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ABSTRACT
                The report presents case studies of microcomputer use
in 12 school districts' special education programs. The case study
approach was designed to focus on organizational issues, specifically
the following four: nature of collaboration between regular and
special education, centralization or decentralization of
decisionmaking in implementation phases, cooperation between
administrators and educators regarding application (administrative
vs. instructional), and training in the use of microcomputers. An
initial section analyzes data across the case studies. Major findings
include overall collaboration in the use of microcomputers between
special and regular education, especially, at the building rather
than district level; the importance of a small team approach to
implementation; lack of conflict between administrative and
instructional applications in microcomputer systems; and emerging
trends in designation of a coordinator to supervise implementation.
Each of the 12 case studies reports on program development and
chronology, features of the microcomputer system, and organizational
aspects. (CL)

Microcomputers
in the Schools --

Implementation
in Special Education

CASE STUDY REPORT

SRA Technologies
and
Cosmos Corporation

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Submitted to

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MICROCOMPUTERS IN THE SCHOOLS--

IMPLEMENTATION IN SPECIAL EDUCATION

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Case Study Report

November 3, 1983

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PREFACE

Computer-assisted instruction (CAI) has been demonstrated as effective with handicapped students (Cartwright & Hall, 1974; Carmen & Kosberg, 1982; Hasselbring, 1982). Further, indirect support for CAI with special populations can be derived from findings reported in more general research. Reviewers have noted that the strongest positive effects of CAI were measured in lower level coursework (Hartley, 1977; Kulik, 1981) and in instruction for "disadvantaged" (Jamison, Suppes, & Wells, 1974) or lower functioning students (Kulik, Bangert, & Williams, 1983).

In addition, there is a growing consensus and enthusiasm for the use of microcomputers in special education programs (Hofmeister, 1982; Taber, 1983), beyond the generally applicable (for all populations) advantages of CAI (Budoff & Hutton, 1982; Roblyer & King, 1983; Torgesen & Young, 1983). The salient features include:

- an ability to structure software to meet predetermined objectives;

- a heightened efficacy of "drill-and-practice" exercises with some students;

- the escaping of the long history of failure with workbooks;

- a nonthreatening instructional interaction;

- a failure-free mastery of new skills;

- the engaging and attention-keeping ability of microcomputers;

- the reinforcement and support for prior learning; and

- the savings in time spent to reach instructional objectives.

Microcomputers have also been targeted as potentially beneficial tools to assist educators in the myriad of information management tasks associated with school administration. In particular, the extensive record-keeping requirements associated with P.L. 94-142 have generated much

interest in administrative applications of microcomputers
(Whitney & Hofmeister, 1981).

Given the potential for the use of this new technology in
special education, this study has been sponsored by the Special
Education Programs division of the U.S. Department of Education.
The project, which includes both research and information
development components, is being conducted by SRA Technologies,
Inc. of Arlington, Virginia, and COSMOS Corporation of
Washington, D.C. During the spring of 1983, twelve case studies
of microcomputer implementation were conducted in school
districts across the country.

The case study method used in this research focused on
organizational issues, and especially the following major
issues:

- the nature of the collaboration between
  special and regular education in imple-
  menting microcomputer use;

- the centralization or decentralization of
  decision making in different stages of imple-
  mentation--planning, adoption, purchasing,
  training, coordination, etc.;

- the nature of cooperation between adminis-
  trators and educators vis-a-vis instructional
  vs. administrative applications; and

- training in the use of microcomputers and
  roles that emerged to foster use of the tech-
  nology.

These issues were examined individually in each case study and
also analyzed across the cases.

This report is in two parts. The first is a cross-case
analysis and summarizes the major results and findings
synthesized from the individual case studies. The second part
consists of the twelve case studies. During 1983-1984, the
information collected and analyzed in this research will serve
as a basis for an extensive dissemination effort, to assist
special educators in using microcomputers appropriately.

For purposes of simplicity, the 12 school districts are identified by one-word names;

Abingdon	Washington County School District, Abingdon, Virginia
Boise	Independent School District of Boise City, Boise, Idaho
Cheyenne	Laramie County School District Number One, Cheyenne, Wyoming
Commack	Commack Union Free School District, Commack, New York
Hopkins	Hopkins School District Number 270, Hopkins, Minnesota
Lexington	Minuteman Regional Vocational Technical School District, Lexington, Massachusetts
Linden	Linden School District, Linden, Michigan
Oakhurst	Township of Ocean School District, Oakhurst, New Jersey
Pittsburg	Pittsburg Unified School District, Pittsburg, California
Prescott	Prescott Unified School District Number One, Prescott, Arizona
Shelby	Shelby City School District, Shelby, Ohio
Tallulah	Madison Parish School System, Tallulah, Louisiana

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SCHOOL DISTRICTS AND

THEIR MICROCOMPUTER "SYSTEMS"

Cross Case Report

I.   INTRODUCTION

The topic of microcomputer implementation in schools is unusually difficult to study. Microcomputers are independent, self-standing units, and their use in schools can involve: a) the units independently, b) the units as part of larger "systems," or c) both.

In studying independent units, the major implementation issues tend to deal with classroom management--e.g., the ways in which teachers may arrange schedules for student use or locate the unit within the classroom. Although such issues may be important in explaining educational outcomes, they are not as relevant in guiding district policy on such questions as:

1. Should all the microcomputers in the district be of the same brand of hardware, or is some mix of brands justifiable or even advantageous?

2. Should the microcomputers all be purchased at the same time, or at regular annual intervals in an incremental fashion?

3. How have microcomputers been used for students with special needs--e.g., the handicapped--and how has the district's administration of regular and special education changed, if at all?

4. How should the microcomputers in a district be supervised--on a centralized or decentralized pattern?

5. What patterns have evolved in using microcomputers for administrative vs. instructional applications?

6. What kind of training tends to facilitate the implementation process and the development of microcomputer use?

7. Are new administrative or supportive roles emerging which districts may need to anticipate?

From the standpoint of these types of questions, a study must deal with the various microcomputer "systems" that may exist within a district, and not necessarily focus on individual units.

The present investigation, based on case studies of micro-
computer use in twelve school districts (see Table I-1 for a
summary of the districts' characteristics), was mainly oriented
toward these organizational and administrative issues, and
therefore concentrated on the experiences with microcomputer
"systems," and not simply individual units. Yet, such an empha-
sis raises new questions, not readily answerable, having to do
with the definition of such "systems." Section II deals with
this definitional problem and also addresses Questions 1 and 2
above. Questions 3, 4, and 5 are then the topics of separate
sections (III, IV, and V), while Questions 6 and 7 are covered
together in Section VI of this report.

Table I-1

District Characteristics

bingdon School District
. Abingdon, Virginia
. Southwest Virginia
  (9th District)
. Suburban/Rural
. Lower and middle
. 8,800 (stable)
. Predominantly White

oise School District
. Boise, Idaho
. Southwest Idaho
  (1st & 2nd Districts)
. Urban/suburban
. Middle
. 21,000 (stable)
. Predominantly White

heyenne School District
. Cheyenne, Wyoming
. Southeast Wyoming
  (At Large)
. Urban/rural
. Middle
. 13,000 (stable)
. Predominantly White

:ommack School District
. Commack, New York
. Long Island
  (3rd District)
. Suburban
. Upper middle
. 9,200 (declining)
. Predominantly White

Hopkins School District
a. Hopkins, Minnesota
b. Minneapolis area
   (3rd District)
c. Suburban
d. Middle
e. 6,900 (slightly declining)
f. Predominantly White

Lexington Regional District
a. Lexington, Massachusetts
b. Boston area
   (7th District)
c. Suburban
d. Upper middle
e. 1,250 (stable)
f. Predominantly White

Linden School District
a. Linden, Michigan
b. Flint area
   (7th District)
c. Suburban/Rural
d. Lower middle
e. 2,500 (slightly declining)
f. Predominantly White

Oakhurst School District
a. Oakhurst, New Jersey
b. New Jersey Coast
   (3rd District)
c. Suburban
d. Upper middle
e. 4,150 (declining)
f. Predominantly White

Pittsburg School District
a. Pittsburg, California
b. East Bay area
   (7th District)
c. Suburban
d. Middle and lower
e. 6,000 (stable)
f. Mixed

Prescott School District
a. Prescott, Arizona
b. Near Phoenix
   (3rd District)
c. Suburban/rural
d. Middle
e. 4,450 (stable)
f. Predominantly White

Shelby School District
a. Shelby, Ohio
b. North Central Ohio
   (4th District)
c. Suburban/rural
d. Middle
e. 2,800 (stable)
f. Predominantly White

Tallulah School District
a. Tallulah, Louisiana
b. Near Jackson, Mississi
   (5th District)
c. Suburban/rural
d. Lower
e. 3,800 (slightly declir
f. Predominantly Black

```
LEGEND: a. City, State                    d. Income Level
        b. Location (and Congressional    e. Student Population
           District)                         (and Trend)
        c. Suburban/Urban/Rural           f. Ethnic Composition
```

II. CHARACTERISTICS OF MICROCOMPUTER "SYSTEMS"

What is a Microcomputer "System?"

A microcomputer "system" may be defined by the existence of several decisionmaking patterns:

- Coordinated decisions have been made for the initial purchase of the microcomputers;

- Coordinated decisions have been made for the upgrading of these units or their augmentation by subsequent purchases;

- Coordinated decisions have been made regarding the allocation of the microcomputers to different physical locations, to different subject topics, or to meet various scheduling needs;

- Some functional interdependency exists among the units--e.g., in the formal sharing of software or the provision of maintenance services; and

- Some common arrangement has been made to provide user training.

