POLICY AND PRACTICE AFFECTING THE INSTRUCTIONAL USES OF COMPUTERS IN ELEMENTARY SCHOOLS

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Abstract

This study looks at instructional policy and teaching practice influencing the educational uses of microcomputers in elementary schools. The research was a preliminary field study on the level of microcomputer use in the elementary schools of a single school district. A "computer literacy" program had been implemented two years earlier and the district's staff wanted feedback for program planning and development.

The goals of the study were to identify (a) district and building-level policies impacting the instructional use of microcomputers, (b) the range of instructional activities involving microcomputers, and (c) the perceptions of staff concerning both future directions for microcomputers in the educational program and the support needed to make that future a reality. Although the effectiveness of the elementary instructional computing program was a question important to the district's administration, the researchers felt that gathering detailed information on the three goals listed above would enable a timely process evaluation by the appropriate district personnel. It was assumed that the availability of objective information on the program would lead to revisions in instructional policy and practice.

Background

Salomon and Gardner (1986) draw an important parallel between research on the instructional uses of television and research on the instructional uses of computers. In the research on instructional television, many investigators pursued questions about the "effectiveness" of TV as a delivery medium in comparison with other alternatives. The overall lack of significant findings from this earlier research may not be because TV is ineffective as a medium. Rather, it may be due to the lack of sensitivity of experimental studies to concomitant changes in the schools and classrooms where TV was used.

The central point is that research questions about relative "effectiveness" (measured by comparisons of gains through testing) may be inappropriate. Salomon and Gardner recommend that research on instructional computer use might be more productive if it were organized using a heuristic approach to describe the context of computer use and to provide information useful for discovering specific questions that can be tested as hypotheses in subsequent research.

There are a few quasi-ethnographic studies that provide valuable precedents for conducting contextually relevant research on instructional computing. In particular, this research provides a core of "foreshadowed issues" that have great value for understanding our present situation. Smith and Pohland (1974) studied the effects of a community's dominant cultural patterns on the implementation of instructional computing. They found that the effective use of computer assisted instruction (CAI) in schools was not as simple as assigning the students time on computers to complete instructional tasks. Instead, CAI was found to be a complex mixture of

"...physical, social, emotional and cognitive behaviors inextricably intertwined and shaped by both administrative routines and norms of the particular schools and classrooms" (p. 36).

In other pioneering research, Stake (1977) concluded that there are particular attributes associated with the role of the teacher in classrooms where computers are present that have a significant impact on whether students succeed or fail in adapting to the use of that new instructional medium. The students were fourth graders who studied mathematics on the CERL PLATO System (the University of Illinois at Urbana-Champaign). Students who lacked a large variety of study skills and learning strategies encountered severe difficulty and tended to give up without the intervention of the teacher.

The teachers studied had apparently become well versed in the learning strategies necessary for the students' effective use of computers in the classroom. The study suggests that this probably was a result of immediate contact between the teachers studied and the developers and designers involved in the PLATO implementation project. This
suggests that productive attitudes and management protocols for teachers can be learned through direct contact with educators who have become experienced with integrating computers into school settings. It is not clear, however, how well teachers can or will learn these things on their own.

More recently, case studies and other descriptive research have focused on staff training, hardware and software distribution, school conditions affecting access to computers, software design issues, and a broad concern for appropriate integration of instructional computing with prior curriculum content and objectives. For example, Sheingold, Kane, and Endreweit (1983) compared instructional computing programs in three contrasting school districts and Meister (1984) provided a single site case study of a "model" elementary school microcomputer program in the San Francisco area.

A multiple site case study conducted in southern California in 1983 (Boruta, M., Carpenter, C.R., Harvey, M., Keyser, T., LaBonte, J., Mehan, H., & Rodriguez, D.) suggests that there is reason to believe the use of microcomputers in school settings may contribute to either equalization or increased stratification of social groups within the population. This apparently depends on relationships between sources of funding for purchase of computers, categorical status of students using the computers (Chapter I, gifted and talented, racial minorities, etc.), the general type of instructional computer use (regular vs. special programs), and the general rationale for computer use in the individual district.

Other multiple site case studies conducted over the last five or six years provide portrayals of a variety of instructional computing programs in individual schools and school districts (O.T.A, 1982; Blomeyer, 1985; Cline, H.F., Bennett, R.E., Kershaw, R.C., Schneiderman, M.B., Stecher, B., & Wilson, S., 1986; and Bennett, 1987). Related studies suggest that increased instructional flexibility attributable to individualization through the systematic use of computer assisted instruction is a significant attribute of some instructional computing programs (Blomeyer, 1986; McInerney, 1986).

