

THE DISTRICT ROLE IN INTRODUCING MICROCOMPUTERS:
A CONTINGENCY APPROACH

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Introduction

There are, among those in education, computer optimists and computer pessimists. Computer optimists can visualize schools of the future as part of large scale networks allowing students and teachers access to information of a quality and quantity never before possible. They see computers rectifying the resource disadvantages of small schools, meeting the needs of minority populations, encouraging problem solving, creativity, and individualized instruction. Computer pessimists, on the other hand, see reading and writing devalued as more time is spent with computers and less time with books, greater personal isolation as learning occurs primarily through interaction with machines rather than with other people, a widening gap between the rich who have computer access and the poor who do not.

(Coburn, et al., 1982)

But whether one is an optimist or a pessimist about the future implications of computers, as a school or district administrator, one must be a computer realist. According to Market Data Retrieval, October, 1982 figures, based on their annual telephone survey of all U.S. districts, over 24,000 public schools now use microcomputers in instruction, up 60 percent from the previous year with the fastest growth rate occurring in elementary schools.

Of the 15,314 districts in the U.S., 9,245, or 60.4 percent, had microcomputers in 1982 as compared with 6,441 a year earlier. The rate of growth was highest in the smallest districts. By October 1982, 52 percent of these small -- under-1,200 students -- districts had microcomputers while almost three-quarters of the districts with over-10,000 students had them (Market Data Retrieval, October, 1982).

The rate of growth in schools and school districts' acquisition of microcomputers is phenomenal and is expected to continue. But the current statistics on the availability of hardware may be misleading. The National Center for Educational Statistics reports that computers were used by an estimated 4.7 million students during the 1981-82 school year, averaging over 9 hours a year of computer access for each student. Differences in amount and type of use were by grade. High schools cite computer science as their major use in instruction; junior highs use terminals for remedial instruction, enrichment, and computer literacy. In elementary schools, terminals are used mainly for enrichment, remediation, and basic skills instruction (National Center for Educational Statistics, 1982, p. 2).

There is great variation, then, in the availability of personal computers in schools and in the uses to which they are put. There is also variability in the role which district offices play in introducing computers into the educational setting.

Some districts, especially large districts or those with strong central administrations, have adopted a highly centralized approach to introducing computers. Here, the district directs the process of selecting, funding, and placing microcomputers in schools, usually with some input from principals or teachers. The advantages of such a centralized approach include 1) the development of conveniently located and deployable expertise for training and troubleshooting in many schools; 2) the increased capacity to coordinate hardware, software, and training; and the added clout the district has when negotiating with vendors on price, service contracts,

and software when they purchase in bulk. Disadvantages of the centralized approach include diminished teacher "ownership" of and enthusiasm for both the hardware and software, less flexibility in accommodating specific classroom needs for particular kinds of hardware or software, lack of knowledge at the central office level.

Other districts have, either inadvertently or intentionally, adopted a grassroots approach to introducing computers. In these cases, computer buffs among the teachers learn as much as they can, find their own or apply to the district for funding, and use their own computers in their own classrooms in their own ways. Their enthusiasm, it is assumed, will spread to other teachers who will then become a critical mass who will eventually come together to form a school-wide plan.

Advantages of this approach include its low cost to the district for educating its own personnel and grappling with individual schools' problems, and the natural spread of the innovation because of enthusiasm and individual initiative. Disadvantages, however, may be serious: much money may be spent on hardware and software while only a few children will learn particular skills, and these skills either may not be picked up in subsequent grade levels or subject areas or may be unnecessarily repeated.

Between the extremes of a highly centralized and a grassroots approach are many intermediate approaches. Each district where the computer issue has arisen -- and we should note that close to 40 percent of the districts have not yet grappled with the situation -- seems to muddle through, formulating its own responses in reaction to various kinds of pressures.

The Growing Importance of the District Role

Our argument here is that the district central office, along with its school board, must take seriously its role in introducing microcomputers into its schools. Mistakes are becoming increasingly costly. Some districts have rushed out to buy microcomputer systems and found, unhappily, that the system they bought will not continue to meet their needs and that their instructional programs are not well served by the system they have purchased (Thomas & McClain, 1981).

