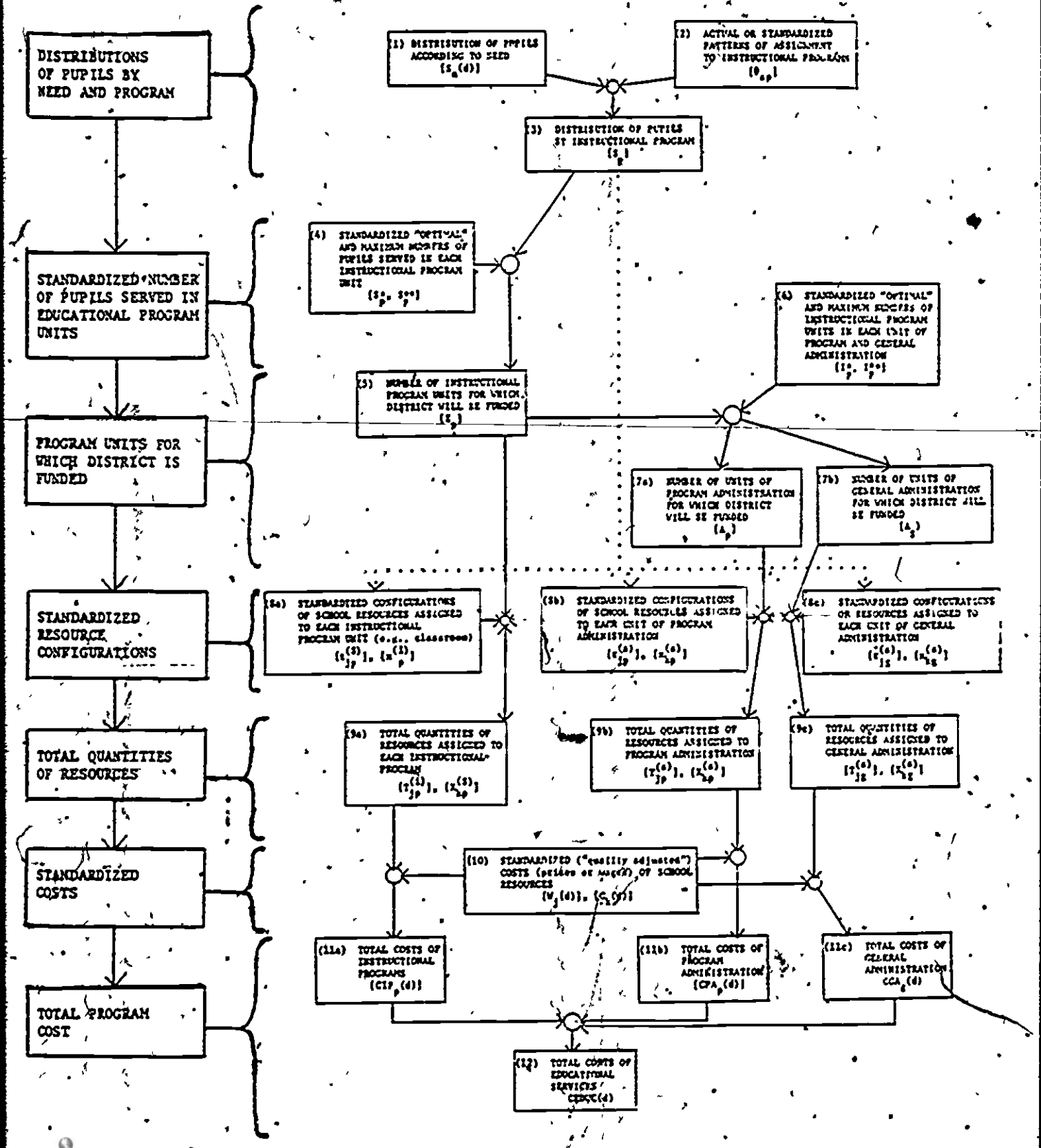
An educational program in this context is defined as a type of educational delivery system that involves a designated input configuration for the delivery of educational services. While the "program" defines the general nature of the delivery system, the "program unit" is simply one such representative educational setting or location such as a self-contained elementary or a special education classroom. For our purposes, it is important to point out that by "program" we do not mean the process or curriculum by which educational services are produced. Program and program units are defined only in terms of the levels of the inputs assigned to them, but not according to the way in which the inputs themselves are used to produce educational outcomes. For example, a program unit might

specify the number of teachers, teachers' aides, desks, books, and other materials used in a special education classroom, but it does not necessarily imply what methods are employed in the classroom to develop cognitive or affective skills. This is not to deny the importance of process and curriculum for ultimate educational outcomes, but rather simply to admit that such refined specification of programs is beyond the scope of the present research effort.

Figure 1 illustrates the components and steps in the process of assembling the data required for the implementation of the RCM approach. The boxes are numbered in the order of the decision process. The circles which appear in the figure designate some kind of algebraic manipulations of the variables involved in order to proceed to the next box. The details of these algebraic operations are described in the Appendix. The alphabetic symbols indicated in each box are used in the algebraic presentation in the Appendix, but are not essential to the discussion which follows. Nevertheless, for those interested in comparing the verbal description of the model with the algebraic presentation, references to these mathematical symbols are included in parentheses below.

What is described in Figure 1 is the process necessary to cost out the educational services provided by a given district. Some of the information presented will be unique to the district (e.g., student counts in different categories), while other information such as program configurations represent standardizations which must be imposed on all districts within a state for the purposes of funding and perhaps service delivery. The relationship between funding and service delivery and the implications for equity in school finance are discussed more extensively in a subsequent

FIGURE 1. DIAGRAM OF THE RESOURCE COST MODEL



section of this paper. The discussion below provides a description of each of the boxes contained in Figure 1 in the order that they appear in the diagram.

Box (1). The process of program specification begins with box (1) which contains the actual distribution of pupils in a given district according to some set of observable "need" characteristics. (This distribution is represented by the vector $[S_n(d)]$ where n indexes the various need categories. The [d] indicates that this count of pupils is unique to a particular district.) This step is intended to identify the number of pupils who possess a particular combination of characteristics. These characteristics are referred to as "need" characteristics because they are intended to reflect or at least be related to some specific dimensions of educational need and will ultimately be relevant in identifying program assignments. While the counts themselves are unique to the district, it will be the responsibility of the state or perhaps federal level policy makers to identify precisely which characteristics of students are important for this purpose. For example, in considering funding for special education, one would begin the process by identifying children according to various handicapping conditions, while for consideration of funding for compensatory education, one would want to identify children who are low achievers or are from families eligible for AFDC payments. While these particular "need" characteristics may not reveal all the necessary information about programmatic needs, they are sufficiently objective that they may be counted fairly readily, and they do bear some relationship to educational needs.

Box (2). This step describes the assignment process that allocates students in the various need categories to educational programs or service

delivery systems. Box (2) represents a matrix whose elements indicate the proportion of pupils with any given combination of need characteristics that are assigned to a particular instructional program (e.g., a special class or a resource room both of which are uniquely described by some combination of resources). (This matrix is represented symbolically by $[\theta_{np}]$, where the representative element θ_{np} indicates the proportion of pupils in need category n to be assigned to program p.) From the standpoint of building the cost model, this matrix of assignment patterns may represent actual assignment patterns in the district or some standardized pattern of assignments imposed by the state. In the former case, the model incorporates data derived directly from local school district sources to determine the actual assignments of children to programs. In this particular instance one may actually begin the determination of district costs in box (3) described below. While using district information on student assignment to programs would provide a more accurate basis for the determination of educational costs, procedures for allocating children among programs are not likely to be uniform across districts. That is, two districts may well assign children who are virtually identical to different instructional programs as a result of different procedures for assignment or differences in perceptions of those responsible for making program assignments. Moreover, use of such district information would require some auditing of district counts in order to ensure that they do not reflect higher proportions of assignments to "high cost" programs than actually exist. The district could actually profit (i.e., be overfunded) from such an arrangement.

An alternative to using actual district data on program assignments is the establishment of a standardized assignment pattern. Based on statewide

averages or some other conventional wisdom about assignment patterns, policy makers could develop a standardized matrix that would be used to allocate students in particular need categories among instructional programs. Alternatively stated, this standardized matrix would be used in conjunction with actual district counts on the numbers of pupils in various need categories box (1) to determine the number of pupils for which the district will be funded in each instructional program. While the standardized assignment matrix reduces the accuracy of educational costs to the extent that the actual assignment patterns differ across districts, it is based on procedures for identifying children in various need categories that are likely to be more uniform across districts than the procedures for allocating children to programs.

Box (3). Combining boxes (1) and (2) through multiplication results in box (3) which contains the distribution of pupils across instructional programs for which the district will be funded. (This distribution is represented by the vector $[S_p]$.) Note that this is a duplicated count since pupils may be assigned to more than one program. For example, in the case of special education, some children will spend part of their school days in mainstreamed classrooms and part in resource rooms or supplementary instructional programs.

Box (4). Step 4 in the process of building this cost model involves specification by educational policy makers of the "optimal" and maximum numbers of pupils that may be served in each instructional program unit. (The "optimal" number of pupils that may be served in any program p is designated by S_p^*, while the maximum is denoted by S_p^{**}. The brackets used in the diagram simply designate vectors since each program type will be

assigned optimal and maximum numbers of pupils to be served.) "Optimal" is used in this context to represent someone's perceived ideal number of students to be served in each program unit (e.g., classroom or therapy sessions). The maximum number of pupils permitted (for funding purposes) to be served is provided for in order to allow policy makers to establish some upper limit on the number of pupils that may "adequately" be served within a given classroom or other instructional situation.