All of these characteristics will not be found in all cases. However, the more that the same set of microcomputers has these characteristics, the more that the units may be considered part of the same system.

This notion of microcomputer "systems" is needed to study microcomputers from an organizational point of view and to consider the related implementation issues. Even with an explicit definition, however, a precise enumeration of the microcomputers within a given system may still not be possible in all cases. For example, an individual microcomputer unit may be purchased by a local parent-teacher association, to be placed in a specific school. The unit may then share some of the same software already in the school. In such a case, whether this unit is considered part of the same or different microcomputer system is rather arbitrary. In spite of such instances, however, the overall definition of microcomputer "systems" is still useful for identifying those microcomputers that fall

within the same decisionmaking and organizational context.

Characteristics of Microcomputer Systems Studied

This definition also allows an analyst to understand that there may indeed be more than one microcomputer system within the same school district. One group of microcomputers may have been purchased and administered for one general purpose (e.g., instructional applications), and another group may have been purchased and administered for some other general purpose (e.g., administrative applications). The implementation pattern for both groups may be different, and neither system may have much to do with the other.

Selection of Systems to be Studied. In the present investigation, the goal was to focus on the microcomputer system used for special education in any given school district. Thus, the procedure for selecting the cases to be studied was based on the characteristics of these particular microcomputers, and not any of the others that also might have been present in the same district.

A nomination procedure was developed, whereby special education staff were contacted in numerous school districts, to determine whether microcomputers were being used for such purposes. If they were, two other criteria were used to select the final districts to be studied: a) the special education microcomputers had to have been in place for three semesters or longer, and b) the special education microcomputers had to have been used for a mix of instructional and administrative patterns across cases. The first criterion was used to assure that the implementation process had proceeded sufficiently to produce adequate information for study—i.e., the investigation was not to be limited to the early adoption experience of school districts. The second criterion was used to assure coverage of a major implementation issue, as described in greater detail in Section V of this report.

Summary Characteristics. Given this procedure, twelve case studies were conducted, each focusing on a microcomputer system within a school district. Table II-1 summarizes the basic characteristics of these systems.

The case studies revealed great diversity in the size and functions of each of the microcomputer systems. Even though all were used for special education, only a few were dedicated solely for that purpose (Abingdon, Linden, and Tallulah); in most cases, the microcomputers were shared between special and regular education applications, with the proportions often not clearly specifiable due to the extensive interaction between

Table II-1

Microcomputer Characteristics

)ingdon School District
- 23 Apple II-Plus
- 1979
- ESEA Title IV-C
- 23 Apple II-Plus

oise School District
- 7 Apple II-Plus
- 2 Bell & Howell Apple
- 2 Commodore 64
- 1979
- ESEA Title IV-C
  Donations
  Parent Teacher Organi-
  zation; District
  Budget; Gifted Program
  P.L. 94-142
- 14 TRS-80
  24 Cromemco C10

heyenne School District
a. 44 Apple II-Plus
   14 Commodore PET
   66 TRS-80
   2 Altair
   4 Commodore 64
). 1979
:. Chapter 1
   Chapter 2
   District Budget
   Association for Students
   with Learning Disabilities
i. 3 Commodore W/P 8082
   5 Commodore CBM 2001
   1 Apple II-Plus

Commack School District
a. 55 Commodore PET
   1 Texas Instrument
   1 Apple II-Plus
b. 1978
c. ESEA Title IV-C
   ESEA Chapter 1
   District Budget
   Parent Teacher
   Association P.L. 94-142
d. 2 Commodore 8032
   13 Compucolor

Hopkins School District
a. 117 Apple II-Plus
   3 TRS-80
b. 1978
c. P.L. 94-142
   ESEA Title IV-C
   District Budget
   Parent Teacher
   Organization
d. None

Lexington Regional District
a. 22 Apple II-Plus
b. 1980
c. P.L. 94-482
d. 5 Heathkit

Linden School District
a. 12 Commodore PET
   2 Apple II-Plus
b. 1979
c. Local Fundraising
   P.L. 94-142
   ESEA Title IV-B
d. 9 Commodore PET

Oakhurst School District
a. 37 Commodore PET
   1 Commodore CBM
   1 Atari
   1 VIC 20
b. 1979
c. Title I/Chapter 1
   Title II/Chapter 2
   Gifted/Talented
d. 5 Commodore PET
   3 Apple II-Plus

Pittsburg School District
a. 10 TRS-80
   4 Apple IIe
b. 1982
c. State Vocational Education Funds
   P.L. 94-142
   Chapter 2
   District Budget
   Local Fund raising (e.g.,
   parents group)
   Emergency School Aid Act
d. 5 Intertec Compustar
   2 Apple II-Plus
   1 CompuPro
   5 TRS-80

Prescott School District
a. 298 Commodore PET
b. 1979
c. ESEA Title IV-C
   State Vocational Education
   Program
   District Budget
d. None

Shelby School District
a. 9 TRS-80
   4 Apple II-Plus
   4 Commodore PET
   1 Apple IIe
b. 1980
c. ESEA Title IV-C
   Gifted/Talented State Funds
   ESEA Title IV-E
   Principal's Budget
   ESEA Title VI-B
   Parent Teacher Organi-
   zation; Local Fund raising
d. None

Tallulah School District
a. 2 Intertec Compustar
b. 1979
c. P.L. 94-142
d. 1 TRS-80
   9 Commodore PET

LEGEND:	a.	Number and type of microcomputers in system studied	c.	Major funding source for micro-computers studied
	b.	Year of intial use of microcom-puters in system studied	d.	Number and type of other micro-computers in district, not studied

these programs in a district. This characteristic and the related educational and administrative issues are discussed further in Section III.

In addition, the microcomputer systems were indeed not necessarily the only microcomputers in the same district. Other microcomputers also co-existed, being part of different systems. In fact, in only three of the cases were the microcomputer systems studied the only systems in the district (Prescott, Shelby, and Hopkins). Thus, Table II-1 indicates the number of microcomputers in each system, as well as the number of units in other systems in the same district.

Table II-1 also captures two other salient characteristics worthy of further discussion. First, the microcomputers within the same system need not be of the same brand of hardware. Indeed, in only three of the cases (Prescott, Lexington, and Abingdon) did the system consist of only one brand of hardware. The diversity of brands within the same system can create coordination problems, as in the case of one district (Shelby). However, such diversity also can be desirable.

For instance, different brands of hardware may have different strengths and weaknesses regarding different applications--e.g., wordprocessing as an instructional tool vs. drill-and-practice routines vs. lessons in computer education (e.g., LOGO). If a district knows it will be undertaking such diverse applications, this may very well justify the purchase of different types of hardware, and coordination problems may be minimized because the applications will involve different teaching staffs and classrooms. Such diversity also has one additional benefit: The units for one type of hardware will be "secure" in relation to the units for another type of hardware. Thus, if specific administrative applications (e.g., grades, test scores) are to be part of the overall microcomputer system, these applications will not be threatened by tampering if they involve a different brand of hardware from the other microcomputers.

Second, the microcomputers within the system have been supported by a diverse array of funding sources. These funds appear to equally reflect federal and state as well as local sources; among the federal sources, both categorical and block grants were used, and among the local sources, both district revenues and funds from voluntary efforts were used. The diversity is probably a reflection of the relatively low cost of a single microcomputer unit. Thus, different units within the same system may have nevertheless been purchased with funds from different sources.

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"Cohorts" of Microcomputers?

Table II-1 also indicates the initial year in which the microcomputers studied were purchased. For all the districts except Pittsburg, this year was 1980 or earlier, reflecting one of the criteria for selecting the district to be part of the study in the first place. (In Pittsburg, the system studied began in 1982, because the initial system upon which the site screening had taken place had ceased to exist.)

What the table does not indicate is that in none of the cases were the microcomputer units all purchased during this first year. Indeed, one of the most salient characteristics throughout all of the cases is that microcomputer systems have been growing in an incremental manner. Some typical examples are illustrated in Table II-2, showing how annual purchases have varied in nine of the cases (the same variations also existed in the other three cases, but the precise numbers of units per year were not available).

The new units each year may represent a commitment to a new curriculum topic or grade level. For instance, a district may have purchased ten microcomputers in one year, to provide all resource rooms at the junior high school level with one unit. The following year, the district may have purchased 12 more units, and initiated computer "labs" of three units a piece in four elementary schools. Next, the district may have purchased 12 more units, and divided them in some manner among junior high school students who are not assigned to resource rooms (and who therefore had no access to the first year's microcomputers).

As the preceding example suggests, the total microcomputer system ultimately represents a collection of different "cohorts" of microcomputer units. This type of incremental change allows the district to absorb increasing numbers of microcomputers at a reasonable pace, so that training, curriculum development, and software activities can be focused each year on a different set of topics or teaching staff. Such incremental growth therefore minimizes the disruption to the entire school district and enables a small group of district staff to coordinate the entire microcomputer system.