The unfairness to students of leaving issues of computer access to chance is becoming more apparent. A survey conducted by Market Data Retrieval (1982) found that school microcomputer use is associated with wealth of the district -- 80 percent of the nation's 2,000 largest, richest high schools used microcomputers, while only 40 percent of smaller, poorer high schools had them (Lipkin, 1983). Access to microcomputers is also dominated by male students. A survey of 10 New Jersey high schools offering computer courses revealed a consistent dominance of male enrollment, slightly more than 60 percent. Studies of California schools report a similar trend (Bakon, et al., 1983). In addition to computer access, the issue of equity is also reflected in how schools use computers. When computers are used in suburban schools, it is often in the context of programming and computer awareness. When computers are used in less affluent inner-city or rural schools, the use is more likely to be for drill and practice and remediation (Field & Kurtz, 1982; Lipkin, 1983). The desirability of having a coherent computer literacy scope and sequence, analogous to that in reading, math, and language arts, is daily becoming more evident.

There are, in short, many issues that are too large and too complex for individual schools to resolve each in their own manner. In the current world of educational computer use, effective districts are essential for effective schools. A brief summary of some of the issues with which a district must eventually cope is included in Table 1. We have grouped these issues into categories: hardware acquisition/fiscal issues, software issues, management issues, staff development issues, and instructional issues. The issues in each category have been organized according to major policy questions and operational planning questions.

A Contingency Approach to District Involvement with Computers

As noted above, many districts have responded reactively to the rapidly expanding availability of relatively inexpensive computers and programs that can be used for managerial and instructional purposes. Whether centralized or grassroots in character, their approach might well be labeled a "non-planning strategy."

There are a number of understandable reasons for the prevalence of this approach. School districts, like many individuals and organizations in the public and private sector, are unsure about how to assess the potential value of an "exploding" technology. And there are other reasons related to the marketing of computers. For example, many computer vendors provide free or low-cost introductory offers to school districts in hardware or software or staff training in order to get districts to make a long-term commitment to the vendor's brand. School districts operating on meager financial resources find it difficult to refuse the hook hidden in this sudden technological largesse and they purchase before they plan.

Table 1

Issues in Need of District Attention

Issues	Policy/Framework Questions	Operational Planning Questions
<p>Hardware Acquisition/ Fiscal Issues</p>	<ul style="list-style-type: none"> ◦ What criteria/guidelines should be established for hardware acquisition? ◦ What percent of the computer budget should be allocated for software purchase and maintenance? ◦ Should a single computer system be used for both instructional and administrative purposes? ◦ What percent of the computer budget should be allocated for software purchase and maintenance? ◦ What resources are available for personnel costs associated with hardware use? ◦ What inservice training budget allocations should be made? ◦ What strategies should be used by educators in dealing with computer vendors? 	<ul style="list-style-type: none"> ◦ What successes/failures have been experienced by other districts with specific hardware? ◦ What is equipment's reliability? ◦ What maintenance warranties and assistance will vendors provide in installing and servicing the equipment? ◦ What peripherals are available for specific hardware and provided by the vendor? ◦ What expansion options exist? ◦ What training will the vendor provide in the operation and programming of the hardware? ◦ What size machines and/or memory are required to run the programs needed and achieve computer use objectives? ◦ What software is available and at what cost in relation to the characteristics of hardware? ◦ What are the estimated costs for hardware, software, maintenance, facility preparation, and staffing needs for each application? ◦ What strategies should be used for financing computer acquisition?