Box (5). The total number of pupils in a given program (box 3) combines with the optimal and maximum numbers of pupils (box 4) to determine the number of instructional program units for which the district will be funded (box 5). (I_p denotes the number of instructional program units for any given program type 'p', and $[I_p]$ is a vector of the number of program units across all programs p=1,...,P.) It is at this stage of the process that the role of the optimal and maximum numbers of pupils permitted in an instructional unit becomes apparent. First, one determines how many instructional units would be necessary to serve all children assigned to any given program in the optimal size unit. This is determined by simply dividing the total number of pupils assigned to a program (i.e., S_p) by the optimal unit (class) size (i.e., S_p^*). Second, since the result of this division may not yield an even number of units, this number will have to be rounded off to the whole number of units that provides the fewest program units to be funded while ensuring that no unit would have to exceed the maximum size. (For more details the reader is referred to the Appendix.)

Note that while the number of pupils is instrumental in the determination of the number of instructional program units, the emphasis for purposes of funding of educational programs is on the number of program units

rather than on the number of pupils served per se. The advantage of this approach is that it recognizes the discontinuous nature of costs with respect to the numbers of students. In many cases adding an additional student to a particular classroom has virtually no significant impact on programmatic costs. By the same token, it also explicitly recognizes the fact that as the number of students served within a particular program expands there is going to come a point when another entire classroom (program) unit will have to be added--in particular at the point where at least one of the units is forced above the maximum students allowed in a program unit.

Box (6). This step in the process involves the specification of the "optimal" and maximum numbers of instructional program units necessary to define a unit of program or general district administration. (These "optimal" and maximum numbers are represented by the symbols I_p^* and I_p^{**}, respectively.) Program administration refers not only to supervisors and directors involved in program development and operations, but also personnel involved in support of direct instructional activities (e.g., psychologists and specialists in curriculum). General administration refers to support and administrative services that apply across all programs within a school or throughout the district. From these brief descriptions, the diagrammatic representation of this step in the process is quite simplified since there are likely to be a variety of kinds of program or general administrative units that would apply (e.g., support services for speech programs, special education administration, school site administration, the office of the superintendent).

Boxes (7a) and (7b). In a manner comparable to the way boxes (3) and (4) combined to determine (5), box (5)—the number of instructional program

units for which the district will be funded--and box (6)--the optimal and maximum numbers of instructional units per unit of program and general administration--combine to determine the number of units of program administration (box 7a) and the number of units of general administration (box 7b) for which the district will be funded. (Symbolically, these are represented by A_p and A_g, respectively.)

Boxes (8a), (8b), and (8c). These boxes represent the decisions of educational policy makers regarding the standardized configurations of various kinds of personnel and nonpersonnel resources required to define each instructional program unit and each unit of program and general administration. The resource configurations themselves will specify on a per unit basis (whether we are referring to an instructional or administrative unit) the numbers of full-time equivalent personnel of different types (e.g., teachers, teachers' aides, special education coordinators, curriculum specialists), the quantities of various pieces of specialized equipment or materials, and the dollar amounts allocated to other less specific categories of school resources (e.g., supplies). (Symbolically, we have used the letter 't' to represent personnel resources and 'x' to represent non-personnel resources. The superscripts 'i' and 'a' indicate instructional and administrative resources, respectively; and the subscripts 'j', 'k', and 'p' indicate type of personnel, type of non-personnel resource and program.) Decisions about resource configurations for each of the various educational programs will be based on some concept of "best practice" within the confines of state and local budget constraints for educational services. This determination of what constitutes "best practice" will likely be a complex process of interaction between the state

level educational policy makers, the educational professionals who provide the services, parents and other major interest groups that have specific knowledge and concern about effective and equitable education. It is important to stress that these resource configurations are not likely to be done independently of overall constraints on educational budgets. As will be seen as we proceed through the diagram, if the total educational costs exceed available revenues, some modifications of these standard resource configurations will be necessary in order to bring costs in line with budgets. However, the starting point for this analysis could well be someone's concept of the ideal programs serving all children.

Note that a dotted line has been drawn from box (3), reflecting the numbers of students in the various programs, to boxes 8a, b, and c. The purpose of this line is to indicate that the model can explicitly take account of the number of students actually served in the specification of the resource configurations. Where there are sufficient numbers of students served in each program, this line would be irrelevant and resource configurations would be done on a per unit basis only. However, in districts serving very small numbers of pupils, either in terms of total district size or with respect to certain programs, the model explicitly recognizes the fact that resource configurations may well have to be modified to reflect the smaller numbers of students. For example, a special class for special education children might normally take ten children and would include a teacher and a teacher's aide as well as other resources. However, suppose that the district only had three pupils in total that would be served by such a program. Even though a normal unit of this kind of program might include the teacher's aide, in the special circumstance

of this district with so few pupils, one might want to exclude the teacher's aide from the standard configuration. Similarly, a very small school may not require a full-time principal, but rather might do fine with a part-time principal who taught during the remainder of the day. In essence, the RCM approach may be easily adapted to circumstances to account for diseconomies resulting from small scale operations.

Boxes (9a), (9b), and (9c). Having defined the per program unit resource configurations in boxes (8), one need only multiply these requirements by the total number of instructional or administrative program units to determine the total quantities of instructional and administrative resources for which the district will be funded. (These totals are simply denoted by using the capital letters 'T' and 'X' in place of the per unit figures 't' and 'x'.)

Box (10). Having determined the total quantities of resources for which the district will be funded, we now need to translate the information into programmatic costs. For this step in the process, we will need to define and specify some standardized wage and price levels of the personnel and non-personnel resources, respectively. The importance of standardizing wages arises out of the fact that not all districts are equally effective, for reasons quite beyond their control, in attracting school personnel.[2] Previous studies of resource price differences in education have shown that in order to attract the same kinds ("qualities") of teachers, districts located in regions exhibiting relatively higher costs of living or a poorer quality of life (e.g., poorer climate or higher crime rates) or districts

serving relatively high proportions of low ability or disadvantaged pupils have to pay relatively higher salaries than districts located in regions with low costs of living, with a better quality of life, and serving a more attractive pupil clientele (see Antos and Rosen, 1975, Chambers, 1980; Kenny, et al., 1975). Similar patterns of wage differentials have also been shown to hold with respect to virtually all categories of school personnel.

In addition to the differential costs of personnel, districts located in different regions of a state might also have to pay different prices for other resources such as energy to heat, cool and light classrooms. Moreover, they may require greater levels of energy consumption to compensate for climatic differences.

With the addition of box (10) to the model, one can see that RCM not only accounts for the differences in educational costs arising out of differences in the combinations of resources required to serve various student populations, but also for those differences in costs arising out of the differences in the wages and prices necessary to employ similar kinds and qualities of educational resources. (These standardized costs are represented by the vectors $[W_j(d)]$ and $[C_k(d)]$ for the personnel and non-personnel resources, respectively. The (d) in parentheses indicates that these wages (W) and unit costs (C) of resources reflect differences associated with factors that are both unique and beyond the control of the individual district.) The simulated wages and prices used in the RCM arise out of the analysis for the development of a "cost-of-education index". The RCM integrates this analysis of educational cost differences into the analysis of programmatic cost differences associated with differential pupil needs,

Boxes (11a), (11b), and (11c). This step simply involves multiplying the total quantities of resources by the standardized wages and prices to arrive at the total costs of instructional programs ($CIP_p[d]$), program administration ($CPA_p[d]$), and general district administration ($CGA[d]$).

Box (12). Summing these individual components of cost finally brings us to the figure representing the total costs of educational services ($CEDUC[d]$) for the district. As one can see, there is a good deal of standardization involved in this ultimate calculation, and it is possible to prepare computer programs that, while being tedious, are relatively straightforward conceptually. Such programs would permit policy makers to replicate this procedure for every school district or local educational agency within the state. Summing over the results of such a computation will provide state policy makers with an estimate of the total costs of educational services throughout the state. It is at this stage of the analysis that comparisons of costs and state budgets can occur and decisions can be made regarding trade-offs of the education budget with other components of state services (e.g., welfare, transportation, health) or trade-offs of resources within the educational budget that might reduce the overall costs.

It should be emphasized that the model primarily provides a decision-making structure for educational policy makers. From a funding perspective, policy decision could enter the model in any one of the following places:

- definitions of student eligibility for various need categories (i.e., the definition of 'n' in box [1]);
- the assignment process described in box (2);

- the determination of the optimal and maximum numbers of pupils served in instructional units and the optimal and maximum numbers of instructional units which define units of program and general administration (boxes [4] and [6]);

- the formula which determines the number of program units for which districts will be funded (boxes [5], [7a], and [7b]);

- the resource configurations for instructional programs, program administration and general administration (boxes [8a, b, and c]).

IV. AN EMPIRICAL ILLUSTRATION OF THE RESOURCE COST MODEL

The purpose of this section is to illustrate the process of constructing an estimate of the cost of educational services as prescribed by the resource cost model. We have chosen to illustrate these calculations for a single hypothetical school district providing only special education and regular education programs. This simplification should facilitate the explanation of the application of RCM without losing any of the generality of the concept and approach as it might be applied in circumstances involving a wider variety of educational settings and programs. Extension of the model to these other programs across all school districts could be used to establish a cost-based funding approach for educational services.