Summary

This section has described the basic characteristics of the microcomputers studies in twelve school districts. First, the focus of study was a collection of "system" of microcomputers in each school district. The relevant system was deemed the one serving special education, although other systems may also have existed within the same district. Second, even within a single

Table II-2

Years of Purchase of Microcomputer Units

DISTRICT	Year:	I	II	III	IV	V
Abingdon		2	3	15	3	–
Boise		2	2	1	4	3
Hopkins		1	17	34	17	54
Lexington		2	10	9	1	–
Linden		3	4	6	2	–
Oakhurst		14	–	14	12	–
Prescott		40	10	40	31	177
Shelby		5	3	7	3	–
Tallulah		1	–	–	1	–

system, the brands of microcomputer hardware could vary, with such variations taking advantage of different capabilities for different types of applications. Third, each system represented annual increments of new microcomputer units, rather than a massive, initial installation.

The remaining sections of this report analyze specific organizational or implementation issues regarding these twelve microcomputer systems.

III. SPECIAL EDUCATION USE OF MICROCOMPUTERS--
COLLABORATION OR SPECIALIZATION?

The case studies examined both the nature of microcomputer applications used to support special education services and the type and extent of collaboration that occurred between regular and special educators in the use of the microcomputers.

As a hardware technology that can be shared by many users, microcomputer systems may be considered natural candidates for substantial sharing between special and regular education programs. However, the distinctive needs of special education students could arguably lead to less sharing. For instance, for students with communicative disorders, special devices may have to be used and the microcomputer units themselves may require special adaptations. Similarly, the distinctive administrative needs of special education programs may also mean that a lesser degree of sharing is possible. Thus, case studies were designed to examine collaborative activities across a variety of stages in implementation, and across time--planned interaction versus actual interaction. Finally, the case studies also investigated the particular benefits or problems that resulted from collaboration.

The school districts were selected to represent a variety of possible collaborative approaches. As shown in Table III-1, the majority of the microcomputer systems involved shared usage by both regular and special education--even if they had not started out that way. Only three systems (Abingdon, Linden, and Tallulah) had restricted their microcomputer implementation to special education applications.

Participants in Initial Adoption of Microcomputers

Patterns of initial microcomputer adoption varied a great deal. In three systems (Cheyenne, Oakhurst, and Shelby), the initial adoption did include special education applications but, nevertheless, no special educators were involved in planning the original implementation.

In systems where special educators were involved in planning for the initial adoption of microcomputers, two patterns occurred. In three systems (Boise, Linden, and Tallulah) only special educators participated in planning the initial adoption. In all of these cases, the original applications were designed exclusively for special education use. Thus, collaboration in initial adoption, between special and regular education, occurred only in the remaining three systems:

Table III-1

Special and Regular Education
Sharing of Microcomputer Applications

	Participants in Applications (School Districts)	
Type of Applications	Special Education Only	Special and Regular Education
Instructional	Abingdon Linden	Boise Oakhurst Cheyenne Pittsburg Commack Prescott Hopkins Shelby Lexington
Administrative	Boise Oakhurst Tallulah	Cheyenne Pittsburg Commack Prescott Hopkins Shelby Lexington

> Abingdon--a high school industrial arts teacher
>   and a high school special education
>   teacher;
>
> Commack--a district administrator and an elemen-
>   tary special education teacher; and
>
> Lexington--a district administrator and a high
>   school special education teacher.

In one of these cases (Abingdon), the planned adoption was for special education students only. In the other two (Commack and Lexington) both special and regular education students were targeted.

This variety of patterns indicated that collaboration between special and regular education, during initial planning and adoption, was <u>not</u> a requirement for subsequent sharing of the resources. Actually, initial adoptions were more often characterized by enthusiasm and initiative of a few individuals who were very interested in the potential usefulness of micro-computers in education. These initial adopters included both administrators and teachers, and they came from both special and regular education programs. In a few cases (Boise, Cheyenne, and Tallulah) the initial adoption involved only one individual. In the other cases, the interactions were between individuals, rather than between organizational units in the school district. In none of the initial adoptions was there a formal collaboration between district-level special and regular education programs.

Later Collaborative Patterns

Table III-2 compares the collaboration of special and regular education personnel, at district and building levels, in subsequent stages of implementation: purchases, allocation, coordination, training, and software decisions. During the growth of the systems, some district level collaboration occurred, primarily over purchases and allocation. In four districts (Hopkins, Oakhurst, Pittsburg, and Shelby), cen-tralized special education administration provided funds for the purchase of additional microcomputers. In all but one of these (Hopkins), district staff also decided where these additional microcomputers would be placed. In Hopkins, district funds were made available to support the purchase of microcomputers that were requested by the principals.

The only district level collaboration in training occurred in Oakhurst. The special education department provided funds

Table III-2

Special and Regular Education Collaboration
During Subsequent Stages of Implementation

Special and Regular Education Collaboration

DISTRICT	Purchases	Allocation	Coordination	Training	Softwa
Abingdon			B/T	B/T	B/T
Boise	B/T	B/T	B/T	B/T	B/T
Cheyenne				B/T	B/T
Commack	B/T		B/T		B/T
Hopkins	D			B/T	B/T
Lexington		B/T	B/T	B/T	B/T
Linden					B/T
Oakhurst	D	D		D	B/T
Pittsburg	D	D			B/T
Prescott			B/T		B/T
Shelby	D	D			B/T
Tallulah	--	--	--	--	--

Key: B/T = Building/Teacher Level
      D = District Level
      -- = No collaboration between special and regular education

for the purchase of 14 microcomputers during the second year of
the district's microcomputer implementation. Because these
microcomputers, as well as previous units in the district, would
now also be used to support CAI with special education students,
a special series of the district's training program was set up
for the special education teachers. However, the trainers and
the curriculum for this inservice were identical to the regu-
larly offered microcomputer inservice. Only the group scheduling
was unique--to attract and accommodate as many special education
teachers as possible.

Overall, there was greater collaboration between regular
and special educators at the building level. In many districts
(Abingdon, Boise, Commack, Lexington, Prescott), both groups of
teachers interacted in management decisions (coordination,
scheduling) related to the microcomputers. Similarly, local
training efforts often included both special and regular
education teachers as trainers (Abingdon, Boise, Cheyenne,
Hopkins, and Lexington). In all studied systems that included
instructional applications (Tallulah--administrative only--was
the sole exception), special and regular education teachers
shared their software. This occurred even in Abingdon and
Linden, where the target systems were intended only for special
education students. In those cases, special education teachers
made software available to other teachers who were interested in
using microcomputers, or were just getting their own
(independent) microcomputer systems underway.

The Overall Pattern: Collaboration

Taken together, these findings on level, nature, and extent
of collaboration did not reflect a strong differentiation
between special and regular education use of microcomputers.
Identical or similar microcomputers and software were used, with
reported success, by both regular and special educators. The
inservice training offered was also identical, and equally
effective, for both groups of users.

These results may be surprising to those who claim that the
instructional use of computers with handicapped children makes
requirements for uniquely different applications of the
technology (than, say, for use with non-handicapped). However,
a review of recent literature in this area (e.g., Taber, 1983;
Hofmeister, 1982; Budoff & Hutton, 1982; Hannaford & Taber,
1982, for special education applications--Cohen, 1982; Kulik,
Bangert, & Williams, 1983; Steinberg, 1983, for general
applications) does not distinguish any general differences
between the components of CAI considered important for either
group. Microcomputer applications with some selective
populations (e.g., severely handicapped and communications

disorders) may require special adaptations of the technology;
but the bulk of "handicapped" students are only minimally
subnormal (e.g., educable mentally retarded) or impaired in onl
certain faculties (e.g., specific learning disabilities).

In fact, the approaches advocated for instructional use oi
microcomputers, and the advantages attached to their use
(individualization, prescriptive diagnosis, consistency, etc.)
are not just the aspects of a generally sound instructional
method, but also the key components of educational approaches
currently favored by special educators.

It should be noted that the sample of school districts
studied in this investigation was purposive and not random.
Districts were selected because of their history of use of
microcomputers in special education. Overall, there may be a
higher frequency of regular education issues, with no concomi-
tant special education need, than reflected by our cases. Thu
the broader level of collaboration may not be as high as ir ou
cases. For instance, recent surveys (Euchner, 1983) have
indicated that the principal use of microcomputers in most
districts is for computer programming and computer literacy, a
these may have dominantly precluded any participation on the
part of special education.

Illustrative Special Education Applications

Independent of the collaborative issue, some of the speci
education applications of microcomputers are worth noting.

In the administrative area, there are only a limited numk
of instances when an application included features particularl
tailored to special education needs. Two districts (Prescott,
Tallulah) used custom-designed IEP development and monitoring
systems. (A few other districts indicated that they were
planning IEP systems, but had not yet implemented them.)

In the instructional area, one system (Boise) used a
microcomputer as a communication aide for a severely handicapp
(traumatic spinal injury) student. The unit had been fitted
with a special keyboard grid to permit the student, who had
limited dexterity control, to type input. Also in Boise, vel(
strips were used on some keyboards to "hide" nonessential cha:
acters that might be distracting for some students.

In a few cases, special education teachers remarked that
there were particular features of some software that were bet
suited to handicapped students. In particular, cne feature
commonly mentioned was large, clear letter-forms. Teachers f
this was especially helpful for visually handicapped youngste

but was also helpful for students with low ability or attention levels. Some teachers also felt that color-coded letters on the keyboard were also helpful.

