

THE COSTS OF INSTRUCTIONAL INFORMATION SYSTEMS:  
RESULTS FROM TWO STUDY DISTRICTS

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## Introduction

Research interest in school district pupil assessment and in the ties between this assessment and instructional practice has progressed with a predictable logic over the past few years. A nutshell history of evaluation inquiry would suggest that long-standing efforts to understand and improve the art and craft of evaluation have recently made room for investigations of just how the results of evaluations are used by educators in our schools. And a consequence of this new focus has been a curiosity, primarily academic thus far, in the costs and benefits of performing and utilizing evaluation (Alkin & Solmon, 1983). Current research at UCLA's Center for the Study of Evaluation reflects this evolution of attention, and this article reports the findings of our second major investigation in the area of "evaluation costs."

This article complements CSE research on school district instructional information systems (Bank & Williams, 1983a,b; Williams & Bank, 1983; Williams, Bank, & Thomas, 1983). This term refers to formally-linked testing/pupil information/instructional planning systems evident in some elementary and secondary school districts (Bank & Williams, 1981, 1982). The research investigates several school system models fitting such a description; two such school district systems, through case studies, were examined in depth during the past year. Our interest centered on two types of analyses: (1) describing these instructional information systems and exploring ways of gauging their impacts (reported by Bank & Williams, 1983a,b; Williams & Bank, 1983; Williams, Bank, & Thomas, 1983), and

(2) identifying and probing issues related to the systems' costs. The cost inquiry is reported here.

The lessons we learned in the process of pursuing this cost investigation -- lessons reflecting research and policy issues -- may be of more lasting importance than the cost findings themselves. We report, therefore, both our cost findings and other observations of general interest which emerged during the study. First, the two district systems are briefly described, along with a rationale for why they were selected for our research. Then the cost data and analyses are presented, followed by a comparison of these findings to some related results from our previous testing costs research (Dorr-Bremme, et al., 1983). Finally, we describe the lessons emerging from our efforts -- those concerning what researchers may expect when approaching field inquiries into educational program costs, and others regarding the nature of the policy issues imbedded in the costs of evaluation systems.

### Two Study Models

#### Model I

The student achievement model, Model I, describes a system developed over the past dozen years in a small California school district as part of its curricular emphasis on individualized instruction. In this district, teachers use the results of twice-annual, criterion-referenced achievement testing to place students in classes, to group youngsters within classes for instructional purposes, to assess the effectiveness of their curricular strategies, to prescribe remedial activities, and to provide a basis of

communication with parents. While all of these purposes are commonly attached to school district assessment practices of one type or another, the study district illustrating this model incorporates these objectives into a tightly linked "system." The purposes listed above are served by a single battery of tests appropriately geared to grade levels. Furthermore, the district's core instructional continua in reading, mathematics, and language skills have been developed in tandem with the tests by the district's teachers and staff. The instructional program and the assessment instruments are thus intentionally matched, and the information generated by the assessments is viewed commonly by district personnel as both relevant and highly salutary for instructional planning and improvement.

Pupils in the Model I district are tested in the fall and winter of each school year. Results of tests, scored and elaborately organized through district data processing services, are available to teachers within a week.\* Learning specialists at each of the district's schools assist in test administration and interpretation of results. Principals use the test results as the primary basis of fall and spring planning sessions with individual teachers -- a critical component of the district's instructional leadership activity.

The student achievement model is now an ongoing, stable, and dominant fact of the district's instructional life. Both daily instructional activities and incidental assessments of pupil progress are directly geared to the scope and sequence of topics outlined in the continua. Teachers and administrators universally reported to us the centrality of this "system."

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\*Test reports are generated for each student, for groups of students, for individual classes, for individual teachers, and for each school.