District History

In our preliminary study, the twelve elementary schools in the cooperating district had students enrolled in grades K-5, with class size of about 25 students. About three years before this study, the school district had initiated the implementation of a "Technology Plan" to achieve the integration of computer technology into all the district's schools. The plan called for the initial development of instructional computing programs in the secondary schools.

In school year 1982-1983 the cooperating district began to implement a secondary school computing program with the purchase of networked minicomputers to serve the programming, word processing, and vocational computing needs. In 1983-1984 the state announced a mandate for a middle school "Computer Literacy" curriculum and the district's implementation plan was modified to include installation of microcomputer laboratories in the middle schools.

In addition to existing programs in the secondary and middle schools, district personnel supported the idea that elementary students should also have an immediate introduction to computer literacy to maximize the effectiveness of the state mandated computer literacy classes. The state's curriculum guides for the middle school classes defined literacy as terms and concepts related to the history, social role, and use of computers; some indicated use of applications software; and computer programming in BASIC or Logo.

When the mandated middle school programs were initiated, the state lacked clear guidelines for computing programs in the elementary schools. The general direction of the middle school mandate suggested a high probability of similar state regulations requiring "computer literacy" classes in the elementary schools. Subsequently, the cooperating district's elementary computer literacy curriculum focused primarily on a terms-and-concepts approach augmented by some hands-on experience as per the perceived state direction.

The district purchased two portable microcomputer laboratories that were to be used to implement the computer literacy program. According to district personnel, these initial portable labs were to be an "initial stimulus" to the growth of more comprehensive microcomputer programs in the elementary schools. Because no appropriate models or clear state guidelines were apparent, the district took a "low profile" approach which was intended to encourage incremental development of instructional computing in the elementary schools.

The elementary microcomputer program was initiated in 1984-85 with fourth and fifth grade students and was to be expanded in 1985-86 with the addition of third grades in each elementary school. The mobile labs consisted of networked microcomputers with a limited amount of CAI (generally drill and practice exercises), graphics, games, and Logo software. Initial training had been offered to teachers throughout the district when the mobile microcomputer labs were first purchased. This training consisted of brief introductory experiences using the micro-computers, experience with a sampling of the software that was to be provided along with the microcomputers, and an introduction to the substance of the computer literacy classes.

During 1986-87 when this study was conducted, fourth and fifth grade teachers were teaching curriculum units on computer terms and concepts for a limited period of time in each elementary school. The particular period of time when each class used the mobile labs depended on the rotating schedule, which moved the labs between schools. An exit exam was developed for use

in all elementary computer literacy classes. At the time of the study, only teachers in the fifth grade classes were reportedly using the exit exams. The substance of the exam was generally recall and recognition of computer terminology. The elementary computing curriculum was intended by the school district to be an addition or "enrichment" to the existing elementary school curriculum.

Procedures

To find out about the instructional use of microcomputers in the district's elementary schools, four of the twelve schools were chosen for site visits including limited direct observation and interviews with school personnel. In addition, a survey on school microcomputer use was developed and mailed to all twelve elementary schools in the district. Interviews and observation were planned as the primary data source for the study with the survey establishing an ethnographic baseline to supply context illustrating the generalizability of the particular observations to more general conditions that might be affecting elementary schools in the entire school district. The surveys were administered to three individual staff members in each elementary school: principal, the school's designated microcomputer resource person, and one non-computer using teacher. Of the 36 survey forms that were mailed out, 31 were completed and returned.

The schools chosen for the site visits were selected to cover the widest possible range of scenarios, including both variations in perceived levels of local school receptivity to the microcomputer program and variations in the affluence and ethnicity of the school district. Typically, each initial visit began with a 30-60 minute interview with the school's principal. In these, the investigators typically got a general sense for the characteristics of the computer activities in the schools and identified teachers or other personnel who were key players in each school's evolving microcomputer program. After the initial interviews with the principals, the investigators attempted to schedule meetings with all the relevant staff members. These interviews progressively refined the focus on events and attitudes that characterized the particular "set" toward microcomputer use in each school.

In total, eight one-half day visits were made for interviews and limited direct observation in four elementary schools. In addition, two half-day visits were made for interviews with district curriculum consultants concerned with instructional programs in mathematics, language arts, reading, and other curriculum areas.

After completion of all observation and interviews, a preliminary analysis of the data was undertaken by the cooperating researchers. Observed events and interview data illustrating foreshadowed questions regarding policies, the range of computer activities, and the nature of staff attitudes toward the program were categorized for comparison with the information obtained from the survey. Interviews with administrative staff and classroom teachers, the survey data, and field notes from the limited amount of direct observation showed general agreement on a range of issues specific to policy and practice in the elementary microcomputer program.