Nevertheless, with the few exceptions just noted, applications of microcomputers did not generally differ <u>substantively</u> between regular and special education users. However, some differences were noted in the perceived impact and value of applications. First of all, regarding administrative applications, special educators in many systems (Commack, Hopkins, Lexington, Pittsburg, Prescott, Shelby, Tallulah) reported that microcomputer capabilities were especially useful in light of the record-keeping and report generation requirements related to P.L. 94-142. Similarly, some (Hopkins, Tallulah) also noted the benefits of word processing/mailing list features for regular communication with parents.

Second as a motivational benefit, teachers in two districts (Oakhurst, Commack) cited specific cases of emotionally disturbed children whose behavior and academic performance were markedly improved, they felt, as a function of the introduction of microcomputers. Teachers also believed (Commack, Cheyenne) that typing skills were very important for development of eye-hand coordination by, for example, students with learning disabilities. These teachers used educational software that focused on learning and practicing typing-keys as part of their instructional approach with these students.

Another "normal" function of microcomputers that was viewed to have special benefits for handicapped students was word processing. In Cheyenne, word processing was taught to regular high school students to improve their writing/composition skills in English and journalism classes. However, a junior high school special education teacher, who knew about the success of the high school project, also introduced word processing (Bank Street Writer) with her LD students. She felt that word processing was extremely helpful with these students whose previous writing had been characterized by failure and frustration. The microcomputer was a nonthreatening tutor, and special features (spelling checks, ability to correct errors) encouraged the students to improve their writing <u>and</u> reading.

Conclusion

The implementation of microcomputers in special education was accompanied by considerable collaboration between special and regular education personnel. This collaboration was most evident at the building (rather than district) level, where special and regular education teachers shared microcomputer resources (hardware and software) and participated equally in

coordination and training activities.

Across the systems studied, an examination of the training offered, and the features of inservice that were best received, disclosed no differences between that provided to regular or to special educators. Both groups had some complaints about the microcomputer equipment and software, but their suggestions and criticisms were generally similar. If anything, special education and remedial education (such as basic skills) teachers were more pleased and made more use of the microcomputers than other teachers (except for secondary math/computer science staff).

Finally, there were few examples of unusual or special uses of microcomputers with handicapped students. For the most part, CAI applications with special and regular education students were highly similar--in terms of equipment, methods, and preparation. At the same time, the few instances of special applications (communication aide) or adaptations (modified keyboards) were recognized as highly effective by users, and the selection of cases did not include special schools for the severely handicapped, which may have established a wider array of special applications.

The purposive selection of case study sites did not permit inclusion of special school systems for the severely handicapped or of small microcomputer systems (within regular districts) that concentrated on unusual or specialized adaptations of microcomputers. Microprocessor technology offers great potential usefulness in this area--providing special solutions to the needs of students with major disabilities (Vanderheiden, 1982). The current investigation documented the growth and efficacy of more typical microcomputer applications with special education students who, for the most part, were receiving their educational services in regular elementary and secondary public schools. In the future, introduction of more advanced and specialized microcomputer applications should increase the opportunities for more handicapped students to participate in the educational mainstream.

IV. SUPERVISING THE MICROCOMPUTERS
FROM THE TOP DOWN, OR THE BOTTOM UP?

Because a microcomputer is a small, self-standing unit, it can be adopted by a single classroom or by a school building. Alternatively, several microcomputer units can be purchased by a district administration and placed in school buildings.

As a result of these options and their variations, an important issue about microcomputers in schools is whether a centralized approach (i.e., district control) is more or less advantageous than a decentralized approach (i.e., classroom or building control). Such a choice is one of the distinctive characteristics of microcomputer systems, due to the fact that earlier computer systems--such as on-line terminals linked to minicomputers or mainframe computers--frequently did not allow the same decentralized option.

Defining Supervisory Patterns

To examine this issue, the case study protocol called for careful documentation of the precise supervisory patterns in each district. Several activities were traced, to determine which staff made the following types of decisions:

- The decision to purchase microcom-
  puters;

- The allocation of microcomputers to
  specific classrooms;

- The review and purchase of software
  for the microcomputers; and

- The arrangements, if any, for train-
  ing of microcomputer users.

The more these decisions were in the hands of district staff, the more that the microcomputer system was regarded as a centralized (top-down) system; the more these decisions were in the hands of principals and teachers, the more the system was regarded as a decentralized (bottom-up) system.

In tracing these activities, one complication was that the decision-making patterns could change over time. This occurred in most of the case studies, with key personnel--e.g., as the

person ultimately serving as a "microcomputer coordinator"--
shifting from one level to another (e.g., Commack), or with
supervision over the microcomputers gradually shifting from one
level to another (e.g., Hopkins). However, in only two of the
districts were such changes on the more drastic side. In one
(Cheyenne), the microcomputers were originally supervised in a
more decentralized manner, with the district staff playing a
minimal role in coordinating purchases and utilization at the
building level; however, the district has gradually asserted
more control by appointing a coordinator and, in the past year,
the Superintendent called for a freeze on all microcomputer
purchases so that the entire system could be reviewed. In the
other (Pittsburg), the microcomputers have shifted in the
opposite direction, with the teaching and building staffs being
more active now than before.

For the other ten districts that were studied, however,
there was a generally consistent pattern of centralized or
decentralized supervision, summarized in Table IV-1. As the
table indicates, six of the ten districts are currently
organized on a centralized basis, four on a decentralized basis,
and two have followed the changing pattern noted above. This
cross-case pattern is revealing, even on a descriptive level
alone, as an initial conclusion is that:

- No pattern of centralization or decen-
  tralization dominated the supervision
  of microcomputers in the twelve case
  studies.

Furthermore, our suspicion is that this type of diversity
probably exists throughout other school districts across the
country.

Examples of Different Supervisory Patterns

A typical centralized pattern of supervision arises when
the superintendent or other district-level staff person has an
early role in adopting and implementing the microcomputer
system. The initial interest may have come from this level or
from the building level, but the district staff takes the
leadership in all phases of managing the new microcomputer
system--i.e., allocating the units to different buildings or
classrooms, scheduling training, and reviewing and purchasing
software. Moreover, the district staff is then involved in
further purchases of new microcomputers in subsequent years, as
the system grows. Among the case studies, this most centralized
pattern was found in Tallulah, Lexington, and Oakhurst.

Table IV-1

MICROCOMPUTER SUPERVISION PATTERNS

DISTRICT	Type of Supervisory Pattern		
	Centralized	Decentralized	System Changing
Abingdon		X	
Boise		X	
Cheyenne			X
Commack	X		
Hopkins	X		
Lexington	X		
Linden		X	
Oakhurst	X		
Pittsburg			X
Prescott	X		
Shelby		X	
Tallulah	X		

A decentralized pattern can also involve district staff,
but at most in an approval capacity only. Thus, a group of
teachers and their principal may have the initial interest in
adopting a microcomputer; the district staff may help to
identify the available funds, but the entire supervision of the
units and their use 'then occurs at the building level. The
funds, as in one case (Abingdon), may be "project-specific"
(e.g., ESEA Title IV-C), and the microcomputers will be used
within the context of a specific, time-limited project (e.g.,
for three years). In this sense, the district staff have
participated in adoption only, and the system is largely outside
of their control once it has been purchased.

Both the centralized and decentralized patterns can have
their disadvantages. A centralized pattern, in the later years,
can lead to situations in which the microcomputers are purchased
and assigned with little regard to the needs or training of the
teaching or building staff. In one centralized case, for
instance, the microcomputer use has not necessarily been closely
integrated with daily lesson plans (Prescott).

Similarly, under the decentralized pattern, the subsequent
growth of the system may be sporadic. Other microcomputers may
be purchased, but only if another group of teachers takes the
initiative; and if these teachers represent different curriculum
topics, the type of microcomputer hardware or software may be
quite different from those purchased initially. This pattern
emerged clearly in one school district (Shelby), with the result
that the district has most recently felt the need for a
centralized, coordinating committee to reassess the purchasing
and allocation process due to complaints about incompatible
units and excessive diversity. Excessive diversity of hardware
was also found under another decentralized pattern in Cheyenne,
to the point that the hardware incompatibility has interfered
with district efforts to provide system-wide inservice training.

A secondary sense in which centralization/decentralization
is important is in the physical location of the microcomputer
units, and not just their organizational supervision. Phys-
ically, a centralized pattern would have a large number of units
located in the same room, typically a computer lab or a media
center (e.g., Linden). This room can then be scheduled for use
by different classes, or it can be made available on a shared
basis to individual students who are sent to the room by their
teachers. A decentralized pattern would have one or a few
microcomputer units located in individual classrooms, under the
direct control of the classroom teacher. One variant of this
pattern is to have the microcomputers on mobile carts (e.g.,
Prescott and Commack), which are rotated to different classrooms
on different school days.

The different physical layouts have organizational implications regarding the centralized or decentralized control over the microcomputers within a school building. Among the cases, no single pattern prevailed; moreover, the same district or building often encouraged the development of multiple patterns, where sufficient numbers of microcomputer units were available. Thus, the resource rooms for special education were a typical place where microcomputers were located, but this did not preclude additional units from being located in other individual classrooms or in a media center.

Overall, in neither the organizational or physical sense, was there a consistent pattern of centralization or decentralization. Whether a district follows one pattern or the other may in part be determined by the degree to which the school district has been centralized or decentralized traditionally. If the district has been traditionally decentralized, the adoption and implementation of the microcomputer system will follow the same pattern, and if deviations are attempted, conflicts may arise. In Cheyenne, for instance, the microcomputers have become a potential source of struggle. The school buildings have taken the major initiatives in adopting and implementing various microcomputer units but the district has attempted to impose a certain degree of coordination and control to assure more effective utilization. Under such circumstances, the accession and implementation process may later be slowed down, as with the moratorium on new purchases that was declared in Cheyenne in the spring of 1982.