## Model II

The school improvement model, Model II, was named for the California educational reform initiative which spawned its creation.\* Legislation over the past ten years has created statewide a pattern of school site planning and programming, which includes the provision of discretionary money to schools for the purposes of carrying out activities identified at each school as critical to its improvement. This planning is performed by school site councils staffed mainly by teachers and parents at each participating school; planning for instructional emphasis is thus decentralized. Instructional decisions are based partly on test data and partly on the results of systematic surveys of various school constituents. A norm-referenced test (The Iowa Test of Basic skills -- ITBS) is administered annually each spring to all pupils in grades 2 through 6. In addition, parents, teachers, and some pupils are surveyed to probe their perceptions of strength and weakness in current instructional programs.

The results of the tests and surveys are used by the site councils as a basis for allocating discretionary resources made available to each school participating in the state program -- funds in excess of \$100 per year per pupil. These resources are commonly used for specialized instructional materials, or for hiring aides to assist in critical areas of the instructional program. The overall thrust of planning efforts under this model is to assess pupil progress in key areas of the curriculum, and to

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\*This legislation is referred to as the "Early Childhood Education Program (ECE) and later as the "School Improvement Program" (SIP), both sponsored by former State Superintendent of Public Instruction, Wilson Riles, during the 1970s.

guide future instructional efforts toward areas of greatest perceived need. Our study district illustrating this model employs it in 40 of its 44 elementary schools.

The two study districts were chosen according to straightforward criteria. During previous CSE inquiries into district evaluation practices, these two districts had exhibited strong evidence of having a coherent "system" of pupil assessment and instructional administration. Since the heart of our proposed work was an exploration of attributes and costs of such systems, we were willing to consider any that appeared to be using a tightly linked system. And we were encouraged by the willingness of central office staff in both of these districts to provide information and access to us, and by their willingness to broach questions of cost in the analysis. As shown later, this latter concession may be more difficult to obtain in district settings than might be first supposed.

#### Approaching System Costs

The costs of a particular program or distinct set of activities in an organization can be thought of in a number of ways. Three approaches dominate the literature surrounding cost analysis: budgetary costs, resource or ingredient costs, and opportunity costs (Levin, 1981). By budgetary costs we mean explicit expenditures directed toward an activity and identified in an organization's budget statements. As might be expected, this approach to cost analysis is meaningful only when considering very distinct enterprises. For example, if a school district budgets for and operates a drop-in center for its out-of-school youngsters -- replete with its own staff, facility, and so forth -- its written budget might reflect a close



approximation of the program's monetary cost to the district. In this case, analysts might look to the district's budget documents for program cost estimates.

For our purposes, and for those of most program cost analyses generally, the budget is very unrevealing. Most school district programs and activities are supported by the efforts of teachers, administrators, staff, parents, and pupils who allocate their time to a multitude of ends, often simultaneously. And just how much effort lies behind any one pursuit is not often formally accounted-for. Our task of evaluating the costs of pupil information systems is a case in point. Both of the systems discussed here are supported in part by all of the participants noted above, each devoting varying amounts of time. An understanding of the costs of maintaining the two models must necessarily entail knowing something about the extent and value of the time of the people involved, as well as the value of other material resources devoted to the systems. A resource or "ingredients" approach -- identifying all resources attached to a system -- involves just this focus.

Even after identifying program resources, a final question remains which has led to a third dominant construct in the analysis of costs: how should the costs of resources associated with an activity or program be valued? One approach is to estimate market values for each resource. Thus, for example, the value of a day of teacher time could be estimated to equal the teacher's annual compensation divided by total days worked per year; administrator time could be similarly valued, costs of facilities used could be annualized and prorated to their various users, and so on.

Where all resources can be obtained in well-understood markets, these values will be good approximations of the costs of using these resources for any particular purpose. From a decision-making standpoint, another and perhaps better sense of the cost of a program has been suggested. When a district devotes its resources to one particular activity, it cannot then devote such tied-up resources to something else. That resources have varying values to their owners in alternative uses has led to the idea of "opportunity costs," defined to represent the value of resources to a decision maker in their best alternative deployment.