The purpose of this process is to determine the funding to be provided to the district for various educational programs. The underlying tenet of this approach is that funding amounts should be based on the costs to the district of providing the instructional programs. Consequently, the RCM process concentrates on student and program characteristics and related policy choices which influence costs and funding levels. In this example, the steps necessary to determine the RCM funding system, including the basic data requirements and necessary policy decisions, are presented for a sample district. Although the specific data in the example are hypothetical, they have been drawn from actual district and state data and are representative of a district special education program.

The first step in the process is for the state to establish a scheme of student classification to be used to identify handicapped students and determine their educational needs. This takes the form of a set of categories of handicapping or exceptional conditions recognized by the state

and generally formalized in statutes and/or regulations. This step has been completed in practically all states, although it may be appropriate to review the existing categories for possible modifications. For the most part, all that will be necessary in this step is to specify what categories are in use and to recognize that this will be an important dimension along which data will need to be collected and reported. The categories selected for our example include: educable mentally retarded (EMR); trainable mentally retarded (TMR); physically handicapped (Phy Hc); speech impaired; deaf, visually handicapped (Vis Hc), seriously emotionally disturbed (SED); specific learning disabilities (SLD); profoundly handicapped; gifted; and homebound and hospitalized (Home/Hosp). All other students in the district were considered to be regular students for the purposes of this example.

The second step is to specify the number of students currently served (i.e., to be funded) for each of these categories at the district level. These data are usually readily available from existing district records and/or the frequently required in reports to the state and federal education agencies. The student numbers can either be in enrollments (membership, average daily attendance) or full-time equivalents (FTE), but whichever is chosen must remain consistent throughout the remainder of the funding calculation process (e.g., number of teachers, students served in one program unit). District enrollments of exceptional students and regular students in the example are shown in Table 1 in the student unduplicated count column. (These numbers correspond to the $[S_n]$ in the previous section.)

The third step involves establishing a standard set of instructional programs in which exceptional children will be served. This should be done at the state level and made sufficiently general to apply across all

TABLE 1

Category/Program Placement Matrix

STUDENTS	Unduplicated Student Count	INSTRUCTIONAL PROGRAMS										
		Self-Contained Class				Special Class			Resource Room		Supplemental Instruction	
		Regular Class	Basic Special Ed. Configuration	Physically Hc or Profound	Emotionally Disturbed	Basic Special Ed. Configuration	Physically Hc or Profound	Emotionally Disturbed	Basic Special Ed. Configuration	Gifted	Basic Special Ed. Configuration	Home and Hospital
Exceptional												
EMR	181					181 (1.0)						
TMR	42		42 (1.0)									
Physically Handicapped	54			20 (0.37)			34 (0.63)					
Speech	356	356 (1.0)									356 (1.0)	
Deaf	29		5 (0.17)			24 (0.83)						
Visually Handicapped	11	5 (0.45)				6 (0.55)			5 (0.45)			
Emotionally Disturbed	99	56 (0.57)			10 (0.10)			33 (0.33)	56 (0.57)			
Specific Learning Disabilities	256	221 (0.86)				35 (0.14)			221 (0.86)			
Profoundly Handicapped	17			17 (1.0)								
Gifted	212	212 (1.0)								212 (1.0)		
Home and Hospital	17											17 (1.0)
Subtotal Exceptional	1,274	850	47	37	10	246	34	33	282	212	356	17
Regular (and all other)	12,004	12,004 (1.0)										
DISTRICT TOTAL	13,278	12,854 (0.97)	47 (0.0035)	37 (0.0028)	10	246	34	33	282	212	356	17

districts. This represents an important policy decision as the funding to districts will be based on this set of programs. For this example, four basic types of programs were established based on the amount of time students spend in each program, the particular set of resources utilized in each program, and the number of students per unit in each program. These programs are (1) self-contained class (greater than 20 hours per week; (2) special class (from 12 to 20 hours per week); (3) resource room (from 5 to 12 hours per week); and (4) supplemental instruction (less than five hours per week). In fact, these four basic programs are extended to 11 different program configurations to reflect the special resources required to meet the educational needs of certain categories of handicapped children.

The next step involves identifying the program placements for each student category. This is done through the use of a matrix with the categories as the rows and the instructional programs as the columns. Working down the matrix one category at a time, the district would specify or report to the state the number of students in that category in each of the programs. Table 1 shows the results of this process for this example. Not all programs are appropriate for all categories and empty cells indicate that there are no students of that category placed in that program. For example, EMR students were reported only in the special class program, specific learning disability students were reported in the regular self-contained class, special class and resource room programs, and the regular students were all assumed to be in regular self-contained classes. (The number of students by category and program correspond to the $[S_{np}]$ in the Appendix. The numbers in parentheses below the S_{np} are the θ_{np}.)

Note that the sums of the proportions of students in various need categories assigned to educational programs exceeds one in some cases. This

reflects the fact that students are assigned to more than one educational program during any given day. For example, five of the students listed as visually handicapped are shown to spend a portion of their day in a regular education self-contained classroom, while the other portion of their day is spent in a resource room. These students are, for the purpose of program assignments, counted twice.

Our example assumes the use of the actual district placements of exceptional children in instructional programs. To reduce district incentives to choose placements for revenue maximization rather than student need, it may be necessary to place state controls or limits on the distribution patterns of students to programs. An alternative would be to establish a single statewide pattern for funding purposes only. This standard pattern would be applied to all districts' exceptional student populations to establish a standardized distribution of students among program placements on which to calculate state aid. (This implies establishment of a standardized assignment matrix $[\theta_{np}]$.)

The next step requires the specification of the input configurations for each of the instructional programs. It is the critical policy-making step in the process since the results determine the funding levels for the programs. In actual practice, it would be appropriate for the specification of the input configurations to be done at the state level with consultation from district personnel and based on available cost and student data.

The specification process focuses on defining a "unit" of each program, which is the basic instruction module, and is usually centered around a single teacher. Two separate, but related components are involved. First is the establishment of the number of students which can be served by one

unit of each program. In order to allow for some flexibility in student assignment within districts, it is necessary to specify both an optimal (or ideal) number of students per unit. These represent judgments by the policy-makers on what the appropriate values should be and can be aided by knowledge of current and exemplary practices, state regulations, experience, and the fiscal effects of different values. The second component of this step is the specification of what resources make up one unit of each program. This requires identification of both personnel and non-personnel resources which comprise the different units. This specification includes the type of resources, their characteristics, and quantities in the units. For example, types of resources may include teachers of various qualifications, instructional aides, other support personnel, materials and supplies, travel, classroom operation and maintenance. In specifying the students per unit and the resource configurations of the various programs, one further consideration is important--the time period for the program. By this is meant the shortest period of time in which the full number of students specified are served by the unit. In the four basic programs in the example this would mean:

1. Self-contained class--one day, since this is a full day, every day program for students placed here;
2. Special class--one day, again, students in this placement receive instructions every day in this program;
3. Resource room--one week, since this is a part-time program for students and they do not necessarily receive room services daily, it is assumed that the teacher will see all students assigned to this program within the course of one week; and
4. Supplemental instruction--also a part-time program with a one week cycle of instruction for the teacher to serve the assigned number of students.

The example of this specification process is given in Table 2. For each of the four instructional programs the basic input configuration is specified in terms of quantities for appropriate teachers, aides, and other professional personnel and the amounts of other non-personnel resources in the given unit. To illustrate with Table 2: The basic configuration of the self-contained class is defined as having one teacher, one aide, the equivalent of 15% of a support person (a more detailed breakdown would reveal that this fraction is composed of .10 FTE school social worker and .05 FTE counselor), and standardized amounts of non-personnel resources ($100 for purchased services, $700 for materials and supplies, etc.). Additionally, the optimal and maximum number of students which can be served by one self-contained class are given as eight and ten, respectively. By contrast, the basic configuration of the resource room provides for one teacher, no other personnel resources, and smaller standardized amounts of non-personnel resources. The optimal and maximum numbers of students per week of 20 and 25 respectively, represent the number of students served by a resource room teacher during the course of one week.

Each of the four major instructional programs has more than one basic configuration specified, however. All in all there are actually 11 programs for which input configurations were specified in the example. For the self-contained class, separate specifications have been made for physically handicapped or profoundly handicapped, for emotionally disturbed, and for regular students. The reason for this is that the needs of the various types of students placed in this basic type of program are sufficiently different from one another to necessitate different input specifications. In comparison to the basic configuration, the physically handicapped

TABLE 2

Specification of Input Configurations

Instructional Programs	RESOURCE QUANTITIES							STUDENTS/UNIT	
	Personnel			Non-Personnel					
	Teacher	Aide	Other Professionals	Purchased Services	Materials Supplies	Other	Equipment	Optimal	Maximum
SELF-CONTAINED CLASS									
Basic Configuration	1.0	1.0	0.15	100	700	150	200	8	10
Physically Hc or Profound	1.0	2.0	0.20	200	1000	200	500	8	10
ED	1.0	1.5	0.30	150	700	150	200	6	9
Regular Class	1.0	-	.05	50	500	100	100	26	28
SPECIAL CLASS									
Basic Configuration	1.0	1.0	-	100	600	150	100	11	14
Physically Hc or Profound	1.0	1.5	0.05	200	900	200	300	9	11
ED	1.0	1.0	0.20	150	600	150	100	10	12
RESOURCE ROOM									
Basic Configuration	1.0	-	-	50	600	100	100	20	25
Gifted	1.0	-	-	100	600	100	100	40	50
SUPPLEMENTAL INSTRUCTION									
Basic Configuration	1.0	-	-	100	500	250	50	50	60
Home & Hospital	1.0	-	-	50	200	200	50	60	12

self-contained class has an additional aide, slightly more allocation of other professionals, and higher amounts of non-personnel resources, particularly equipment, in order to accommodate the needs of these students. The other reason for a separate specification would be the use of different numbers of students per unit values. In the resource room specifications, for example, the basic and the gifted configurations have almost the same resource quantities specified, but the number of students per unit is doubled in the resource room for gifted students. In the language of the general RCM model, each of these separate specifications represents a different program.