Does the Pattern Make a Difference?

The cases have clearly followed different patterns, with neither centralization nor decentalization dominant. Furthermore, neither pattern appears to have clear advantages or disadvantages under all circumstances. What this begins to suggest is that the centralized and decentralized dimension, per se, may not be as important to the growth and utilization of the microcomputers as other factors.

For instance, regardless of the organizational pattern,

- Persons with key characteristics seem to be present as microcomputer use be- comes more widespread within a district: teaching experience and control over administrative resources.

The first characteristic appears to be some recent or current teaching experience. The handful of persons beginning to serve as microcomputer "coordinators," for instance, include staff persons who have either been teaching within the recent past or are still teaching part-time, even if their formal positions are now located at the district level. The teaching skill appears to be invaluable in assuring the appropriate integration of microcomputer use within the classroom and daily lesson plans.

The second characteristic appears to be some control over administrative resources. Whether this person is a Superintendent, an assistant superintendent, or even a building principal, the skill is needed to support strongly the initial adoption decisions and to rearrange the necessary administrative procedures as implementation proceeds, including the revision of schedules, the provision of time for inservice training, and even the reallocation of physical space. In one case (Commack), for instance, an elementary school principal had to move walls to make room for a small computer lab.

Together, persons with the two skills may work as a formal or informal group, and the group may or may not be at the district level. The person(s) with the teaching skill helps to identify relevant training and technical assistance procedures as well as the acquisition or development of appropriate software. The person(s) with the control over administrative resources assures that sustained resources are made available for subsequent purchases of microcomputers or software. This tandem combination can operate within both centralized and decentralized patterns and was found in a large proportion of the cases (Lexington, Hopkins, Prescott, Pittsburg, Commack, and Oakhurst).

Microcomputers and Mainframe or Mini-Computers

Related to centralization and decentralization is a second issue that received only peripheral attention in the case studies. This issue followed the notion that, among computer technologies, microcomputers represent an inherently decentralized technology in comparison to the traditional mainframe or even minicomputer. Thus, each microcomputer unit has "stand-alone" capabilities and can be used and relocated in direct relation to a user's needs. Mainframe or minicomputers, in contrast, are centrally controlled and scheduled, but offer a much larger computing capability. The issue was whether any clear patterns of coordination or conflict were emerging among these systems in any of our cases.

In fact, some functional distinctions were emerging, but

only with a typically trial-and-error pattern. Minor
administrative tasks that can be done on microcomputers--e.g.,
the establishment of a class list of students or of a mailing
list of parents--were found in several of the districts (see
Section V of this report for a full description) where such
functions might have been done by the mainframe or minicomputer
in the past. With the microcomputers, these tasks appeared to
be more satisfactorily conducted, in relation to the user's
needs. Similarly, certain kinds of instructional applications
that had been done on on-line terminals with a mainframe (e.g.,
Commack) were now more readily performed on microcomputers, and
at lower cost. At the same time, large-scale data reporting or
analysis (e.g., payroll, student records, student reporting)
were functions generally perceived as more appropriate for
larger computer systems.

To this extent, the different computer technologies may all
have different niches in the range of functions found in a
moderately sized school district. Under such circumstances, it
may even be better to have different computer systems for
different functions, as such separation increases the security
of all of the systems, and also gives each function its rightful
priority. A system totally dedicated to payroll, district
personnel, and student grades, for instance, would be more
secure if no other functions were integrated into the same
system, and at the same time would not interfere with the
conduct of the other functions (which would have their own
computer systems).

Organizationally, the evolution of these different
functional patterns are likely to proceed with some care and
deliberation. How the coordination and leadership is exercised
will vary from district to district, but it is unlikely that
either the microcomputer systems or the mainframe (or
minicomputer) systems will entirely dominate the whole range of
district functions. This realization has emerged, in part, in
one case (Prescott) where the supervisor of the mainframe
computer has gladly encouraged the transfer of certain functions
to the microcomputers.

In spite of this potential long-term complementarity of
different computer systems, conflicts did arise in two cases as
the microcomputer systems were adopted and expanded. In
Oakhurst, the director of data processing voiced some concern
over planned administrative use of microcomputers. He believed
that such applications would produce inefficiecies and
redundancies with the existing mainframe service offered by his
department. In Lexington, the data processing department
largely ignored the initial adoption and growth of the
microcomputer system, and is only now beginning to understand
that the commitment of resources to the microcomputers may be a

threat to the minicomputer system in the future.

Conclusion

Both the centralized (top-down) and decentralized (bottom-up) patterns of supervision of microcomputers were found in the case studies. More important than the issue of the relative merits of these approaches was the finding that the microcomputer systems being used successfully tended to depend on support from two different levels--someone acquainted with teaching concerns and another person who could provide the needed administrative support. This team of skills was invaluable during the implementation of the new microcomputers, including arrangements for training, decisions and monitoring regarding the actual location of the microcomputers, and general review of software acquisition.

.The role of this implementing team is not to be confused with that of the adopting team. One proposition for future study is that, whereas the decision to purchase new microcomputers may be best put in the hands of a larger committee (representing different interests) or in the hands of a teacher-dominated project team (representing the project directors for a project-specific award), larger-scale implementation requires the mix of teaching and administrative support noted above, but within a small group of two to three persons. In other words, larger committees may not be efficient mechanisms for dealing with implementation issues, and teacher-dominated project teams may not have the administrative support needed 'ɔ expand microcomputer use beyond the initial project.

V.   ADMINISTRATIVE AND INSTRUCTIONAL APPLICATIONS:
COMPETITIVE OR COMPLEMENTARY?

Introduction

As more microcomputers are used in school districts, the
number of instructional and administrative applications
increase.   The balance of resources between these two types of
applications can affect the growth and stability of the entire
microcomputer system.   Therefore, an important issue examined by
the case studies was the integration of instructional and
administrative applications within the same microcomputer
system.

School districts have generally considered instructional
applications to be more important than administrative ones.
However, a common debate is whether administrative applications
tend to complement or compete with the instructional uses.   Some
people view administrative uses as eventually dominating a
computer system and displacing the instructional applications.
Others feel that the addition of administrative applications can
lead to greater district support of a computer system, with the
eventual allocation of more resources to both types of uses.

Whether this debate is applicable to microcomputer systems,
as well, was one topic investigated by the case studies.   The
cases were deliberately selected to represent some districts
with administrative applications only, with instructional
applications only, or with both types of uses.   The goal was to
compare these types over time--i.e., to see whether there was
any evidence that the administrative applications were
displacing instructional ones, or whether they were producing
increased support for the entire microcomputer system.

Defining Instructional and Administrative Applications

The case study protocol called for determining the degree
to which the microcomputers were initially adopted for instruc-
tional or administrative use.   In documenting the adoption of
microcomputers in a school district, the case study focused on
the initial purpose and justification for the use of microcom-
puters.   Therefore, the initial design of the system was traced
to determine whether there was a favoring of either
instructional or administrative uses, with regard to the
following priorities:

- the physical location of the micro-
  computers;

- accessibility of the units to admi-
  nistrative staff and teaching staff;

- the allocation of hardware resources;

- scheduling of microcomputer time; and

- the acquisition of software.

Also, in conducting the case studies, the major applica-
tions in each school district were identified and enumerated as
being either instructional or administrative. The following
criteria served as the basis for categorizing each application:

- the subject matter;

- the dominant type of users;

- the proportion of microcom-
  puter hours used; and

- the name and type of software.

Typical examples of instructional applications in the
school districts were: computer literacy, computer programming,
and computer-assisted instruction (including drill-and-practice
exercises), simulations, problem-solving, and skill games. In
addition, the use of microcomputers for word processing to
develop students' written skills was found in several school
districts.

The most frequently found administrative applications were
at the school building level and included student scheduling,
grade reporting, attendance reporting, test score data, and
student information records. Microcomputers also performed
administrative functions at the district level, such as payroll
preparation, accounting, data collection, student records,
personnel files, and production of education reports. The major
applications in each school district are displayed in Table V-1.

Based on the priorities and the types of microcomputer
applications, the microcomputers were categorized as being for
instructional applications only, for administrative applications
only, or for both. In nine of the twelve cases, microcomputers
were initially used for instructional activities only. In one

Table V-1

MICROCOMPUTER APPLICATIONS
(Applications and Grade Level of System Studied)

ingdon School District

ith instruction drill and practice
(h.s. special ed.)
mputer Literacy program (7th grade
gifted/talented)
ogramming course (h.s.)

Hopkins School District

Library inventory and check-out
system (elem.)
Basic skills, drill and practice
reading comprehension (elem.)
Special education student records
and tracking (elem. & h.s.)
Advanced programming (h.s)
Financial planning
Basic skills instruction with CMI
(elem. special ed.)
LOGO and Turtle programming
(elem. & jr. high)

Pittsburg School District

Attendance records (h.s. principal)
Student data record files (h.s.
guidance director
Equipment inventory (h.s. vocational
director)
Basic skills instruction (h.s.
special ed.
Computer literacy programming
(h.s.

ise School District

ASIC programming (elem. gifted/
talented)
isic skills instructional programs
(elem. special ed.)
mputer literacy (elem. gifted
talented)
ventory in food services training
program (h.s. special ed.)
isic skills, drill and practice,
and games (jr. high special ed.)
chool transportation (Bus scheduling

Lexington Regional District

Financial planning and budgets
(superintendent)
Student test records (h.s. teachers)
Tutorial instruction in chemistry,
biology, and physics (h.s.)
Design and drafting of blueprints
in building trades department (h.s.)
Basic skill instruction (h.s.
special ed.)