Our analysis of the costs of maintaining Models I and II approaches the task from an ingredients perspective; our central interest is to identify the full range of resources attached to each system in the study districts, and to generate estimates of the monetary value of these resources. We could thus compare "system" resources to total pupil expenditures in our desire to gauge their overall importance. While the analysis presented acknowledges the importance of the "opportunity cost" perspective, it concentrates for now on identifying resources and estimating their market values.

We relied heavily on the chief coordinator of each of the two instructional information systems studied in order to generate resource estimates. Both were intimately familiar with their systems. Where they did not know how much time or who was involved in performing certain activities, or how much was expended for purchased materials or services, other district personnel were consulted or appropriate district records checked. This approach provided a relatively complete picture of each model -- one

that withstood crosschecks with various district personnel. The possibilities of response bias are discussed below.

We organized our search for system resources, and report the results here, at three levels of district operation as well as for the district overall. For both Models I and II, we identified activities at the central office, school, and classroom levels. Totals of resources were recorded in their primary units (such as hours per week or fraction of full time, or actual dollars spent). For purposes of analysis, we calculate monetary equivalents for these resource allocations using estimates of district salary scales. In addition, per-pupil calculations are provided to facilitate comparisons.

#### Costs of Model I, Student Achievement

The resources needed to maintain the criterion-referenced testing and instructional management system of Model I are displayed in Tables 1 through 4. Table 1 presents the costs at the central district office level. These consist primarily of partial time allocations of central staff, and to a lesser extent the costs of test scoring services and purchases for such materials as answer sheets. The coordinator spends on average a little less than one day per week in support of the system over a typical year. In addition, an assistant superintendent reported spending about a day per month on system activities, as did the district instructional materials coordinator. A little more than one third of a secretary's time at the central level is required, primarily to assist with the processing of test results and with the generation of reports used by teachers and principals.

These time allocations have been valued according to approximate salary and fringe benefit levels and fractions of time devoted to the system. These factors are shown in Table 1. The overall level of central resources shown, about \$22,000, amounts to a little more than \$4.00 per pupil in the district.

Table 1  
Model I: Central District Costs

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Personnel	
° Evaluation Coordinator (17.5% FTE @ \$34,000)	\$ 5,960
° Instructional Materials Coordinator (5% FTE @ \$30,000)	\$ 1,500
° Assistant Superintendent (5% FTE @ \$40,000)	\$ 2,000
° Clerical Support (37.5% FTE @ \$18,000)	<u>\$ 6,750</u>
Total Personnel Costs	\$16,210
B. <u>Equipment and Materials</u>	
° Computer (17.5% devoted to CRT, annualized cost of \$10,000)	\$ 1,750
° Paper and Materials	
- Answer sheets	\$ 750
- Photo copying	\$ 750
- Printing	<u>\$ 2,500</u>
Total Equipment and Materials Costs	\$ 5,750
C. Total Central District Costs	<u>\$21,960</u>
D. Per Pupil Cost	\$ 4.22

Costs at the school site level, based on the same approach, are greater than those at the central office level. This is primarily because

of the significant amount of time spent by teachers and principals in planning instruction on the basis of system reports. Each principal spends a full week twice per year in one-to-one consultations with teachers to assist in instructional management. For each principal, this contributes to a total of more than a ten percent allocation of time on a yearly basis to the system. For each teacher, this planning activity occupies about six hours per year. In addition, a learning specialist at each school site devotes one day every other week to system activities. These school site-level costs, shown in Table 2, amount to a total of about \$15.00 per pupil over the year.