Results: Observation and Interviews

In all four schools visited, the fourth and fifth grade teachers professed to be somewhat disillusioned by the current state of the computer literacy classes. Because of staff turnover, many of the current teachers had never been given the initial inservice training on either the hardware or the elementary technology curriculum. Even those who had been trained, frequently commented that their introduction had not been sufficient and more training was needed. Generally, the emphasis on terms and concepts was questioned because of its limited scope.

Many teachers interviewed also complained about the unreliability of the hardware and the generally low quality of the instructional software available with the traveling microcomputer laboratories. Some teachers voiced open opposition to the computer literacy curriculum and said that they would rather have that time to work on subject matter required by the state scope and sequence. A common remark was that the technology curriculum was seen as an "add on" that was not specifically relevant to the state mandated scope and sequence for elementary schools.

Some teachers indicated that they made attempts to use the drill and practice software that accompanied the traveling labs as a supplement to regular classroom instruction. Those teachers reported unsatisfactory results from these attempts at curricular integration because of the inflexibility of the software and the infrequent availability of the labs in the schools.

Teacher accounts as well as observations classes in schools where Apple II microcomputers had been purchased by local PTA funds, indicated more integration of these microcomputers in curriculum. This was especially true for the one school studied where Apple IIe microcomputers had been supplied as original equipment for a designated microcomputer laboratory. Use of the Apple II microcomputers in support of general curriculum objectives was generally limited, however, to drill and practice in mathematics and spelling.

There was some observed use of word processing and data base management activities with the gifted and talented classes, but the use of these tool programs was marginal compared to the use of more traditional CAI. Teachers working as resource specialists with students having learning disabilities and other handicaps had microcomputers and some instructional software available for their use. These teachers indicated that word processing software would be a welcome addition to their programs, but they would need more training to use it successfully with the students.

Although many of the teachers expressed an interest in the use of flexible tool applications, they apparently lacked training and easy access to hardware and software applications. Both the curriculum specialists and the classroom teachers regularly expressed the opinion that if the district wanted to develop a stronger microcomputer program in the elementary schools they should purchase Apple II microcomputers and a variety of instructional applications for regular use in the elementary schools.

In the four schools visited during the study, patterns of observed microcomputer use varied markedly. Probable factors influencing individual school microcomputer programs were number of available microcomputers, hardware installation (fixed or mobile), availability of software, scheduling efforts by the principal or a designated microcomputer resource person, availability

of parent volunteers to assist with microcomputer use, and overall attitude of the local community toward the instructional use of microcomputers in each school.

One school had a central microcomputer laboratory (15 Apple IIe microcomputers) where each student used mathematics and spelling drill and practice software for 30 minutes per week. Gifted and talented classes in that school were pilot testing The Voyage of the Mimi which includes videotaped story episodes, workbooks, teachers guides, and microcomputer activities suitable for both social sciences and general sciences curriculum.

In another school there were seven microcomputers; one was assigned to the Learning Resource Center and remaining units were on rolling carts and assigned to individual teachers in grades K-5 on a rotating schedule. Some teachers used the microcomputers for drill activities but others let the microcomputers sit idle.

In a third school, three Apple microcomputers were housed in the learning center. These were primarily used as "rewards" with students on behavior modification management plans. In addition one grade two teacher used drill and practice software for about 15 minutes per child every other week.

In a fourth school, only two microcomputers were available for instructional use. One was used primarily for administrative tasks (e.g., grade books, P.E. record keeping) and the other was available only for use with Title I students. This scarcity of resources created a climate where access was limited, demand was high, and tempers were short.

Teachers interviewed in the four schools studied seemed to support the idea of instructional computing, but there was some apparent confusion about the district's policy on the role of microcomputers in the elementary schools. Gifted programs and remedial education were viewed as more important uses of microcomputers than computer literacy. Though the teachers reported that they favored the integration of microcomputers as a supplemental medium for instruction in a variety of curricular areas, the district policy was oriented to a terms-and-concepts approach.

This apparent conflict between the teachers' commitment to the traditional scope and sequence and the apparent "non-centrality" of the district's approach to microcomputers in the curriculum was apparently unrecognized or was not viewed by the school administration as a significant issue affecting the elementary instructional computing program. Other apparently significant issues were:

(1) Teachers' perception that additional in-service training was necessary to develop the appropriate classroom use of microcomputers,
(2) Uneven access to microcomputer resources within and among the schools (i.e., fourth and fifth grade students having more systematic access to microcomputers and schools in more affluent suburbs having more hardware units because of PTA donations), and
(3) Apparent restriction of microcomputer applications promoting higher level thinking and problem solving skills (e.g., creative uses of tool programs and programming languages) to the small population of gifted students.

It appeared that the instructional staff (teachers and principals) was at odds with the district's existing position guiding the introduction of microcomputers into the elementary schools.