Prescott School District

Beginning and advanced program-
ming courses (h.s.)
Computer literacy (4th-7th grades)
Basic skills instruction (elem.
special ed.
Student records and placement
files (h.s. teacher.
Individual Educational Vocational
Plans (h.s. teacher

levenne School District

isic skills, drill and practice,
and reading comprehension (elem.)
tudent records (jr. high principal)
ASIC programming (jr. high)
ord processing for school newspaper
and compositions (h.s.)
isic skills instruction (h.s.
special ed.)

Linden School District

Basic skills, drill and practice
(elem. & jr. high special ed.)

Shelby School District

Staff information and evaluation
files (elem. principal
Student grades (elem. teacher
Self-directed programming course
(6th grade
Introductory programming, using
high-resolution graphics (jr.
high gifted/talented
Basic skills, drill and practice
program with CMI (elem.
special ed.)

mmack School District

isic skills, instruction and multi-
sensory, interactive games
(elem. special ed.)
ord processing and graphics (jr.
high special ed.)
ASIC programming (elem. gifted
handicapped)
OGO and Turtle programming (first
grade)
tudent records, inventories, budgets
and personnel records

Oakhurst School District

Basic skills instruction, drill and
practice, and games (h.s. teacher)
Introductory programming and computer
literacy (elem. & jr. high gifted/
talented)
Advanced programming (h.s.)
Tutorial instruction in Spanish and
French (h.s.)
Student records

Tallulah School District

Special ed. forms and manuals
Records of Individual Education
Plan (I.E.P.) conferences
Communications and mailings to
parents
Comprehensive, special ed.
student tracking system:
student data record files
District inventory of materials
and supplies
Accounting, budgeting

of the cases adoption was for administrative applications only
and in two districts the microcomputers were for mixed (both
instructional and administrative) applications. Table V-2
presents the distribution of the twelve cases.

Initial Patterns of Use

In school districts that began with microcomputers dedica
ted only to instructional applications, the earliest users wer
typically teachers or staff persons. These persons usually
became interested in the instructional potential of microcom-
puters and had acquired a unit for their classrooms (e.g.,
Abingdon, Boise, Cheyenne, Linden, Prescott, Shelby). This
initial interest in the educational uses of microcomputers the
set the pattern and direction for other teachers to acquire
microcomputers for instructional use. Only later in the proce
did the district administration become involved in the impleme
tation of the microcomputers, based on the teachers' growing
interests, requests for equipment, and needs for technical
assistance and training.

In other cases (Lexington, Oakhurst), the initial interes
in adopting the new technology was generated at the district
level, but the emphasis still was on acquiring microcomputers
for instructional use. The districts would either secure
funding and resources for acquiring the units and software to
meet individual teachers' requests (e.g., Boise, Cheyenne,
Shelby), or make bulk purchases of units and distribute them t
schools or individual teachers (e.g., Prescott, Commack,
Oakhurst). In one district (Lexington) microcomputers were
allocated to teachers only after they had demonstrated potent:
uses. In another site (Oakhurst), teachers received microcom-
puters only after completing a training course on computer
operations.

In the school district with microcomputers for administr;
tive purposes only (Tallulah), the initial adopter, a distric(
level administrator, was interested in the business capabilit:
of the microcomputer and secured the funding and approval for
unit in his office.

In the planned mixed systems (Pittsburg, Hopkins), the
initial adopter or planning group investigated the administra
tive as well as the instructional benefits of the microcom-;
puters. Consequently, both sets of applications were taken i
consideration when making the first purchase and allocation
decisions. In both districts, the first microcomputers
purchased were allocated specifically to either instructional
administrative use, and resources for software were allocated
support both types of applications.

Table V-2

Microcomputer Systems: Patterns of Use

istricts	Applications: Initial Adoption of System	Applications: Present System
bingdon	Instructional	Instructional
oise	Instructional	Mixed
heyenne	Instructional	Mixed
ommack	Instructional	Mixed
opkins	Mixed	Mixed
exington	Instructional	Mixed
inden	Instructional	Instructional
)akhurst	Instructional	Mixed
'ittsburg	Mixed	Mixed
'rescott	Instructional	Mixed
'helby	Instructional	Mixed
rallulah	Administrative	Administrative

How Did Patterns of Use Change?

These initial patterns of use changed over time and are
summarized in Table V-2. Of the nine school districts with
microcomputer systems initially devoted to instructional uses
only, seven later expanded to include administrative applica-
tions. Thus, as the microcomputer system grew to meet different
needs and more users, administrative uses were also added. Of
these six, the administrative uses gradually evolved at the
school building level among teachers and principals. Usually,
the administrative use has been limited to grade reports,
scheduling, attendance, test scoring, equipment inventories, and
curriculum development.

In two districts (Cheyenne, Prescott), administrative
applications emerged together with the creation of new
district-level positions--i.e., microcomputer coordinator or
specialist. Persons in these positions acquired units as part
of their services and supported other users by reviewing and
cataloging software, writing new programs and adapting existing
ones, maintaining equipment inventories, and purchasing
information. In several districts (Lexington, Shelby, Oakhurst,
Cheyenne, and Prescott), one or more microcomputers were
allocated to a district-level or principal's office to be used
exclusively for administrative purposes. For example, in
Lexington, the Superintendent acquired a microcomputer for his
office, which he has used for budget projections and reports.

The two districts that began with both administrative and
instructional applications (Hopkins, Pittsburg) continued to
grow and expand, with the addition of more units and software
programs for both types of uses. In Pittsburg, the allocation
of resources has assured the growth of administrative and
instructional applications at approximately the same rate. To
secure the continued development of both instructional and
administrative use in Hopkins, two positions have been
created--one to concentrate on instructional applications and
the other to assist the implementation of administrative ones.

However, in two districts originally having instructional-
only microcomputer systems, little expansion of the original
microcomputer system has occured. In these districts (Abingdon,
Linden), the microcomputer system has been restricted to
instructional applications either through local interpretation
of federal project guidelines or by district limitations. Both
Abingdon and Linden secured microcomputers through federal
projects. The grant proposals specified the exact allocation of
hardware, types of applications, and dominant users of the
microcomputers. In both cases, the microcomputer system has not

expanded beyond the original project guidelines in terms of applications or additional units.

Similarly, in the district with administrative applications only (Tallulah), the microcomputer system has not added instructional applications, as the system has not grown beyond its original two units and one user for administrative purposes.

It is interesting to note then, that:

- the instructional-only and adminis-
  trative-only microcomputer systems
  that have not changed over time to
  become mixed systems are also those
  that have not grown or expanded in
  terms of either the number of units
  or additional applications.

This observation can be explained by the fact that microcomputer systems have not expanded either their base of users (to cover staff turnover) or their tasks of applications (to extend beyond a single project). Consequently, the microcomputer systems do not have the same growth potential and may be more vulnerable than systems having both types of applications.

For example, in Abingdon the future direction and use of the microcomputer system for special education students is uncertain, due to the scheduled termination of the federal project. With the project director's position ending, no one has been delegated the responsibility of managing the microcomputer system or determining its use. Similarly, the administrative-only microcomputer system in Tallulah is especially vulnerable to staff turnover, because the knowledge of computer operations and the software programs is limited to a single individual. In fact, one district with administrative-only applications was eliminated from our original case study sites because the microcomputer system had fallen into disuse upon the departure of the primary adopter and user, just before selecting sites for the case study.

The Coordination of Instructional/Administrative Use

To the extent that both instructional and administrative applications exist in the same microcomputer system, it is important to determine whether the districts developed any coordinating procedures or strategies. Thus, the case studies documented any evidence of such procedures as those for:

- resource allocation between uses;

- allocation of microcomputer units;

- scheduling of time on microcomputers

- identifying specific users.

Among the districts, those with currently mixed (instruc-
tional and administrative) microcomputer use followed different
strategies to coordinate the applications. Two school districts
(Commack, Oakhurst), starting out with microcomputers for
instructional uses, decided to purchase separate microcomputer
units for the administrative applications. In Commack, a
deliberate decision was made to purchase different hardware, to
avoid any conflict between the two types of uses. A different
example is Tallulah, where the microcomputer system studied has
remained exclusively administrative, but the district has
adopted an entirely separate system (different hardware brands)
for instructional purposes. The installation of separate
systems for adminstrative and instructional uses precludes any
sharing of the microcomputers, which in turn avoids conflicts
between the different applications.

In other school districts, the same microcomputers are used
for both administrative and instructional applications, with
coordination between the two evolving informally among the
users. Several districts (Prescott, Lexington, Cheyenne) have
enough microcomputer units and other resources so that the use
of some units for administration does not hamper or curtail the
instructional use. Resources such as software, equipment, and
training are allocated to the teachers and staff persons to
support both instructional and administrative interests in the
microcomputers.

Conflict between the two types of uses has been avoided in
some districts by having teachers and staff persons schedule any
administrative use during times when there is not student use.
In one district (Pittsburg), a teacher had the students involved
in his administrative applications by having them enter data,
update files, and adapt business software, as practical learning
experience on the computer.