Issues	Policy/Framework Questions	Operational Planning Questions
Software Issues	<ul style="list-style-type: none"> ◦ Under what conditions should districts undertake software development? ◦ Should the district operate a software library? ◦ What is district policy relating to copy-right issues for purchased and teacher-developed programs? ◦ How and by whom should software be located evaluated, and acquired? 	<ul style="list-style-type: none"> ◦ How can results of software evaluation be disseminated? ◦ Do the software cassettes or discs include documentation? ◦ Is the software program educationally sound? ◦ How can computer software be integrated with other instructional activities?
Management Issues	<ul style="list-style-type: none"> ◦ What role will other educational service agencies and groups have in the district framework and plan? ◦ How will the district judge if their computer implementation program is successful? ◦ How should resources be allocated to ensure equal educational access and use of computers? ◦ What security precautions should be taken? ◦ What phasing-in strategy should be implemented for the district's computer plan? 	<ul style="list-style-type: none"> ◦ What implementation strategy and timelines are needed for elementary and secondary levels of the district? ◦ Should schools have centralized placement or individual classroom/department placement of computers? ◦ What strategies can districts use to encourage female students in computer use?
Staff Development Issues	<ul style="list-style-type: none"> ◦ What do teachers, principals, and other district staff need to know to use computers? ◦ What teacher certification requirements should be established, if any? ◦ Who should conduct and evaluate the computer training and what type of follow-up assistance will be provided? 	<ul style="list-style-type: none"> ◦ Will the district develop staff to be local computer resource persons? ◦ What computer training, both preservice and inservice, should be required for teachers and administrators? ◦ What strategies should be used to allocate time for staff training and hands-on computer experience?

Issues	Policy/Framework Questions	Operational Planning Questions
<p>Instructional Issues</p>	<ul style="list-style-type: none"> ◦ What roles will computers have in the school, e.g., computer-assisted instruction, computer literacy, computer programming? ◦ Should all students meet minimum computer competency requirements? ◦ How will the instructional role of teachers change with increased computer use? 	<ul style="list-style-type: none"> ◦ What kind of social problems are being introduced into schools along with computers? ◦ How can the district ensure equity in computer use, especially higher level and creative uses? ◦ What are reasonable rules and guidelines for student computer use? ◦ Is there a specific need for a "computer literacy" curricula? ◦ What are appropriate educational goals and curriculum materials for computer literacy? ◦ How can the teacher overcome the constraints of using individually-oriented computers in the context of a group-based instructional organization?

Another reason for non-planning is avoidance: the level of uncertainty and ambiguity is so high that central office staff don't know where to begin in devising a comprehensive strategy. The hardware and software is constantly changing; is unfamiliar to many who would potentially benefit from its availability; threatens some who think they don't want to or can't learn about it. A further psychological complication is created by students who seem to know far more about and have far greater aptitude and appetite for this new technology than do their teachers.

To some administrators, the logical response to this problem is to begin with a rational planning model, following a series of sequential steps that would include: carefully defining the district's objectives as regards computer use; determining those steps that would have to be taken by various district components, e.g., teachers, district administrators, principals, in order to accomplish each objective; establishing time lines and sequences to be followed; determining ways to evaluate whether specific objectives had been achieved; applying corrective actions in instances where objectives had not been met.

Linear planning can be an effective tool to help organizations achieve specific goals when there is a common knowledge base, where lines of authority are clearly defined, and where there are the resources to carry out the implementation sequence; we doubt, however, that linear planning is an appropriate tool for questions of computer selection. School districts lack sufficient knowledge about or control over important factors that must be accurately estimated in order for a linear model to work. For example, school districts are subjected to shifting forces

outside of their organizational boundaries over which they have little control, e.g., political support in the community, changing population, externally mandated strategies in key administrative and instructional areas, and uncertain financial resources. Given these conditions, and the rapidly expanding computer technology, we think it a waste of time to try to determine exact goals and the means to accomplish them. By the time such a comprehensive plan is devised, it is likely that conditions will have changed so as to make the plan obsolete.

Under such conditions of uncertainty and change, we reject both "no planning" and "linear planning." We suggest instead the use of an intermediate scheme which we will refer to as a contingency planning approach. This approach suggests that districts' planning be ongoing, incremental, adaptive, and self-correcting.

While traditional planning is based on events that have a high probability of occurring, contingency planning takes into consideration other likely conditions, which, if they actually occurred, could create serious difficulties for a school district. A contingency approach prepares one to take specific actions when an event or condition not planned for in the formal planning process actually does take place. It therefore eliminates uncertainty and time delays in making responses, and makes responding to the unpredictable a reasonable part of daily life.