Table 2  
Model I: Site Level Costs (non-testing)

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Principal (2 weeks plus 1/4 to 1/2 day per week ongoing = 12% FTE @ \$30,000)	\$ 3,571.00
B. Learning Specialist (10% FTE @ \$28,000)	\$ 2,800.00
C. Media Specialist (2% FTE @ \$25,000)	\$ 500.00
D. Teachers (6 hrs. @ \$17 per hour for each of 22)	<u>\$ 2,244.00</u>
E. Total Cost at one school site	<u>\$ 9,115.00</u>
F. Per Pupil Cost	\$ 15.19

The remaining costs of conducting the Model I system, costs for testing, are displayed in Table 3. In addition to spending 5 to 10 hours per semester in administration of the tests, teachers spend about 5 hours in preparation and grouping youngsters for testing, and some teachers receive brief inservice sessions related to the testing program. In addition, some

items on the tests are teacher- or aide-scored, and the values of these time allocations are shown in the table. The time pupils spend taking tests and the time of parent volunteers have been recorded in the table, but no dollar approximations have been made. Testing costs identified amount overall to a little more than \$17.00 per pupil.

Table 3  
Model I: Testing Costs (per 30 pupils)

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Pre-Test Activities	
◦ Teacher planning: 5 hrs. (@ \$17 per hr.)	\$ 85.00
◦ Teacher inservice: 1/2 hr. average per teacher (not all teachers each year)	\$ 8.50
B. Test Administration	
◦ Teacher: 15 hrs. per year average (5 to 10 hrs. per semester)	\$ 255.00
◦ Pupils: 15 hrs. per year	\$ n.b.*
C. Scoring and Analysis	
◦ Teacher-scored items: 8 hrs. per year average	\$ 136.00
◦ Aide: 4 hrs. @ \$10 per hr.	\$ 40.00
◦ Parent Volunteers: 4 days	\$ n.b.*
Total Testing Costs (30 pupils)	<u>\$ 524.50</u>
Testing Costs Per Pupil	<u>\$ 17.48</u>
D. Total District Testing Costs (3800 pupils)	<u>\$60,600.00</u>

\*n.b. = Non-Budget Item

The costs of Model I are summarized in Table 4. Central office, school site, and pupil testing costs total about \$34.00 per pupil in the district. To this figure we might add a factor representing the value of

pupil time involved for testing (about 15 hours per year) and 4 days of parent volunteer time per classroom to achieve an overall picture of resources supporting the Model I system.

Table 4  
Model I: Total System Costs

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Central Costs	
° Personnel	\$ 16,210.00
° Equipment and Materials	<u>\$ 5,750.00</u>
	total \$ 21,960.00
B. School Site Level (non-testing)	
° Coordination and development	\$ 63,805.00
C. School Site Testing (524.50 per 30 pupils)	\$ 60,600.00
	Total <u>\$146,365.00</u>
D. Total Costs Per Pupil	\$ 34.00

Costs of Model II: School Improvement

As described earlier, there are substantial differences between the student achievement model and the school improvement model as systems for guiding instruction. Whereas the chief activities of the former are to test pupils, analyze test-generated information, and modify teaching activities, the primary methods of Model II are to conduct a comprehensive planning process and to direct specific added resources to identified areas of instructional priority on the basis of planning outcomes. As we might expect, observed patterns of resource use and costs for the two systems also differ. The costs of Model II are presented in a manner parallel to

the discussion above. Tables 5 through 8 present district, school site, and classroom level costs as well as a summary of costs respectively.

The central district costs for Model II were more plainly evident both to researchers and district staff than were those for Model I. Two professional staff members -- an evaluation specialist and a resource teacher -- devote themselves entirely to the Model II planning and evaluation system. Other central office personnel involved include a secretary at about half-time, and a small amount of temporary clerical assistance. Costs for these personnel (with total benefits to these staff shown separately because of district reporting formats) are displayed in Table 5. The table also shows costs for contracted research services (for assistance with the constituent surveys), and for word processing and printing. The total central costs, a little less than \$100,000, amount to between \$6.00 and \$7.00 per pupil.