Conclusion

        None of the twelve cases offers any evidence to suggest
that there is a conflict between administrative and instruc-
tional applications in microcomputer systems. Furthermore,
there is a possibility that the two types of applications are
complementary, as neither instructional-only nor
administrative-only systems have grown and expanded as readily
as mixed systems.

        Districts with mixed systems have developed different
coordination strategies and procedures to manage both types of
applications, in order to reduce the possibility of competition
or conflict. Some districts have chosen to allocate separate
units to the two types of uses; other districts have used the
same microcomputers for both administrative and instructional
applications. Both coordination strategies have resulted in
similar growth and stability of the microcomputer systems.

        Furthermore, microcomputer units used for both
administrative and instructional applications are not at this
time dominated by the administrative ones or displacing any
instructional use. In part, this can be explained by the fact
that administrative use tends to grow gradually and is limited
to only a few users. Consequently, it is not likely that a
district's demands for administrative microcomputer use will
race ahead of the number of units. Also, a single microcomputer
and several software packages can serve many administrative
needs.

        When administrative use does reach the level where there
may be competition with instructional applications, then
additional units can be designated. This flexibility may be
different from earlier experiences with computer systems in
schools, in which the number of on-line terminals or the amount
of computing time was limited. With microcomputer systems,
additional units can be added, as the system as a whole can grow
in an incremental fashion.

VI.. TRAINING AND EMERGING STAFF ROLES
FOR MICROCOMPUTER IMPLEMENTATION

Training

The literature on the implementation of microcomputers in school systems stresses the importance of training for teachers and other staff if they are to be able to use microcomputers effectively (Coburn et al., 1982, Taber, 1983). Teachers must know how to operate the microcomputer, how to select, evaluate and run software, and how to manage the microcomputer. This is necessary to effectively integrate the technology into the classroom. Thus, it may be argued that training is essential not only for successful implementation but also for subsequent growth of the microcomputer system to occur.

For the purposes of this study, training was defined as organized, inservice, group instruction. This could have included a multiplier approach, in which the individuals trained were required to train others. However, totally individual instruction, such as one-to-one technical assistance, was not considered training.

Examples of Training The case studies documented the training activities for planners and users of the microcomputer systems in 12 school districts. Table VI-1 shows the training provided in each district. Six districts (Cheyenne, Commack, Hopkins, Lexington, Oakhurst, and Prescott) were all considered to have offered major resources for training. The other six districts had the following experiences.

In two cases (Boise and Pittsburg), the microcomputer systems were considered to be in a transition stage. In Pittsburg, the users of the existing 14 microcomputers were self taught or had received individualized technical assistance from the system coordinator. The district was beginning to implement formal training in anticipation of additional microcomputer purchases. Training was being offered to teachers who as yet, had no computers and, in effect, was being conducted during a "pre-implementation" stage. Similarly, four of the 13 microcomputers in Boise were purchased within the last year, and applications on these were just being implemented. The primary resource in Boise was individual technical assistance, although a training program had been initiated for teachers in the gifted/talented program.

In a third case, Tallulah, only the administrative microcomputer system was studied. The major operator of the system was self-taught. In the remaining three districts

Table VI-1

Inservice Training for Microcomputer Implementation:

Districts with <u>Major</u> Inservice Resources

District	Format	Content Areas Covered
Cheyenne	District Workshops TRS-80 and Apple Users Groups Building Level Inservice Evening Courses (sponsored by student group)	Introduction to Computer Operations BASIC Programming Software Adaptations Computer Literacy Word Processing
Commack	District Inservice Course Open to All Staff District Inservice for Administra- tors Building Level Inservice	Computer Awareness and Operations BASIC Programming Integration of Computers into the Classroom Advanced BASIC Programming Word Processing Computer Graphics
Hopkins	District Inservice Building Level Inservice	Beginning BASIC Intermediate BASIC Computers in the Classroom Use of Computers for "Cooperative Learning" Advanced Programming
Lexington	District (one building) In- service	Microcomputer Operation Evaluation/Selection of Software Lesson Development Instructional Applications Administrative Applications Computer Awareness Programming
Oakhurst	District Inservice for All Staff District Inservice for Special Education	Introduction/Orientation to the Microcomputers Evaluating Commercial Software BASIC Programming Advanced Programming
Prescott	District Inservice	Introduction to Computers Computer Literacy Computer Programming

Table VI-1

Inservice Training for Microcomputer Implementation:
District with Minimal Inservice Resources

District	Format	Content Areas Covered
Abingdon	Group Training for Title IV Project Participants (Spec. Ed.) only	Basic Introduction to Computer Running Project Software and BASIC Programs
Boise	District Inservice for Gifted/Talented Teachers Building Level Inservice for Special Education	Using Computer as Instructional Tool Computer Literacy
Linden	Group Training for Title IV Project Participants (Spec. Ed.) only	Use of Project Software Computer Literacy
Pittsburg	District Inservice	Introduction to Microcomputers
Shelby	District Inservice for Project Participants Building Level Inservice	Computer Literacy
Tallulah	(None – Administrative System only)	

(Abingdon, Linden, Shelby), minimal training had been provided. In Abingdon and in Linden, the training content was limited to Title IV-C project objectives and was offered to project participants only.

When Does Training Make a Difference? It was anticipated that the level of training available would be associated with the growth of the microcomputer system. The case studies examined the validity of this assumption. Growth was defined as a rate of increase in the number of microcomputers in the system, together with the increase of users, expansion of applications, and diversification and efficiency of microcomputer use.

The patterns for growth in numbers of microcomputers for each district are summarized in Table VI-2. In three of the districts (Abingdon, Linden, and Shelby) the initial purchase of microcomputers was for pilot special education projects. The federal project in Abingdon was expanded to include an additional computer lab in a second school, resulting in an increase in the number of computers and users. Although the project did not expressly limit the applications to those originally intended, there was no expansion of applications beyond those for which the teachers had been trained. Shelby was an example of a system where growth in the number of microcomputers had outstripped the training opportunities. Some teachers received computers because federal funding was available even though they did not request them. Some teachers with microcomputers reported that they did not know how to operate them. A moratorium was placed on additional microcomputer purchases and a committee was established to assess the microcomputer curriculum.

For the remaining districts (Cheyenne, Commack, Hopkins, Lexington, Oakhurst, Prescott), two clear patterns emerged. First, all demonstrated steadily or rapidly growing microcomputer systems and also offered major resources for training teachers and administrators during the implementation stage. A combination of group training opportunities were made available, as well as the assistance of district or building level microcomputer experts or computer coordinators for additional help and information. Major training opportunities included district organized inservice training on a variety of topics and levels, offered on a continuous basis (e.g., Hopkins, Commack, Prescott). In addition, user orientation, building inservice, parent inservice, classes by local universities, school clubs and user groups, and individual technical assistance by a computer coordinator/expert were also available.

The second pattern that emerged was different from prior expectations regarding growth and training. It had been

Table VI- 2

GROWTH PATTERNS FOR MICROCOMPUTER SYSTEMS

Districts with Major Resources for Training	Total Number of Microcomputers in System	
	By 1979	By 1983
Cheyenne	4	130
Commack	10	46
Hopkins	1	123
Lexington	2	22
Oakhurst	14	40
Prescott		298
Districts in Transition		
Boise	4	12
Pittsburg	4	14
Districts with Few Resources for Training		
Abingdon	4	23
Linden	3	15
Shelby	5	18
Tallulah	1	2

anticipated that where training had been planned and offered
during the start-up or pre-implementation phase, smoother and
more rapid growth would take place. However, analysis of the
case studies disclosed that group training was <u>not</u> a critical
factor during the start-up phase. Rather, this phase was
characterized by individual technical assistance, orientation,
and exploration. This form of instruction appeared to satisfy
user needs for the first few microcomputers in the system.
However, individual technical assistance limits the growth of
the system. The technical assistant can only train one or two
individuals at a time, thereby taking longer to reach all the
users within the system. When the system expands beyond six to
ten microcomputers, the training needs of the increased number
of users require formal training to be established.

Three districts (Oakhurst, Lexington, and Hopkins) did
offer inservice training to users during the start-up phase. In
these cases the training appeared to be extremely useful in
establishing interest in and awareness of the microcomputer
system. In fact, in one district (Oakhurst) a policy decision
was made in the planning stages that microcomputers would not be
distributed to the teachers until they had undergone enough
training to enable them to use the microcomputers properly. In
another site (Lexington), teachers were required to develop a
plan demonstrating how they would use the computers in their
classroom as justification for receiving one.

The case studies also investigated the effect of the
quality of training on the use of the microcomputer. "Quality"
training was perceived by users to mean relevancy of training
topics, and compatibility between the equipment used in training
and the equipment accessible to users. District training which
emphasized basic orientation to microcomputers and direct
applications in the classroom seemed most popular and was often
oversubscribed.

In contrast, initial training efforts were less successful
when the objective was to teach participants how to program
(Cheyenne, Oakhurst). The introductory courses were subse-
quently changed to cover issues of more immediate relevance:
microcomputer use and operations (loading and running programs);
integrating computers with the curriculum, authoring systems,
word processing, and evaluating software. Some districts
(Hopkins, Cheyenne) did offer advanced level programming courses
which were well attended. However, these courses were part of a
continuum of beginning and intermediate level inservice training
that had been offered in previous years. As users demonstrated
more technological sophistication, the need for advanced level
courses including programming and languages evolved.