The next step is to determine the number of program units that the district is allowed for funding purposes. Ideally, each unit would be of optimal size, but this is not likely to be possible in an actual district due to uneven distributions of students. Therefore, the procedures have been designed to allow for the fewest number of program units while ensuring that no single unit exceeds the maximum.

The calculation of the number of allowable program units involves the number of students in the category/program placement matrix (Table 1) and the optimal and maximum numbers of students per unit for the program (from Table 2) and follows the general calculation process described in the Appendix. The calculation process is demonstrated in Table 3. First, the number of students of a given category in a given program placement (e.g., TMR in self-contained class = 42) is divided by the optimal number of students in a unit of that program (e.g., 8 for the basic configuration which applies to TMR). The resulting number of units (e.g., 5.2) is rounded down to a whole number of units (e.g., 5 units) since it is assumed for the

TABLE 3

Calculation of Instructional Units

Instructional Program	Category	Number of Students	Optimal S/U	Average Units	Rounded-Down Units	Students / Rd Units	Maximum S/U	Below Max?	Allowable Units
Self-Contained	TMR	42	8	5.2	5	8.4	10	OK	5
	Phy Hc	20	8	2.5	2	10.0	10	OK	2
	Deaf	5	8	.6	0	inf.	10	No	1
	ED	10	6	1.7	1	10.0	9	No	2
	Profound	17	8	2.1	2	8.5	10	OK	2
	Regular	12, 8, 54	26	494.4	494	26.0	28	OK	494
Special Class	EMR	181	11	16.5	16	12.9	14	OK	16
	Phy Hc	34	9	3.8	3	11.3	11	No	4
	Deaf	24	11	2.2	2	12.0	14	OK	2
	Vis Hc	6	11	0.5	0	inf.	14	No	1
	ED	33	10	3.3	3	11.0	12	OK	3
	SLD	35	11	3.2	3	11.7	14	OK	3
Resource Room	Vis Hc	5	20	0.25	0	inf.	25	No	0
	ED	56	20	2.8	2	28.0	25	No	3
	SLD	221	20	11.0	11	20.1	25	OK	11
	(All Hc	282	20	14.1	14	20.1	25	OK	14)
	Gifted	212	40	5.3	5	42.4	50	OK	5
Supplemental Instruction	Speech	356	50	7.1	7	50.9	60	OK	7
	H & H	17	10	1.7	1	17	12	No	2

example that only complete units will be funded. A check is then performed to see if the rounding down results in the number of students divided by the rounded down number of units yielding an average number of students per unit (e.g., 42 ÷ 5 = 8.4) greater than the maximum number of students per unit allowed (e.g., 10 for TMR in a self-contained class). If it does not, then the allowable units are equal to the rounded down number of units (e.g., 5 units). If it does exceed the maximum, then one is added to the rounded down number of units to obtain the allowable units (e.g., physically handicapped in a special class goes from a rounded down number of units of 3 to an allowable number of units of 4 to meet this criterion).

It is important to emphasize at this point the focus on program units as the basis for cost and funding determination rather than on a per student basis. This approach more closely approximates the actual district situation in which the marginal cost of one additional pupil, in general, is close to zero, until the maximum class size is exceeded. At that time, there is a large increase in costs as a full additional unit is added.

There may arise instances in which the district has too few students in a certain category to qualify for even one unit of a given program; that is, there are fewer students than the optimal number of students per unit. There are several alternatives when this occurs: (a) always allow one unit of the program if there are any students in the category/program combination; (b) allow one unit of the program if the number of students equals, say, half or more of the optimal number and disallow a unit with less students than this number; (c) disallow a unit if the program has fewer than the optimal number of students and expect the students to be placed with students of different handicaps in the requested program (e.g., deaf with

profoundly handicapped in self-contained classes) or to be placed with students of the same handicap in a different program (e.g., deaf from self-contained in with deaf in special classes); or (d) modify the specification of the input configuration to adjust for the fewer number of students. Different decision rules may be appropriate for different categories and programs or to fit different state or district preferences. In the example, the second alternative was used for simplicity. The numbers of both the deaf students in the self-contained class and the visually handicapped students in the special class exceeded half of the optimal number of students per unit for these programs so one unit was allowed for each. On the other hand, the number of visually handicapped students in the resource room was only 25% of the optimal number of students per unit for this program so no unit was allowed. It is assumed that the visually handicapped students will be placed with students of other handicapping categories in the resource room units that the district operates. In fact, this is a common practice for this program.

The generic nature of the resource room, in which it is often possible for a given resource room teacher to serve most categories of mildly handicapped students in a single setting, provides another alternative for calculating the number of allowable units. If it is felt that it is feasible to mix different categories of mildly handicapped students in a given resource room, then there is no need to calculate the number of program units by separate category. Rather, it would be easier and more realistic to calculate the number of allowable units based on the total number of handicapped students in the resource room program. This alternative calculation in which the handicapped students are summed is shown in parentheses in the

example. The total number of allowable units is identical in this case, although this is not necessarily always the case. In fact, if there is a difference, separate calculations by handicap will yield a higher number of allowable units.

In a similar fashion, it is now necessary to specify and determine the requirements for supervision and administration of the instructional programs. This involves the same process of establishing the supervision and administrative programs (or functions) which are to be provided and funded, specifying the input configurations of each of these programs, and calculating the number of allowable units of each program. For the sake of the example, these activities have been simplified into only two functions--administration of instructional programs and general administration. In actual practice, a much more detailed identification could be made and would include in-program administration functions all of the supervisory, support, curriculum, and coordination activities necessary to operate and direct the instructional programs, and in the general administration functions all of the overall district activities and services such as district office staff, facility maintenance, and transportation.

Table 4 provides the example specification of both the program and general administration activities. In each, the personnel and non-personnel resources are specified in terms of one unit of administration. Analogous to the instructional program unit, the administrative unit is centered around a manager and identifies the support personnel and services which are thought to be required for the unit to operate adequately. One unit of program administration, for example, has been specified to include a manager (e.g., supervisor, program coordinator), half-time clerical support, and

TABLE 4

Program and General Administration Specification

	Resource Quantities							Program Units per Administrative Unit	
	Personnel			Non-Personnel					
	Manager	Clerical	Other Prof	Purch SVC	Mat & Sup	Other	Equip	Optimal	Maximum
PROGRAM ADMIN.									
Special	1.0	0.5	0.5	2000	1000	200	200	12	14
Regular	1.0	0.5	-	1000	700	200	100	15	18
GENERAL ADMIN.									
Special	1.0	1.0	1.0	3000	1000	300	200	60	70
Regular	1.0	1.0	-	2000	1000	300	200	75	85

half-time from another professional (e.g., school psychologist, curriculum specialist, school social worker, assessment personnel) for personnel resources and dollar amounts for the various non-personnel resources totaling $3,400 per unit. In the example, the number of administrative units is a function only of the number of program units allowed the district. For every 12 instructional program units for special education, one exceptional administrative unit is allowed, with a maximum number of program units to exceptional administrative units of 14. Regular education program administration has an optimal program unit to administrative unit ratio of 15 and a maximum of 18. A more precise specification might also consider the number of students in the district by both category and program placement as well.

The calculation of the required number of program and general administration units for the district example is shown in Table 5. In an identical procedure to that of instructional programs, the allowable administrative units are determined by dividing the number of instructional program units by the optimal program unit to administrative unit ratio, rounding the result down to the nearest whole number, and checking to see if this rounding down results in an average ratio exceeding the maximum. The outcomes indicate that for the overall exceptional program five program administration units and one general administration unit will be allowed.

With the resource specification and the allowable number of units for the instructional programs, program administration, and general administration established, it is now possible to determine the district costs for each of these areas. In order to calculate the different program and total costs, it is necessary to establish the prices of each of the resources

TABLE 5

Calculation of Program and General Administration Units

	Number of Pgm. Units	Optional Ratio	Average Units	Rounded-Down Units	Pgm. Units per RD Units	Maximum Ratio	Below Max?	Allowable Units
PROGRAM ADMIN.								
Special	69	12	5.75	5	13.8	14	OK	5
Regular	494	15	32.9	32	15.4	18	OK	32
GENERAL ADMIN.								
Special	69	60	1.15	1	69.0	70	OK	1
Regular	494	75	6.6	6	82.3	85	OK	6

identified in the input configuration. For example, this includes personnel costs (salaries and benefits) for each of the different types of personnel specified. The non-personnel resource costs were originally specified in dollar amounts and these amounts can be used directly in the costs calculations. The process of establishing the personnel costs is illustrated in Table 6. For each personnel type a basic salary is determined; this amount would be specified by the state after a thorough analysis of the average cost of the given position given a standardized set of personal characteristics. It is at this point that the resource cost indicies are used to adjust the average salary figures. The teacher or other personnel cost indices are used to adjust salary levels for variations in the cost of attracting and employing personnel with similar personal characteristics to any particular job assignment. An example of the impact of such a wage adjustment is subsequently presented.

Note that a difference in average base salary, is shown between special education teachers and regular education teachers. It was derived by examining the differences in salaries paid to special education teachers versus regular education teachers holding constant other characteristics such as years of experience, age, sex, race degree level, personal circumstances related to mobility, district working conditions, and general district and regional characteristics relating to attractiveness and cost of living. The result indicated that on average the added cost of a special education versus regular classroom teacher was 2%. This is reflected in the $16,320 salary used for special education teachers and the $16,000 salary for regular education teachers. To the base salaries, an amount equal to 20% was added to account for benefits. The sum of the base salary and benefits were used as the personnel costs by type of personnel.