Table 5  
Model II: Central District Costs

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Personnel	
° Evaluation Specialist	\$27,600
° Resource Teacher	\$18,800
° Secretary	\$ 8,000
° Temporary Clerical	\$ 1,500
° Benefits for all of above	<u>\$15,500</u>
	Total \$68,300
B. Contracted Research Services	\$16,000
C. Word Processing Services	
° Equipment Rental	\$ 2,500
° Maintenance Contract	\$ 1,000
° Supplies	<u>\$ 1,500</u>
	Total \$ 5,000
D. Printing	\$ 7,000
E. Miscellaneous	<u>\$ 1,000</u>
F. Total Central Office Costs	<u>\$97,300</u>
G. Costs Per District Pupil*	\$ 6.41

\*15,178 pupils in grades 2-6

The costs of Model II incurred at school sites, not including those for testing which are discussed separately below, are concentrated primarily in the time that various individuals devote to system planning and management. The school site councils engage teachers and parent volunteers in planning for constituent surveys and in making instruction-related recommendations based on the results of surveys and pupil tests.

Administrators assist site councils in ongoing monitoring of instructional

activities at each school. The amounts of time spent on the system for each of these types of people are recorded in Table 6. For teachers and administrators, dollar approximations of these costs are presented. Again, volunteer time is noted but not translated to dollar equivalents. The total site level costs amount to almost \$9.00 per pupil.

Table 6  
Model II: Site-level Costs, (non-testing)

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Planning	
◦ Administrator (1 day @ \$150)	\$ 150.00
◦ Certificated Staff (1 day @ \$100 for each 16)	\$1,600.00
◦ Community Volunteers (1 day for each of 12)	<u>\$ n.b.*</u>
Total Planning Costs	\$1,750.00
B. Ongoing Program Management	
◦ Administrator (1 day per month over 9 months)	\$1,350.00
◦ Certificated Staff (1 hr. per month over 8 months for each of 16 @ \$17 per hr.)	\$2,176.00
◦ Community Volunteers (1 day for each of 12)	<u>n.b.*</u>
Total Program Management Costs	<u>\$3,526.00</u>
C. Total Site Level Costs Per Site	<u>\$5,276.00</u>
D. Costs Per Pupil	\$ 8.80
E. Total Cost for 15,178 pupils	\$133,570.00

\*n.b. denotes non-budget costs

Testing costs for Model II are shown in Table 7. The annual administration of the test (The Iowa Test of Basic Skills) requires three

hours of teacher and pupil time, as well as two hours of a reading coordinator's time per classroom. Tests are administered to all pupils in grades 2 through 6. The costs of this testing amount to a little less than \$3.00 per pupil per year.

Table 7  
Model II: Testing Costs (per 30 pupils)

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Teachers (3 hrs. @ \$17)	\$ 51.00
B. Reading Coordinator (2 hrs. @ \$17)	\$ 34.00
C. Pupils (3 hrs. each)	\$ n.b.*
Total Cost	<u>\$ 85.00</u>
D. Total Site Level Testing Costs (grades 2-6, all schools)	<u>\$42,955.00</u>
E. Per Pupil Cost	\$ 2.83

\*n.b. = Non-Budget Item

The costs of Model II are summarized in Table 8. Central office, school site, and pupil testing costs total about \$18.00 per pupil in the district. We would add to this figure the value of pupil time taken up by testing (3 hours per year) to gain an overall picture of resources supporting the Model II system.

Table 8  
Model II: Total System Costs

<u>Type of cost</u>	<u>Cost Estimate</u>
A. Central Costs	
° Personnel	\$ 68,300.00
° Contracted Research Services	\$ 16,000.00
° Equipment and Materials	<u>\$ 13,000.00</u>
total	\$ 97,300.00
B. School Site Level (non-testing)	
° Coordination and development	\$133,570.00
C. School Site Testing (524.50 per 30 pupils)	<u>\$ 42,955.00</u>
Total	<u><u>\$273,825.00</u></u>
D. Total Costs Per Pupil	\$ 18.04