Although the computer literacy initiative spurred the acquisition of hardware and software by the individual schools, the extension of microcomputer use into the regular scope and sequence of the curriculum was slow at best.

The teachers seemed to have been looking for cues from the curriculum materials provided with the traveling labs to help them determine what they should be doing with microcomputers in the curriculum. The cues actually received apparently encouraged teachers to try limited use of drill and practice CAI programs and to provide instruction about computer terminology and concepts. An apparent lack of in-service training or other educational incentives has left the teaching staff with little base on which to build a more innovative instructional computing program.

Results: Survey

Survey data generally seemed to support the anecdotal observations made in the individual schools. Generally, 5-15 microcomputers were permanently assigned to each school in the district. These were located in central sites, individual classrooms, or on rolling carts. The most important use of computers was perceived to be middle school computer literacy, programming or computer mathematics at the secondary school level, and the elementary technology curriculum. However, some staff members indicated that they did not believe the district had a clear policy guiding the use of microcomputers in elementary curriculum.

Respondents in the elementary schools also indicated that the temporary assignment of movable labs was not satisfactory. Regular access to microcomputer equipment that would be permanently assigned to the schools was seen as necessary. Purchase of instructional software appropriate for regular use with the elementary classes was also seen as a necessary addition. Respondents who identified themselves as elementary teachers indicated that the microcomputer training conducted by the district at the outset of the technology program was inadequate and additional training would be necessary to improve on the present situation.

District Actions Initiated After Completion of the Study

The field study detailed above was completed by early May 1986, and a final report was delivered to the district in July 1986. A reply from the district in December 1986, indicated that the rotating microcomputer labs were retired and that over the summer enough Apple IIe's were purchased to "bring everybody up to the same level." All twelve elementary schools in the district are now reported to have a minimum of twelve Apple IIe's to be used for CAI.

In addition, $3000 was allotted to each elementary school for the purchase of software. A prerequisite for release of these funds to a school was the development of an implementation plan demonstrating how the microcomputers and software would be used. The instructional personnel in each school are responsible for evaluating the software prior to purchase. Copies of evaluations are forwarded to the school's central administration so that a list of approved and disapproved titles is compiled each month and circulated among the schools to eliminate duplication of effort. Any disagreements over software evaluations are rationalized by the district's Curriculum Department.

The district made the decision to increase support to the instructional computing program in the elementary schools during the spring of 1986. Members of the school district staff said they were

aware that there was an inequitable distribution of microcomputer resources within the elementary schools because of uneven purchases of microcomputers by groups supporting individual schools. Microcomputers purchased by PTA's activity funds or other sources were allocated within particular schools to fill the needs of categorical programs (gifted and talented, special education, Chapter I, etc.). In all, about $250,000 was spent over the summer of 1986 to equalize the uneven distribution of microcomputer resources and to make instructional computing resources available to support subject matter instruction in the district's elementary schools.

Conclusions

While only tentative conclusions are warranted by this preliminary study, the evidence suggests that states and individual school districts should be careful in planning and structuring the initial policies and interventions used to introduce instructional computing into the elementary curriculum. In this case, the state's lack of clear policy guidance for elementary instructional computing programs led to the school district's adoption of a "terms and concepts" approach to elementary school computer classes. This initial program had an apparently negative affective impact on elementary school teachers and administrators.

An important finding of the study is that in this specific case there was a clear conflict between the instructional goals of the classroom teachers (subject matter instruction as specified by the state's elementary scope and sequence) and the district's more limited goals for the elementary computing program. This suggests that state education agencies and individual school districts should make the curricular integration of instructional computing, with an emphasis on content emphasized in the general curriculum, a high priority among program objectives taken into account when planning for the use of microcomputers in elementary schools.

In the four schools studied, the parents in the community were evidently "pro-technology" and supported the introduction of microcomputers in elementary curriculum. In some schools, parents wanted more microcomputers in the schools than the district could afford, so the parents purchased Apple II microcomputers with PTA funds. Because of this, schools in more affluent areas generally had more microcomputers than those in less affluent areas of the district. Parental intervention at the local school level led to uneven distribution of resources and possible programmatic inequity.

The characteristics of initial interventions and the perceived nature of a state's or district's policy guiding the integration of microcomputers in elementary curriculum is likely to profoundly affect the range of options that teachers see for microcomputers in the classroom. A definition of computer literacy as knowledge about terms and concepts was seen by instructional personnel and some principals as being irrelevant to the primary educational mission of the elementary schools.

Teachers' perceptions of computer literacy programs as being peripheral to existing curriculum objectives may be difficult to alter once such programs are established. Unless general policies supporting the integration of microcomputers as a relevant and flexible instructional medium are established at the outset, implementation of comprehensive microcomputer education programs in elementary schools may be difficult.

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