A contingency approach identifies issues of concern (e.g., "what if" questions) and estimates the probability of their occurrence (Steiner, 1979). Both the degree of criticality and the degree of probability must be considered. Alternative strategies to deal with the possible occurrence

of these events are identified and considered in terms of the anticipated nature of the events and the district's capabilities and constraints in dealing with them. The result may be a decision by district staff to take some advance "damage control" actions as well as to identify potential strategies to be followed at the time of the events.

A contingency approach may describe "trigger points" or those warning signs which would signal the imminence of the events for which contingency plans have been developed (Steiner, 1979). In some cases, the trigger point might be the event itself, but in other cases the point at which some action should be taken is less clear.

For example, using a contingency approach, districts should begin or continue to become knowledgeable about a wide range of computer-related topics from technology to staff needs, attitudes, and purposes. At the same time, the district should become aware of present uses of computers and start to imagine alternative arrangements that could accommodate the district's activities to the technology's demands.

Armed with such data, the district should, at the same time, identify the optimal dates by which it must make critical decisions regarding what computers to buy, when they should be bought, who should use them, and who should have them. In other words, many of the district's future plans and actions will be contingent upon the unknown opportunities that will be emerging at some unknown point in time. It is a complex task to decide not only how, but when, to act.

Components of a Contingency Approach

Gearing up for computer use in the district can be viewed as occurring simultaneously in three areas: 1) doing a situation audit (external and

internal environments); 2) generating support; 3) formulating district-wide policy; and 4) developing an ongoing operational plan to facilitate decision making.

1. Doing a Situation Audit

The term situation audit refers to a systematic analysis of data, past, present, and future (Steiner, 1979). Such an audit provides the base for planning computer purchase and use. The potential range of topics covered in a situation audit is wide -- anything of importance in the internal and external environments. A major objective of the situation audit is to identify and analyze the key trends, forces, and phenomena that have a potential effect on the formulation and implementation of a framework for district computer use. The situation audit also provides a forum for sharing and debating divergent views about relevant issues regarding potential changes. We discuss the situation audit in terms of an internal inventory and an external resources listing.

An internal inventory. In order to develop an effective district framework, administrators need to know what is already occurring in the community, schools, and homes of students enrolled in the district. Through surveys and interviews, baseline information can be collected regarding what equipment is now available, how much it is now used, what resources and skills there are at present in the district.

Detailed information is needed on the district's current inventory of types of hardware, maintenance problems and their costs, support from vendors, the extent to which existing hardware is compatible and expandable.

Districts should know what software has been purchased, where it is stored, how much it has been used. In addition, the district will need to know who, at each school, is managing the use of the computers, how they are being used, and for what percentage of time. In California, one district, inundated with a variety of microcomputers, conducted a survey to determine what equipment existed in their schools. They found that during the past few years each secondary school department had been acquiring its own equipment to meet specific needs. This piecemeal acquisition was now creating problems since schools had bought different brands (Stremple, 1983).

Staff in the district also can be surveyed to determine who has skills for operating what equipment and software, who can program in various computer languages, who can be a trainer of trainers, demonstration teacher, or software evaluator. Parents of students enrolled in the district can be surveyed to determine if a computer is in the home, what type, and if it is used by the student.

The district data base should also indicate what information is already being systematically collected by the district about existing instructional programs, demographic profile, student achievement data, financial transactions, etc.

Finally, an inventory can assess teachers' and students' attitudes towards computers to discover those who are likely opinion leaders and those who are not.

An external resources listing. In addition to internal resources, there are many groups and agencies external to the school district that

might provide assistance to district staff contemplating computer use. Electronic Learning magazine (1982) conducted a survey that identified 38 statewide educator-user groups in 33 states, all of which have the general aim of promoting the effective use of computers in the classroom. In those states where no statewide groups were identified, most often a special unit within the state department of education was filling the role. These groups varied in the services they offered, providing a range of the following activities: cooperative funding, newsletter publication, conference organization, resource center, inservice training, software library, and software evaluation. A few of these user groups have national memberships. For example, school teachers in the Santa Clara County area of California formed the Computer-Using Educators (CUE) group which has a membership of over 700 people in 19 states (Unseem, 1981). Minnesota Educational Computing Consortium (MECC) provides services to Minnesota schools and schools in adjoining states.