TABLE 6

Example Personnel Costs

Type of Personnel	Base Salary	Benefits (20%)	Personnel • WST
Special Education Teacher	$16,320	3,260	19,580
Regular Education Teacher	16,000	3,200	19,200
Instructional Aide	6,000	1,200	7,200
Other Professional Personnel	20,000	4,000	24,000
Program Administrator			
- Exceptional	24,000	4,800	28,800
- Regular	25,000	5,000	30,000
General Administrator	28,000	5,600	33,600
Clerical	10,000	2,000	12,000

To calculate the separate program costs, it is necessary to determine the number of various types of resources required by the allowed program units and multiply these amounts by the price of the resource. This procedure is shown in Table 7. For instructional programs for special education the various allowable program units are arrayed by type of program and

TABLE 7

Calculation of District Funding

	Program	Category	Allocated Units	Number of Teachers	Number of Aides	Number of Other Professionals	Total Non-Pers. Resources	
INSTRUCTIONAL PROGRAMS								
Special	Self-Con	TMR	5	5	5	.75	5,750	
		Phy Hc	2	2	4	.40	3,800	
		Deaf	1	1	1	.15	1,150	
		ED	2	2	3	.60	2,400	
		Profound	2	2	4	.40	3,800	
	Sp Class	EMR	16	16	16	-	15,200	
		Phy Hc	4	4	6	.20	6,400	
		Deaf	2	2	2	-	1,900	
		Vis Hc	1	1	1	-	950	
		ED	3	3	3	.60	3,000	
		SLD	3	3	3	-	2,850	
	Res Rm	Vis Hc	-	-	-	-	-	
		ED	3	3	-	-	2,550	
		SLD	11	11	-	-	9,350	
		Gifted	5	5	-	-	4,500	
	Supp Ins	Speech	7	7	-	-	6,300	
		Home & Hos	2	2	-	-	1,000	
Total			69	69	48	3.10	70,900	
Price/Resource				19,580	7,200	24,000	1	
Cost ($000)				1,351	346	74	71	1,842
Regular	Self-Con	Regular	494	494	-	24.70	370,500	
Price/Resource				19,200	-	24,000	1	
Cost ($000)				9,485	-	593	370	10,448

TABLE 7 (cont.)

Calculation of District Funding

	Allocated Units	Number of Managers	Number of Clerical	Number of Other Professionals	Total Non-Pers. Resources	
PROGRAM ADMINISTRATION						
Special	5	5	2.5	2.5	17,000.	
Price/Resource		28,800	12,000	24,000	1	
Cost ($000)		144	30	60	17	251
Regular	32	32	16	-	64,000	
Price/Resource		30,000	12,000	-	1	
Cost ($000)		960	192	-	64	1,216
GENERAL ADMINISTRATION						
Special	1	1	1	1	4,500	
Price/Resource		33,600	12,000	24,000	1	
Cost ($000)		34	12	24	4	74
Regular	6	6	6	-	21,000	
Price/Resource		33,600	12,000	-	1	
Cost ($000)		202	72	-	21	295
Total Special ($000)		1,529	388	158	92	2,167
Total Regular ($000)		10,647	264	593	455	11,959
Total District ($000)		12,176	652	751	547	14,126

by category. The number of each of the types of personnel resources associated with the number of allowable program units is tallied along with the amount for non-personnel resources. For example, for TMR students in self-contained classes, five program units are allowed. This in turn requires five special education teachers, five aides, .75 (FTE) other professional personnel, and $5,750 in non-personnel resources (5 x $1,150/unit). The requirements for all of the special education programs are totaled; the example shows totals of 69 special education teachers, 48 aides, 3.10 other professional personnel, and $70,900 in non-personnel resources. These quantities are then multiplied by their respective prices to obtain the cost of instructional programs for special education--$1,842,000 in the example. Similar calculations are carried out for regular instructional programs, program administration, and general administration. The results from each program are then summed to arrive at the total district cost of $14,185,000. Thus, the example shows how district costs are determined from student needs, program specification, and prices of resources.

It is important to reiterate at this point that the purpose of the RCM funding system which the example illustrates is not only designed to establish district funding based on student needs, but to provide for differences in funding levels of districts with differing student needs. First, it should be clear that another district with the same number and mix of students and facing the same prices for resources would have calculated the same costs and received the same amount of funding.

Let us now extend the example to examine what would happen if there are differences between two districts in either the number and mix of students and/or price of resources. First, the students will be varied. For

simplicity, only one category of exceptional students will be considered. Assume that: (a) a second district has the same total number of students and an identical student composition, except for the SLD category; (b) that instead of 256 SLD students, the second district had 400 (or 144 more SLD students); and (c) that the 50 SLD students are assigned to special classes and 350 to resource rooms. What differences would this make in district costs?

To determine the effect of the greater number of SLD students on-costs, it is first necessary to recalculate the allowable number of instructional program units for this category. Following the same procedure shown in Table 3, the allowable number of units for the special classes and resource rooms for SLD students increase by one and six respectively. The additional program units cause a cost increase of $150,310. These additional program units also have an impact on the units required for program and general administration; the specific situation in the example causes both the program and general administration units to increase by one, which causes an additional $124,300 in these costs. Therefore, the total district special education cost increase due to the difference in the number of SLD students and their placements is $274,610. However, the placement of 15 additional students into special classes for SLD and out of regular education classrooms has a potential effect on regular education costs as well. (The SLD students in resource rooms are assumed to already be in regular education classrooms as their primary placement.) The reduction in the number of regular education students causes a reduction of one in the allowable units for instructional programs. Program administration and general administration units are not affected in this situation. The net cost reduction

associated with the loss of one program unit is $21,150 from the regular education costs. The net effect for the district for the increase in SLD students is a cost increase of $253,460. Table 8 shows these calculations.

Next, the effect of changing the prices of resources between districts will be examined. Assume in this case: (a) that a second district has an identical composition of students as the example district; (b) that the second district is in a different portion of the state and faces different wage requirements due to differences in cost of living or other factors which affect the ability of the district to attract similar personnel; (c) that the salary cost for personnel with similar characteristics is 2% lower in the second district, and (d) that the non-personnel resource costs are the same for both districts. (The salary or other resource price differences are derived from separate statistical analysis of the overall variations in prices and their salaries or prices are simulated while controlling for (holding constant) all those explanatory factors which are within the discretion of local school decision-makers.) What would the effect on total district costs be of the lower personnel resource costs?

To determine the impact of wage differentials between the two districts, it is necessary to reduce personnel costs calculated for the first district by 2%. (An alternative procedure would be to recalculate the example district costs [Table 7], but include a wage index of .98 applied against personnel costs and calculate the difference between the two districts' total costs). The results of procedure are shown in Table 9. The calculations indicate that the impact of a 2% differential for the prices of personnel resources would reduce the total costs in the second district by $271,580 with the greatest effect in the regular education program.

TABLE 8

Cost Differences Due to Additional SLD Students

	Number of Students	Allowable Units	1st District Units	Difference	Cost/Unit	Cost Increase
Special Education						
Instructional Programs						
Special Class	50	4	3	+1	27,730	27,730
Resource Room	350	17	11	+6	20,430	122,580
				Subtotal		$150,310
	Program Units					
Program Administration	76	6	5	+1	50,200	50,200
General Administration	76	2	1	+1	74,100	74,100
				Subtotal		$274,610
			Total Special Education Cost Difference			$274,610
Regular Education						
Instructional Programs	12,839	493	494	-1	21,150	-21,150
Program Administration	493	32	32	0	-	0
General Administration	494	6	6	0	-	0
			Total Regular Education Cost Difference			$-21,150
Total District Cost Difference						$253,460

TABLE 9

Cost Differences Due to Prices of Personnel Resources

	Instructional Programs	Program Administration	General Administration	Total
Special Education	-35,420	-4,680	-1,400	-41,500
Regular Education	-201,560	-23,040	-5,480	-230,080
Total	-236,980	-27,720	-6,880	-271,580

As a final example, let us consider the two effects together--a comparison district facing both a different number and mix of students (SLD example) and a different price of resources (2% lower personnel costs). In this case, not only the cost implications of the individual effects must be determined, but additionally the joint effect of the differences in pupil needs and resource prices. The results of this process are shown in Table 10. The cost implications of the individual changes have already been presented in the two previous tables and they are simply repeated here. However, the joint effect is slightly more complicated. They involve the 2% wage adjustments to the personnel cost changes caused by the additional SLD students. First, the personnel costs in the additional special education units (instructional programs, program administration, and general administration) have to be reduced by 2%, resulting in a reduced cost of $5,200. Conversely, the savings on the elimintated regular education unit (instructional programs) also have to be reduced by 2% of the personnel costs or $420. When combined with the two individual effects, the net cost difference for a district with the differences in student number and mix and in the prices of the personnel resources is a reduction of $22,900 from the example district.