Comparison of Models I and II

Table 9 presents summaries of the various monetary costs discussed in the previous sections. The comparative figures illustrate some fundamental differences between the two models. The most obvious difference is in the amount of testing time devoted to support each system. Model I's criterion-referenced assessment occupies youngsters for about 15 hours per year and their teachers for even longer. In contrast, the ITBS administered for Model II is completed in 3 hours. This results in testing costs of more than \$17 per pupil in Model I and less than \$3 per pupil in Model II before considering pupil time itself. The second major difference in the two approaches, at least in their generation of costs, is the relative abundance of teacher and principal time required by Model I for instructional management activities. This is reflected in Table 9 showing that site-

level non-testing costs are more than \$12 per pupil for Model I and less than \$9 per pupil for Model II. The central-office costs of maintaining the two models are about \$4 and \$6 per pupil, with Model II being the more expensive here because full time staff are allocated to the pupil information system. The overall picture indicates that in estimated dollars per pupil, Model I is considerably more expensive to administer -- \$34 versus \$18 per pupil.

One additional perspective is generated in Table 9. When district operational expenditures per pupil are considered, each model requires less than 1 percent of district spending for its maintenance, with Model I taking up about 1 percent and Model II requiring about 2/3 of 1 percent of district per-pupil expenditures. This overall level of system resources devoted to instructional information systems is consistent with the findings of our previous research into the costs of all pupil achievement testing conducted in school districts. There we found that testing for all purposes, of which the type of testing discussed here is a subset, accounted for approximately 3 percent of district expenditures (Dorr-Bremme, et al., 1983).

Table 9  
Model I and Model II: Cost Comparisons

<u>Location of Cost</u>	<u>Model I</u>		<u>Model II</u>	
	<u>Total</u>	<u>Per Pupil</u>	<u>Total</u>	<u>Per Pupil</u> <sup>1</sup>
Central Office	\$ 21,960	\$ 4.22	\$ 97,300	\$ 6.41
Site Level, non-test	\$ 63,805	\$ 12.27	\$133,570	\$ 8.80
Testing at Site	\$ 60,600	\$ 17.48	\$ 42,955	\$ 2.83
Total Costs	\$146,365 <sup>5</sup>	\$ 34.00	\$273,825 <sup>4</sup>	\$ 18.04
Percent of P.P.E.		0.97% <sup>2</sup>		0.67% <sup>3</sup>

1) 15,178 pupils, grades 2-6

2) Estimated \$3,523 p.p.e.\*

3) Estimated \$2,700 p.p.e.

4) Plus community volunteer time and pupil time

5) Plus parent volunteer time and pupil time

\* p.p.e. denotes estimated per pupil expenditures for district operations

#### Implications for Decision Making?

The view afforded by this analysis of the costs of instructional information systems suggests that these enterprises are not particularly costly, and that they are not potential sources of reallocatable resources for districts looking for cost-saving changes. Testing and test-related costs of ten to thirty dollars per pupil in the face of \$3,000 annual per pupil expenditures are not cause for immediate alarm. This conclusion is reinforced by the limited degree to which even these small costs could be considered discretionary. If the costs of the two models are explored for direct expenditures which could be curtailed by decisions to not spend money (such as for supplies or purchased services) few cost-saving

candidates emerge. Table 10 shows that of Model I costs, only about 2 percent fall into this category, and for Model II, discretionary costs amount to less than 11 percent.