Corporations and industry leaders also provide support to school districts. Hewlett-Packard in California has fostered industry-education ties by having a number of full time employees who devote time to improving the company's contact with public schools. A committee of top executives examines ways the firm and industry can provide more support for public education. They have loaned personnel and given equipment to schools (Unseem, 1981). A partnership exists between the Washington, D.C. schools and Control Data Corporation. Their partnership calls for the firm to donate \$118,000 worth of terminals and software and an equivalent amount of training and administration to the school district. The school system will be matching that contribution (Education Daily, 1982).

Organizations also exist that provide services to districts in specific areas of computer use such as software evaluation (e.g., MicroSIFT in Oregon); information exchange (e.g., Association for Educational Data Systems); data bases (e.g., Resources in Computer Education [RICE]); and newsletters and magazines (e.g., The Computing Teacher, School Microware Directory, Software Review).

In its survey of external resources, the district should become knowledgeable about the talents, skills, and attitudes of people living within its attendance area such as merchants and industrial specialists.

2. Generating Support Within District

This is a top priority. The biggest problem technology enthusiasts had a few years ago was convincing educators that there was a need for computers in our schools; today, in many districts, that is no longer such an obstacle (Oliver, 1983). But commitment from groups such as board members, parents, administrators, teachers, industry and community leaders, and other educational resource agencies is necessary to build a policy consensus. A network of interested persons can be a continuing support system for services, equipment, or funding to achieve program goals.

Successful strategies for generating support for a computer policy vary from district to district. Hands-on experience helps. In some districts, having computers available for home experimentation by teachers and principals has been effective. Establishing demonstration sites so that board members, principals, and teachers can have the opportunity to see computers in operation and have some hands-on experience has worked in other districts (Swalm, 1983). School districts have loaned

school computers to parents over weekends and holidays. A large school district in Texas initiated a computer project that offered low-income parents and children 12 hours of instruction, after which parents could check out computers for home use (Sturdivant, 1983). Other school districts have organized computer fairs, computer clubs, and computer competitions to increase public and student interest (Fisher, 1983).

Identifying an enthusiastic "idea champion" in each school can persuade other teachers to consider approaching the computer supporters in the district. One Texas district developed a new job role called "teacher technologist" for each school (Sturdivant, 1983). Resource centers and use groups have also been formed to share information between schools (Useem, 1981; Stremple, 1983; West, 1983).

Idea champions in districts are also critical to the success of any computer use plan. In some districts, administrators have created formal structures to address issues and allocate resources. For example, the Houston Independent School District has a new division called the Department of Educational Technology that is responsible for implementing a district-wide plan for computer use (Oliver, 1983).

3. Formulating a District-wide Policy Framework.

A critical process in the implementation of a district computer program is to formulate a framework that will guide the development of an operational plan. A framework allows the district to examine all aspects of computer use and then decide the best applications for students in the district. The development of a framework for a contingency planning approach begins with the assumption that each district's planning process

is unique and allows for a range of expertise, points of view, and experience to apply to issues.

With administrative support, an inter-school committee can be organized and charged with the responsibility for developing the district's policy framework. If the district wants computers to be used by all teachers, the committee should not be dominated by any one subject area (Swalm, 1983). The committee should include representatives from interested groups while remaining small enough to constitute an effective working group. One large district with a committee of 25 members took two days to agree on only four goals related to computer use, while another district committee, with seven members, wrote the entire plan in one day (Fisher, 1983).

In deciding upon district policies the committee needs to list the big picture issues it will discuss. In doing so, it should decide whether the central office or the schools will make the decisions on those issues and whether the decisions should be made now or put off until sometime in the future:

- Computer use: Instructional applications? Administrative applications? Both?
- Criteria for hardware acquisition;
- Software location, evaluation, and acquisition;
- Software development;
- Maintenance of software library;
- Evaluation of computer use program;
- Development of teacher certification requirements;
- Development of minimum computer competency requirements for students.

The task of the committee is to develop a policy framework of broad goals and an overall timeline. Districts that have successfully integrated computers into school programs developed policy frameworks that spread implementation over several years. West (1983) found that the best way for the district to incorporate computer literacy into the curriculum was to develop a five-year framework setting goals and objectives in instructional and management applications. Fisher (1983) suggests that a long-term framework is more effective than a one-time plan. According to Fisher, having a framework spanning several years signals a continuing commitment by the district and is visible evidence that teachers can become involved in the planning at several stages of the process. A long-term framework can also aid in reducing the fiscal burden in any one year.