TABLE 10

Cost Differences Due to Both Additional Students and Prices of Personnel Resources

Cost increase from more SLD students	$ 253,460
Cost decrease from lower personnel costs	-271,580
Cost change due to both effects combined	
Lower cost of additional SLD units	-5,200
Lower savings on reduced regular units	420
Net cost change from both effects	$ -22,900

V. IMPLICATIONS OF THE MODEL AND SOME CONCLUDING REMARKS

What we have proposed in the preceding pages is a model designed for the purpose of funding educational services provided by local school districts. The model emphasizes a cost-based funding approach that explicitly recognizes systematic differences not only in the prices of schooling resources employed across districts in different locations, but also differences in the patterns of employing various school resources necessary to provide the kinds of educational programs directed at the different combinations of pupil needs. It implies that state and federal policy makers will need to take account explicitly of both differences in resource costs and programmatic differences in service costs in the distribution of state aid to local educational agencies. It also provides a rational basis for making fiscal decisions at the state level regarding the provision of funding for any given educational program or the entire package of educational programs to be offered by the state and provided by the local schooling organizations. With these issues in mind, let us now explore some of the virtues and limitations of the approach by examining its relationship to equity and efficiency considerations in school funding.

Equity Issues

The ultimate effort of school finance reform, whether limited to general education programs or extended to include categorical programs directed at special needs, is to improve the equity in the distribution of state aid to local districts for the provision of educational services. For the purposes of this discussion, we shall ignore the concerns expressed by some policy makers over local control and focus on systems of full state assumption where the equity issue is best illuminated. Within a system of full

state assumption of school finance, would equal dollars to all districts provide an equitable distribution of state and/or federal funds to local districts? The answer to this rhetorical question is obviously no on at least two counts. First, any two districts might be serving students with different educational needs and thus require different combinations of school resources and incur differential costs accordingly. Second, even if the two districts served the same combinations of children with respect to educational needs, one might find that they confront differences in the prices they have to pay to attract similar kinds of school resources (e.g., teachers or other school personnel). Thus, it seems reasonable to conclude that a more equitable solution to the inequity of the school finance system would be to provide enough additional dollars to compensate for the higher costs incurred by districts serving pupils with special educational needs or districts located in regions exhibiting higher prices for school resources.

The proposed resource cost model does just this. It provides an estimate of the additional costs of providing for special programmatic needs of pupils and can incorporate into the cost and funding calculations the differences in resource prices paid by districts in different locations. It forces policy makers, at least at the state level, to think systematically about what an adequate educational program should look like for different kinds of children; and once having defined what they believe is an adequate program, it requires a systematic distribution of resources according to pupil needs across districts serving various combinations of pupils. Districts in similar circumstances with respect to the combination of pupils according to educational needs and the prices of school resources they face

are treated similarly, while districts serving different combinations of pupils and facing different resource prices are treated systematically different.

Once we have accepted as reasonable the standardized resource configurations associated with serving the various programmatic needs of different pupils, then we can say that the resource cost model treats districts and ultimately the children they serve equitably. However, there are serious and important limitations to this conception of equity that ought to be recognized by the state and/or federal policy makers considering such a funding approach. While it does provide a systematic framework within which one might consider relationships between educational inputs and outcomes, it in no way ensures that the distributions of resources to different districts or to different kinds of pupils will result in similar "life chances" or even similar educational outcomes. Obviously, this problem goes right to the heart of how one defines the concept of equity. At best, the model ensures that with respect to funding similar students will be treated similarly and different students will be treated differently where the differences have been identified and defined in terms of the perceptions of educational policy makers. It is the responsibility of these policy makers to (a) identify the kinds of differences in pupil needs that will be recognized and (b) the differences in the program configurations that are "adequate" to meet these different needs. Whether or not the identification of students or specification of their needs is coincident with some more basic concept of educational outcomes or life chances is not essential to the development or implementation of the resource cost model. Moreover, the resource cost model does not imply any kind of attention paid to how programs are

actually implemented. At one level this means that no specification of curriculum and curriculum materials is included in the definition of a program, and there is no attempt to define what goes on inside programs in terms of instructional technology. Moreover, this resource cost model approach could be implemented as strictly a funding mechanism with no required link to service delivery. Districts could be given a lump sum grant which simply accounts for the differences in resource prices and program configurations and permitted to spend the funds as they please. Alternatively, districts might be given funds based on RCM, but portions of which are earmarked for particular programs and told they could spend within programs in any way they please. Or finally, districts might be given funds and told to spend them according to the resource configurations specified in the construction of the funding allocations. In this last case, the delivery of services would simply mirror the resource configurations specified in RCM.

If RCM is used exclusively for funding purposes and there is no link to the actual delivery systems for educational services, the relationship between equity in funding and service delivery is obviously mitigated to some degree. The use of standardized patterns of student assignment among programs would further reduce the linkage of this funding mechanism to equity. Without accurate headcounts of students in programs by district, it is not possible to tie costs to actual service delivery and therefore a standardized matrix would be required indicating the proportion of different combinations of children (e.g., AFDC, non-English-speaking, educationally mentally retarded) who are assigned to specific programs. This may or may not actually reflect the patterns of service delivery within a given district.

Efficiency Issues

RCM provides a solid foundation for educational policy makers to make rational decisions regarding funding of educational services in local school districts. It provides a framework for specifying what policy makers regard as adequate educational programs to serve various pupil needs and provides a systematic mechanism for distributing funds across local districts. It also can serve as a planning device that can be used to make projections into the future as well as to evaluate current options for trade-offs both within and between programs to examine the costs of alternative delivery systems and/or to reduce costs. To see how this tool might be used, it is useful to describe how the approach could be used to determine the funding for educational services within the state.

The state would specify all of the appropriate programs, count up the students served (or predicted to be served) by each of these programs within each of these districts, and price out the appropriate combinations of resources to arrive at not only a dollar figure required for each district, but also a total dollar figure required to provide the various programs for the state. This figure may be used by policy makers to trace out the relationships between potential patterns of service delivery and costs. This information could be used to arrive at final budget figures based on the willingness of policy makers to spend money to provide certain kinds of services. Policy makers are forced to think systematically about what the appropriate input configurations are to provide adequate educational services and to make comparisons against alternative uses both within and across programs. From this perspective, it is clear that one cannot consider the funding of various programs in isolation from one another. they must be considered

simultaneously. Policy makers will have to confront two facets of the comparisons across programs and the trade-offs within programs. First, they will have to make some judgments about relationships between educational outcomes and inputs. Clearly, there is not likely to be much objective information upon which to base such judgments. Nevertheless, some perceptions of what the educational process yields in terms of outcomes for these various programs will have to be considered seriously in the debate. Professional judgments, perhaps based on observations of programs over time and discussions with educational professionals providing the services, will have to be made in order to begin to specify these programs.

Second, some value judgments will have to be made not only with respect to the various component outcomes associated with various educational programs (e.g., achievement test scores, or the acquisition of self-help skills by a mentally handicapped child), but also with respect to the importance of meeting the overall educational needs of different kinds of children (e.g., handicapped, disadvantaged, or those without special needs). Without more objective information about educational technologies and input-output kinds of relations (if that is indeed possible), it will be virtually impossible to distinguish between the professional judgments about educational outcomes being produced versus the relative priorities placed on them.

Despite all of these difficulties, it still seems clear that RCM provides a systematic framework within which these issues may be explicitly addressed. However, that in itself may present another difficulty. Policymakers (particularly elected officials) may not want these kinds of trade-offs made so apparent for "outsiders" who might evaluate their judgments. In the case of RCM, any changes in the resource configurations, etc. from

one year to the next or from one proposed budget to the next within a given year reveals quite explicitly the nature of the trade-offs that have been made, not just in dollar terms (as is currently possible), but also in terms of the specific resources devoted to children. It frankly may not be that attractive to make these kinds of trade-offs so apparent. Without more objective information on the educational effects of these trade-offs, the numbers become open to widely varying interpretations by various interest groups and create potential difficulties for legislators considering budget allocations.

This does not mean that RCM cannot be used in this context. Some policy makers may welcome this kind of framework for decision making. However, it may suggest that the stage of the budgetary process at which this model gets implemented be carefully considered and that the ultimate funding decision made by a legislative body might be simplified so as to avoid some of the technical arguments over educational program specification and political difficulties that could arise from these decisions. As an example, the state of Florida uses full-time equivalent (FTE) counts of pupils assigned to various "programs" in the funding of the state educational system. While the Florida funding approach differs in some important respects from RCM, there is an interesting facet of the way in which it is implemented. Each FTE pupil receives a weight according to the "program" in which the pupil is served. This weight is, in fact a per pupil "cost factor." (For the purposes of this discussion it is not important how the "cost factor" is derived.) Therefore, the state can determine both unweighted and weighted FTE counts of pupils. A regular pupil in grades 4-9 is counted as one (1.0), while a deaf pupil is given a weight of 3.92. The legislature

is then asked to attach a dollar figure to one FTE. In other words, the legislature attaches a dollar figure indicating the amount they are willing to spend on a per pupil basis to educate a regular pupil in grades 4-9. The allocations among the various categorical programs may then be determined by simply looking at the weights associated with each type of educational program and the number of weighted FTE pupils assigned to each by district and for the state as a whole. Since the weights are based on "cost factors," the legislature never has to consider these trade-offs (at least not on a year-to-year basis).

Some kind of similar technique could well be devised for RCM only it would more likely be based on a standardized unit of service rather than on a per pupil basis.

Notes

[1]See Hartman (1980a) for a more detailed discussion of the advantages and disadvantages of these alternative funding approaches.

[2]For a more comprehensive theoretical discussion of the issues related to the development of resource price differences, see Chambers, 1979.

[3]This 2% cost differential is derived from simulating the salaries required to attract similar kinds of personnel between the two districts. This is derived from personnel cost indices like those developed by Chambers, 1980.

References

Antos, Joseph R., & Rosen, Sherwin. "Discrimination in the Market for Public School Teachers." Journal of Econometrics 3:3 (1975), 123-50.