Table 10  
Model I and Model II: Direct (discretionary) vs. Indirect Costs

<u>Model I</u>		<u>Model II</u>
Total System Costs	\$176,661	\$273,825
Discretionary Costs	\$ 4,000	\$ 29,000
	(Paper, photocopying, printing)	(Word processing, miscella- neous, contract research,
	<hr/>	<hr/>
Percent discretionary costs	2.3%	10.6%

The notion of opportunity costs can further inform our discussion here. While the various displays in this report generally show small dollar approximations of the many resources contributing to the pupil information systems studied, they also portray these resources in ways that facilitate an "opportunity" conception of costs. To illustrate, if the evaluation director spends all of his time on one of our "systems," he or she is unavailable for other pursuits. If a school principal spends two weeks on one required task (such as in conferences with teachers in Model I), he or she cannot spend this time on an alternate activity. In short, any time devoted to an instructional information system in a school district, or to anything for that matter, has an "opportunity cost." That

cost is the value of what that time might gain for the district if spent differently.

The most valid approximation of the magnitude of the "opportunity costs" implied by any chosen activity is the value of the best alternative use to which the taken-up resources might be applied. The opportunity costs of the systems studied here are represented in this analysis only indirectly. The amounts of resources devoted to the systems, most significantly the time commitments of teachers and administrators, are listed, but no attempt is made to fully assess the value of the opportunity costs involved. Estimating just what these professionals might accomplish with their time, toward similar or unrelated ends, must submit to further analysis or at least to the considerations of those contemplating resource use decisions in light of this information. We do not perform these exercises as a part of this report. But such analysis could contribute to answering some important questions, such as: What sorts of instructional information systems are most cost effective? -- under what circumstances? Are they worth supporting at all?

#### Other Lessons

We suggested earlier that we learned more than the cost estimates we sought by pursuing this research. We attempt to catalogue these observations here:

- 1) Cost inquiries require creative detective work on the part of researchers. Program costs are not customarily recorded in accessible form in school district documents. This is due primarily to the multiple



contributions of the primary district actors -- teachers, administrators, and pupils -- to an ample range of programs and goals of the district's schools. It is also due to an historical lack of district sponsored cost analyses similar to these attempted here.

2) Accounting for the ingredient or resource costs of a particular school program requires that researchers develop a complete understanding of the functioning of the program under scrutiny. The basic questions of this accounting -- who and what are involved and to what extent -- demand such understanding. As such, members of our team of researchers who wished to focus on system characteristics or estimates of system impacts also benefitted from the activities of the cost analysts. Conversely, researchers providing descriptive analyses of programs may have less additional work than they might first suppose if they wish to extend their analyses to areas of cost.

3) Since program cost analyses of the sort described here are rarely undertaken within school districts, the subjects of such proposed research may demonstrate either disinterest or reluctance when solicited for participation. Disinterest may be caused by the impression that the information would have little practical utility and therefore not warrant any costs of cooperation. Additional skepticism may be caused by the simple fact that cost analysis is presumed to be driven by a quest for economies. A potential result of a cost analysis is the suggested reallocation of resources, and if a program is portrayed by researchers or interpreted by decision makers to be expensive, it may suffer pressure for budget reductions. Since the type of knowledge generated by cost analysis is not generally

available for a full range of most school district programs, the subjects of proposed research may feel singled-out and threatened by a proposed study. This issue has been overcome in our research so far through our guarantees of confidentiality, through a shared exploratory curiosity among researchers and our subjects, and probably through the convictions of our respondents that the systems under study in fact do not command extraordinary resources.

4) Some bias may be anticipated in the responses of school personnel to questions regarding the resource demands of their programs. We relied in our research on the expertise of the sponsors and administrators of the instructional information systems studied. Their self-interests may be presumed to lie in casting their programs in a positive (i.e., least expensive) light. (See #3 above.) We did not uncover specific instances of underestimation in our research. Much of what was told to us by sponsors was verified by the views of teachers and other district personnel, but we did not systematically verify all information that contributed to our estimates. For this reason, the estimates reported should be considered reliable and "lower-boundary" in nature.

5) A key to understanding the meaning of these cost findings is the development of further knowledge of alternative ways of providing the sort of instructional information systems studied here. We have looked at only two models in detail, and the elaboration of a full range of actual or potential configurations of such systems would assist researchers interested in questions of efficiency -- a natural extension of our work thus far.

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