General financial planning should go on concurrently with developing a framework. A common error in financial planning is to think only about the initial direct cost of the computer facility. Larer and Moursund (1980) listed other aspects that should be considered:

- The needs assessment and general planning, writing of specifications, dealing with vendors, evaluation of bids, supervision of installation, all take time and expertise that require financial resources;
- Costs for site preparation for the facility;
- Computers use supplies and supplies maintenance, both of which mean additional costs;
- Computers need to be maintained and repaired -- a standard estimate is that for large computers a maintenance contract costs about .75% of total equipment cost per month and for microcomputers, perhaps 2% per month;
- Large computer systems require operators and a programming staff;

- ° Teachers need to be trained; curricula may need to be revised; courseware may need to be developed;
- ° Software may need to be revised, developed or acquired. Software will also have to be maintained and distributed.

The goals will facilitate the definition of school-level objectives and determine at what grade level and in what subject areas each should occur. For example, in a framework developed by one California school district, under the broad goal of programming, modifying computer programs was an objective for students in grades 6-8 (Fisher, 1983).

4. Developing an On-going Organizational Plan

Using the policy framework, either the committee or other school or subject groups may want to develop more specific operational plans. Activities that the committee members might engage in to contribute to the on-going operational plan could include analyzing curriculum needs, investigating and evaluating software, visiting programs in other school districts, attending conferences and vendor demonstrations, and developing staff development strategies. Such plans can identify specific aspects of each school's use of computers. An on-going operational plan may want to state instructional objectives in terms of types of students, grade level, and subject areas. Instructional objectives might be some or all of the following: to develop computer literacy for all students, to provide the elements of programming using BASIC, to provide equal access to computer time for all students, to use computer-assisted instruction for remediation in basic skills for identified groups of students.

In Albany Unified School District in California, for example, under the broad goal of use/operation of the computer, objectives were given for

three subsets of grade levels: K-5 students would learn how to operate the computer, load programs, and respect copyrights; 6-8 students would focus on appropriate computer use, typing, keyboard, and functions; and 9-12 students would spend time on appropriate programs and vocational use, such as word processing, data bases, network, and telecommunications (Fisher, 1983).

In Cajon Valley Unified School District, also in California, all of the 22 schools in the district were asked to submit a statement of assurances specifying how they would use computers, what their goals and student objectives were, how they would evaluate the program, and who would be responsible for their school's computer program (West, 1983).

The ongoing operational plan might also include objectives and strategies for staff training necessary to implement the district computer use framework. A school district in New York State developed the following four inservice goals: to acquire a functional knowledge of computers for educational use, to learn how to integrate computers into the learning environment, to develop the necessary programming skills to facilitate creation of software suitable for classroom use, and to acquire the knowledge necessary to teach principles of computer awareness (Center for Learning Technologies, 1982).

Naiman (1982) proposed the following staff development strategies:

- ° Have individual teachers, already knowledgeable, train others;
- ° The school or system can provide inservice courses during or outside of class times or on inservice days;
- ° Push on the state department of education and regional centers to offer computer training;

- ° Some professional associations offer computer workshops at their meetings;
- ° System can provide release time on a regular basis for teachers to take courses;
- ° Provide sabbaticals for someone in the district to learn and then share expertise with others;
- ° Colleges offer semester-long courses or weekend workshops;
- ° Other public or private organizations, user groups, computer stores, manufacturers, and vendors offer occasional or regular workshops.

When instructional objectives are clear, and inservice needs assessed, the committee can investigate and evaluate software, and finally determine what hardware is required (Swalm, 1983).

A contingency approach is better than no-planning or lockstep planning. And we approve of Fisher's (1983) admonition to leave lots of space in whatever plans are developed: "A good plan will provide time for schools and teachers to 'get up speed,' to become informed and trained in computer use so they can make effective decisions; it will also leave room for serendipity and individual differences." (Fisher, 1983, p. 13.)

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