Arkansas Department of Education. "State Plan for Special Education." Little Rock, Ark.: Arkansas Department of Education (1975).

Augenblick, John, & Adams, Kathleen. "An Analysis of the Impact of Changes in the Funding of Elementary/Secondary Education in Texas: 1974/75 to 1977/78." Denver, Colo.: Education Commission of the States (1979).

Bentley, R. W. "An Exploration of the Relationships between Expenditures for Educational Programs for Exceptional Children and Expenditures for Regular Education Programs." Unpublished doctoral dissertation, University of Wisconsin (1970).

Bernstein, C. D., Hartman, W. T., Kirst, M. W., & Marshall, R. S. Financing Educational Services for the Handicapped. Reston, Va.: Council for Exceptional Children (1976).

Brazer, Harvey E. "Adjusting for Differences Among School Districts in the Costs of Educational Input: A Feasibility Report." Selected Papers in School Finance 1974. Washington: Office of Education, U.S. Department of Health, Education, and Welfare (1974).

Brazer, Harvey E., & Anderson, Ann P. "A Cost Adjustment for Michigan School Districts." Selected Papers in School Finance 1975. Washington: Office of Education, U.S. Department of Health, Education, and Welfare (1975).

Busselle, Tish Newman. "The Texas Weighted Pupil Study." Austin, Texas: Texas Education Agency (1973).

Chambers, Jay G. "The Development of a Cost of Education Index: Some Empirical Estimates and Policy Issues." Journal of Education Finance, Winter 1980, 5(3).

Chambers, Jay G. "Educational Cost Differentials and the Allocation of State Aid for Elementary/Secondary Education." The Journal of Human Resources, Fall 1978.

Chambers, Jay G. "The Hedonic Wage Technique as a Tool for Estimating the Costs of School Personnel: A Theoretical Exposition with Implications for Empirical Analysis." Journal of Education Finance (forthcoming).

Chambers, Jay G., & Hentschke, Gilbert C. "The Impact of Declining Enrollments on Costs of Education and the Level of School District Expenditures: An Analysis of School Decision-Making in the Face of Declining Enrollments." Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, California, April (1976).

Chambers, Jay G., & Vincent, Phillip E. "Geographic Cost-of-Education Differentials." Paper presented at the Seventeenth Annual Meeting of the Western Regional Science Association, Sacramento, California, February 24-26, 1978.

Chambers, Jay G., Odden, Allan, & Vincent, Phillip E. "Cost-of-Education Indices Among School Districts." Denver, Colo.: Education Commission of the States (1976).

Clemmons, A. L. "An Assessment of Cost Variations in Selected Exemplary Special Education Programs in Six Selected Minnesota School Districts." Unpublished doctoral dissertation, University of New Mexico (1974).

Cooper, Gary D. "Spatial Price Indices: The Florida Experience." Review of Regional Studies 6 (Winter 1976), 36-47.

Florida Department of Administration. "Florida Price Level Index, October 1976." Tallahassee, Fl.: Florida Department of Administration (1977).

Fox, James N. "Cost-of-Living Adjustments: Right Intent, Wrong Technique." Phi Delta Kappan 56 (April 1975), 548-50.

Frey, D. E. "Wage Determination in Public Schools and the Effects of Unionization." Labor in the Non-Profit and Public Sectors, ed. D. S. Hammermesh. Princeton, N.J.: Princeton University Press (1975).

Governor's School Finance Study Group. "Mississippi Public School Finance." Jackson, Miss.: Governor's School Finance Study Group (1973).

Grubb, W. Norton. "Identifying Teacher Supply Functions and Constructing Cost Indices: Methodological Explorations with California Unified School Districts." Berkeley, Ca.: University of California (1975).

Grubb, W. Norton, & Hyman, James. "Constructing Teacher Cost Indices: Methodological Explorations with California Unified School Districts," Selected Papers on School Finance 1975. Washington: Office of Education, U.S. Department of Health, Education, and Welfare (1975).

Hartman, William. Estimating the Costs of Educating Handicapped Children. Washington: Bureau of Education for the Handicapped, Office of Education, U.S. Department of Health, Education, and Welfare (1979).

Hartman, William. "Policy Effects of Special Education Funding Formulas." Journal of Education Finance (forthcoming).

Hartman, William. "Policy Issues in Funding Special Education Programs." Washington, D.C.: National Institute of Education, School Finance Study (1979).

Hawaii Department of Education. "State Plan for Special Education and Services." Honolulu: Hawaii State Department of Education (1975).

Hyman, James B. "Cost of Education Indices: Alternative Methods, Issues, and Answers." Unpublished doctoral dissertation, Stanford University (1977).

Johns, Roe L. "An Index of Extra Costs of Education Due to Sparsity of Population." Gainesville, Fl.: Education Finance and Management Institute (1975).

Johnson, Gary P. "Cost of Education Indices: The State of the Art and Implications for Indiana School Finance Reform." Indianapolis, In.: Indiana State Department of Public Instruction (1978).

Jones, Philip, & Wilkerson, William. "Special Education Program Cost Analysis." Bloomington, In.: Department of School Administration, Indiana University (1972).

Kakalik, James S. "Policy Issues in Cost and Finance of Special Education." Santa Monica, Ca.: The Rand Corporation (1977).

Kakalik, James, et al. "Services for Handicapped Youth: A Program Overview." Report R-1210-HEW. Santa Monica, Ca.: The Rand Corporation (1972).

Kenny, Lawrence W., Denslow, David, Jr., & Goffman, Irving J. "Determination of Teacher Cost Differentials Among School Districts in the State of Florida." Selected Papers in School Finance 1975. Washington: Office of Education, U.S. Department of Health, Education, and Welfare (1975).

Leppert, Jack, & Routh, Dorothy. "Providing for Special Education in Missouri." Tallahassee, Fl.: The Policy Resource Center (1978).

Leppert, Jack, Huxel, Larry, Garms, Walter, & Fuller, Heber. "Pupil Weighting Programs in School Finance Reform." School Finance Reform: A Legislators Handbook, ed. John J. Callahan and William H. Wilken. Washington: National Conference of State Legislatures (1976).

Loatman, Bruce. "Alternative Cost-of-Education Indices." Arlington, Va.: Killalea Associates, Inc. (1977).

Lucas, Robert E. B. "Working Conditions, Wage Rates, and Human Capital: A Hedonic Study." Unpublished doctoral dissertation, Massachusetts Institute of Technology (1972).

Lucas, Robert E. B. "Hedonic Wage Equations and Psychic Wages in the Returns to Schooling." American Economic Review 67: 4 (September 1977), 549-58.

Marriner, Leigh S. "The Cost of Educating Handicapped Pupils in New York City." Journal of Education Finance 3 (Summer 1977), 82-97.

McClure, William P., Barnham, Robert A., & Henderson, Robert A. "Special Education: Needs--Costs--Methods of Financing." Urbana, Il.: Bureau of Educational Research, College of Education, University of Illinois at Urbana-Champaign (1975).

McGuire, Kent, Augenblick, John, & Espinoza, Jennie. "School Finance at a Fourth Glance." Denver, Colo.: Education Commission of the States (1979).

McKeown, Mary P. "Distributing State Aid for Pupil Transportation: An Average Cost Formula." Springfield, Il.: Illinois Office of Education (1978).

McMahon, Walter W., & Melton, Carroll. "Differences in the Cost of Living Among States and Within States." Faculty Working Paper No. 459. Urbana-Champaign, Il.: University of Illinois (1978).

National Educational Finance Project. "Financing the Public Schools of Florida." Gainesville, Fl.: National Educational Finance Project (1973).

National Educational Finance Project. "Financing the Public Schools of South Dakota." Gainesville, Fl.: National Educational Finance Project (1973).

National Educational Finance Project. "Financing the Public Schools of Kentucky." Gainesville, Fl.: National Educational Finance Project (1974).

Odden, Allan, & Vincent, Phillip E. "Analysis of the School Finance and Tax Structure of Missouri." Denver, Colo.: Education Commission of the States (1976).

Odden, Allan, & Vincent, Phillip E. "The Fiscal Impacts of Declining Enrollments...." Declining Enrollments: The Challenge of the Coming Decade, ed. Susan Abramowitz and Stuart Rosenfeld. Washington, National Institute of Education, U.S. Department of Health, Education, and Welfare (1978).

Rossmiller, Richard A. "Financing Educational Programs for Handicapped Children." Financing Educational Programs for Handicapped Children, ed. Nancy Cain. Denver, Colo.: Education Commission of the States (1974).

Rossmiller, Richard A., & Moran, Thomas. "Programmatic Cost Differentials for Delaware School Districts." Gainesville, Fl.: National Educational Finance Project (1973).

Rossmiller, Richard A., Hale, James A., & Frohreich, Lloyd E. "Educational Programs for Exceptional Children: Resource Configurations and Costs." Madison, Wis.: Department of Educational Administration, University of Wisconsin (1970).

Schrag, Judy A. "A Study of Exceptional Children in Idaho: Special Education Needs Assessment Study." Boise, Idaho: Department of Public Instruction (1974).

Scott, Michael J. "Alaskan Interregional Cost Differentials." Fairbanks, Alaska: Center for Northern Educational Research, University of Alaska-Fairbanks (March 1977).

Simmons, James C. "Comments on Cost-of-Living Adjustments in School Finance." Phi Delta Kappan, 57 (October 1975), p. 120.

Simmons, James C., et al. "Florida Cost-of-Living Research Study: Florida Counties Price Level Index (FPLI) for October 1972." Tallahassee, Fl.: Florida State University (1973).

Snell, D. E. "Special Education Program Cost Analysis for Three Selected School Corporations in Indiana." Unpublished doctoral dissertation, Indiana University (1973).

Sorensen, Frank. "A Cost Analysis of Selected Public School Systems in Illinois." Springfield, Il.: Office of the Superintendent of Public Instruction (1973).

Thomas, M. A. "Finances: Without Which There Is No Special Education." Exceptional Children 39 (1972), 475-80.

U.S. Bureau of Labor Statistics. Consumer Expenditure Survey. Integrated Diary and Interview Survey Data, 1971-73. Washington: U.S. Department of Labor (1978).

Wendling, Wayne. "Cost-of-Education Indices for New York State School Districts." Denver, Colo.: Education Commission of the States (1979).

Wood, Norman. "Survey of Florida Teacher Purchases: Forty-Two Counties, Analysis and Results." Athens, Ga.: University of Georgia (1974).

APPENDIX

ALGEBRAIC SPECIFICATION OF THE RESOURCE COST MODEL

(a) Assessment of Pupil Needs and Program Assignment

Define

$S_n(d)$ = the number of pupils in district d who possess some observable set of need characteristics which are indexed by n;

θ_{np} = the proportion of pupils in each need category n who are assigned (for funding purposes) to each instructional program of type p;

S_{np} = the number of pupils in need category n assigned to program type p;

and $S_p(d)$ = the number of pupils in district d assigned (for funding purposes) to educational program type p;

Dropping the 'd' for simplicity, we have the following identify:

(1) $\sum_n S_n \cdot \theta_{np} = \sum_n S_{np} = S_p$ for all n and p, n = 1,...,N and p = 1,...,P

where N = the total number of need categories and P = the total number of different types of programs or delivery systems. Note that since any one pupil may be assigned to more than one program, we have

(2) $\sum_p \theta_{np} \geq 1.$

As suggested in the text of this paper, θ_{np} may either be standardized across all n and p or it may reflect the actual program assignments of pupils included in various need categories. In the first case, only $S_n(d)$ is unique to the district, and S_p reflects a standard pattern of program assignments once given $S_n(d)$ and the standardized values for the θ_{np}. In the second case, $S_p(d)$ reflects the actual patterns of pupil assignments to programs

since θ_{np} is derived directly from district data. In fact, if actual district assignment patterns are used, the step described in equation (1) is superfluous and analysis may begin immediately with the data for $S_p(d)$.

(b) Specification of the Number of Program Units to be Funded

For the purpose of determining the number of program units for which a district will receive funding, let us define the following variables:

S_p^* = the "optimal" number of pupils that educational policy makers believe should be served in each unit of an educational program of type p;

S_p^{**} = the maximum number of pupils that educational policy makers believe could be served in each unit if an educational program of type p;

I_p' = the integer value of the ratio S_p/S_p^*;

INT = an integer operator (function) that drops all digits beyond the decimal from a ratio (e.g., INT(2.8) = 2).

and I_p = the number of program units for which the district would be funded for program type p serving S_p pupils.

Given these variables, we may now define the following algorithm necessary to calculate the number of units or program type p for which the district will be funded.

$$(3) \qquad I_p = \begin{cases} I_p', & \text{if } S_p/I_p' \text{ is less than or equal to } S_p^{**} \\ I_p' + 1, & \text{if } S_p/I_p' \text{ is greater than } S_p^{**} \end{cases}$$

where $I_p' = \text{INT}(S_p/S_p^*)$.

To illustrate how these formulas might work, consider an educational program (e.g., a special class for handicapped children) for which it has been determined that optimal size (in terms of learning opportunities.

per dollar spent) is 10 pupils, while the maximum size that policy makers felt was permissible for this program is 12 pupils. (Clearly, such a determination may not be totally objective, but rather a matter of state policymaker perception of what makes a good program.) Further suppose that the district had determined through their "assessment program" that there are 83 pupils eligible for this particular educational program in the district. The number of program units offered by the district is determined as follows:

$$S_p^* = 10,\ S_p^{**} = 12,\ S_p = 83$$

$$I_p' = \text{INT}(83/10) = \text{INT}(8.3) = 8$$

Now since $83/8 = 10.375$ is less than 12 (i.e., S_p/I_p' is less than or equal to S_p^{**}), we set $I_p = 8$ and the 3 remaining students would presumably be assigned one each to any 3 of the 8 program units that would be established for this program. Suppose instead of the 83 students, the district has discovered only 38 students to be assigned to this particular educational program. Then $I_p' = \text{INT}(38/10) = \text{INT}(3.8) = 3$ and $I_p = 4$ since $38/3 = 12.67$ is greater than 12 (i.e., S_p/I_p' is greater than S_p^{**}). That is, the program units are increased from 3 in the initial computation to 4 because of the "extra" students.

A similar algorithm may be specified for the determination of the number of units of program administration and general administration for which the district will be funded. The one complicating factor here is that units of program administration and most certainly general administration will not necessarily be unique to any given program. While a special class may define a specific program for particular categories of handicapped children,

it may not have associated with it a specific configuration of program administration. Special education administration may span several programs or delivery systems all of which involve educational services for children with various handicapping conditions and specific programmatic needs. The algorithm for determining the number of administrative units (both program and general) which will be funded is a straightforward extension of that specified in equation (3) and is left to the reader.

(c) Specification of the Standardized Resource Configurations for Programs

The resource requirements that define an educational program include both personnel and nonpersonnel components and may be formally specified as follows:

$t_{jp}^{(i)}, t_{jp}^{(a)}, t_{jg}^{(a)}$ = the number of full-time equivalent (FTE) school personnel of type j assigned to each instructional program unit (superscript i), unit of program administration (superscript a), or unit of general administration (superscript a with subscript g replacing the p), respectively;

$x_{kp}^{(i)}, x_{kp}^{(a)}, x_{kg}^{(a)}$ = the amount of non-personnel school resource type k assigned to each instructional program unit (superscript i), unit of program administration (superscript a), or unit of general administration (superscript a with subscript g replacing the p), respectively.

The levels of these resources may generally be fixed on a per unit basis for districts where there are adequate numbers of pupils requiring these programs. However, where there are particularly small numbers of pupils within a given district, alternative levels of these resources may be specified. In any case, it is the responsibility of educational policy makers to specify these standardized resource configurations associated with each of the possible educational programs or delivery systems that might be

offered across districts within the state. These standardized configurations involve specification of the resources necessary to provide the instructional programs, to provide the administrative and professional support directed to specific instructional programs, and to provide the overall or general administration that supports the operations of the entire school district.

Under the simplist of circumstances, one can determine the total number of resources of various kinds to be funded by multiplying the number of units times the per unit resource configurations. We may write the following simple relationships:

(4a) $T_{jp}^{(i)} = I_p \cdot t_{jp}^{(i)}$ and $X_{kp}^{(i)} = I_p \cdot x_{kp}^{(i)}$ for all j and p

(4b) $T_{jp}^{(a)} = A_p \cdot t_{jp}^{(a)}$ and $X_{kp}^{(a)} = A_p \cdot x_{kp}^{(a)}$ for all j and p.

(4c) $T_{jg}^{(a)} = A_g \cdot t_{jg}^{(a)}$ and $X_{kg}^{(a)} = A_g \cdot x_{kg}^{(a)}$ for all j and g.

More complex relationships may be required in cases where it is deemed necessary to take account of the total numbers of pupils being served in the specification of support services and some components of program administration. Nevertheless, in most cases the simple equations (4) capture the nature of the relationship.

(d) Determination of Resource Prices and Total District Costs

The full explanation of the determination of the standardized prices (salaries) of school resources is beyond the scope of the present paper. But suffice it to say, that it involves first an empirical analysis of the determinants of the variations in, for example, personnel salaries—those

components that are within district control and those that are beyond local district control. And second, given this explanatory equation, the standardized prices are then determined by simulating the variations in salaries necessary to attract some standardized kinds ("qualities") of school personnel assigned to specific types of job assignments (e.g., educational programs). For a more complete theoretical explanation the reader is referred to Chambers (1979), while an empirical analysis may be found in Chambers (1980).

Nevertheless, the result of this analysis of price and wage differentials may be summarized with the following symbols:

$W_j(d)$ = the wage or salary cost index for district d for personnel of type j standardized according to some set of personal characteristics;

$C_k(d)$ = the standardized cost of each unit of non-personnel school school resource of type k for district d.

The total costs of educational programs may be defined as follows:

$CIP_p(d)$ = total costs of instructional program type p;

$CPA_p(d)$ = total costs of program administration for program type p;

$CGA_g(d)$ = total costs of general administration of type g;

$CEDUC(d)$ = the total costs of educational services for district d.

Program Costs

$$(5a) \quad CIP_p(a) = \sum_j W_j(d) \cdot T_{jp}^{(i)} + \sum_k C_k(d) \cdot X_{kp}^{(i)}$$

$$(5b) \quad CPA_p(d) = \sum_j W_j(d) \cdot T_{jp}^{(a)} + \sum_k C_k(d) \cdot X_{kp}^{(a)}$$

$$(5c) \quad CGA_g(d) = \sum_j W_j(d) \cdot T_{jg}^{(a)} + \sum_k C_k(d) \cdot X_{kg}^{(a)}$$

Overall Costs

(6) $$CEDUC(d) = \sum_{p} [CIP_p(d) + CPA_p(d)] + \sum_{g} CGA_g(d)$$

Overall costs of educational programs to the state (CEDUC) may be defined then as:

(7) $$CEDUC = \sum_{d} CEDUC(d)$$