The history of microcomputer implementation in Cheyenne

illustrated the need for "qua ity" training. Cheyenne had 130
microcomputers, which included fi   different brands, and
various models of each. The district's initial efforts at
training focused on programming skills. These efforts were
hindered because the training equi nent did not match equipment
available to users within each bui ling. At that time,
programming courses were too advanced for teachers' experience
and interest, and were undersubscribed. Subsequently, two of
the initial users of micro:omputers in the district began a
series of Saturday morning workshops for a basic introduction to
microcomputers, oriented towards TRS-80 or Apple users. The
district now sponsors workshops which include an introduction to
computer operations, BASIC programming, and methods for adapting
software to meet user needs. Advanced level programming is now
available with high school students as instructors.

     The pattern for training during the successful
implementation of microcomputers in a school district appeared
to follow a distinct sequence. The adoption of the first few
microcomputers was usually initiated by computer enthusiasts,
often self-trained or intrinsically self-motivated enough to
seek training on their own. As new users became involved, the
initial adopters were able to provide technical assistance to
them. The informal tutoring and sharing of information created
the setting for others to become interested, but at the same
time did not compound any fear or resistance to change that some
teachers may have had.

     As the new users increased, however, this expansion created
a demand for more formal training beyond the reach of a single
adopter. At this stage more formal training was required, and
needed to cover a basic introduction to microcomputers as well
as information on how to integrate them into the classroom.

     Separate Training for Special Education Teachers. Across
the case studies, the content of training and course objectives
appeared to be equally relevant and applicable for both regular
and special education. In other words, techniques and knowledge
required to use the microcomputers did not differ between
regular and special education users. (The software used by
special educators was developed for students in general;
specific software geared to special education needs was not
readily available.)

:ging Staff Roles

The growth of the microcomputer system in a school district
ates a need for managing the system. When implementation
jrs in a decentralized manner, decisions regarding implemen-
ion tend to occur in isolation. As elements of the system
omes centralized, decisionmaking can be coordinated across
 district. This can reduce redundancies and inefficiencies
the system.

Coordinator Role. The case studies documented the
rdination patterns for the districts' microcomputer systems.
sons involved in the implementation support process were
ntified, and coordination activities traced, to determine the
ent to which new organizational roles were created for
aging the system. A person (or group) was considered to be
 "coordinator" as a function of participation in:

   ● the purchase and allocation of the micro-
     computers;

   ● the review, purchase and allocation of
     software;

   ● maintenance of a central file/catalogue
     of software;

   ● the scheduling and planning of computer
     use; and

   ● provision of training and technical assis-
     tance for users.

In some cases, evidence for this role was determined by a
;trict formalizing the role with a position statement/title.
:oordinator role could also be filled in an informal manner;
 enthusiast/expert assumed these responsibilities. Whether
: district recognizes or establishes an official coordinator's
Le is in part determined by its overall centralized or
:entralized pattern for supervision, and also by its support
: microcomputer implementation.

Table VI-3 shows the status of coordinator roles across
stricts. It can be seen that this role did emerge in some
:m in each district, whether or not it was supported or
:malized on a district level. Whether these activities were
iducted by a single individual or a planning group varied
:oss sites, but responsibilities were similar. It appears
at, like training:

Table VI- 3

PLANNING GROUPS AND COORDINATOR ROLES

District	Pre-Implementation Stage		Implementation Stage		Formal Coordinator Role	Informal Coordinat Role
	Formal Group	Informal Group	Formal Group	Informal Group		
Abingdon*		X	X		X	
Boise	None	None		X		X
Cheyennes	None	None	X		X	
Commack		X		X	X	
Hopkins	X		X		X	
Lexington	X			X	X	
Linden*		X		X	X	
Oakhurst		X		X	X	
Pittsburg		X		X		X
Prescott	X			X	X	
Shelby		X	X			
Tallulah**						X

*Abingdon and Linden established role for duration of project only
**Tallulah coordinator is primary user

- when growth occurs beyond the initial adoption of the first microcomputers, the need for coordination of the microcomputer system evolves and the role of a formalized or informal coordinator emerges.

Two districts (Abingdon and Linden) established a coordinator role for the duration of their federal projects. The coordinator's activities did not extend beyond the computers allocated for the project and were terminated when the projects ended. The coordinators were primarily responsible for carrying out the tasks stipulated within the project guidelines, which directed how the microcomputers were to be used. Those districts demonstrating the most rapid and extensive growth also had established at least one formal (full or part-time) coordinator role (Lexington, Hopkins, Prescott, Oakhurst, Commack, and Cheyenne). In Lexington there were two staff members performing these duties. After the first 12 microcomputers were purchased, the Superintendent created the position of microcomputer master teacher. The designated individual was previously a special education resource teacher in the developmental math lab. The new role required him to divide his responsibilities between instructing special education students and coordinating the microcomputers. He became responsible for providing inservice training, maintaining the equipment, and serving as a resource to staff. In addition, the staff person in the media center/library became the "microcomputer specialist" for the units in the microcomputer center. The specialist's responsibilities included: scheduling and managing the use of the center's computers and maintaining the district's software library.

In Hopkins, a combination of supervisory patterns for managing the 120 microcomputers emerged. Centralized coordination occurred at the district level, and decentralized coordination/autonomy occurred at the building level. At the district level, the following activities were coordinated: the development of instructional and administrative applications, software, and training sessions; maintenance and use of computers; and coordination and compilation of software. Individual purchases of equipment were made at the building level. The media specialists in each school were responsible for implementation of the system including acquisition and maintenance of the equipment. They also received support from the district level coordinators.

The pattern for the emergence of coordinators appeared to parallel trends in training. That is, the same person or group

that had initiated or adopted the first microcomputers in the
district became the most likely candidates to fill the
coordinator's role. Having served as a resource to users during
adoption, the initial "adopter" continued to be approached by
district personnel and teachers for technical assistance. In
Commack, for example, the special education teacher who had been
instrumental in implementing the district's first pilot
microcomputer project, took on a newly created part-time role as
the district's computer curriculum specialist. She also
c(·inued to teach in a resource room at one of the elementary
s ,, .,ls. Under guidance from the director of student services,
her responsibilities included developing educational computer
programs, designing staff development activities, coordinating
allocation and use of equipment, and preparing budgets and
purchase orders for the director. She also developed and
implemented pilot demonstrations in classrooms for new sets of
applications.

In districts without an officially designated coordinator,
a technical resource person still emerged. In Boise, the
implementation process was highly decentralized. Purchases of
microcomputers and their applications were implemented
independently within schools by individual teachers, and
allocated to those who had requested the computers. The first
microcomputer was acquired by one of the special education
consulting teachers and, subsequently, he informally became the
coordinator for the special education microcomputers. He added
this responsibility to his concurrent role of technical
assistance provider for special education teachers; he
considered microcomputer assistance part of his support role.
He offered suggestions on using the equipment, transported
computers between buildings, and trained teachers for new
applications. He advised teachers on the suitability of
particular software, and shared software as needs arose.

Does A Coordinator Make a Difference? The lack of some
type of coordination for the microcomputers leads to problems
that may impede growth and effective use. Without the
monitoring, direction, or guidance from someone serving in this
capacity, users will operate independently of each other. The
lack of communication may result in isolated purchases, which do
not benefit from the shared experience of others. People
unaware of applications within their building or across the
district duplicate purchases and costs. The increasing
diversity of types of computers purchased creates incompatabi-
lity of software, and limits shared, more efficient use of the
computers. The coordinator can facilitate continuity within the
school district and conserve dollars, time, and effort.

REFERENCES

Budoff, M., and L.R. Hutton, "Microcomputers in Special Education," _Exceptional Children_, 1982, 49(2), 123-128.

Carmen, G.O., and B. Kosberg, "Educational Technology Research: Computer Technology and the Education of Emotionally Handicapped Children," _Educational Technology_, 1982, 22(2), 26-30.

Cartwright, G.P., and K.A. Hall, "A Review of Computer Uses in Special Education," in L. Mann and D. Sabatino (eds.), _The Second Review of Special Education_, JSE Press, Philadelphia, 1974.

Coburn, P., P. Kelman, N. Roberts, T.F.F. Snyder, D.H. Watt, and C. Weiner, _Practical Guide to Computers in Education_, Addison Wesley, Reading, Massachusetts, 1982.

Cohen, V.B., "Criteria for the Evaluation of Microcomputer Coursework," _Educational Technology_, 1982, 23(1), 9-14.

Euchner, C., Citation of data collected by H.J. Becker, in "Stress on Computer Drills Diminishing," _Education Week_, 1982, 2(32), 17.

Hannaford, A.E., and F.M. Taber, "Microcomputer Software for the Handicapped: Development and Evaluation," _Exceptional Children_, 1982, 49(2), 137-142.

Hartley, S.S., "Meta-Analysis of the Effects of Individually Paced Instruction in Mathematics" (Doctoral Dissertation, University of Colorado, Boulder, 1977).

Hasselbring, T.S., "Remediating Spelling Problems of Learning-Handicapped Students Through the Use of Microcomputers," _Educational Technology_, 1982, 22(4), 31-32.

Hofmeister, A.M., "Microcomputers in Perspective," _Exceptional Children_, 1982, 49(2) 115-121.

Jamison, D., P. Suppes, and S. Wells, "The Effectiveness of Alternative Instructional Media: A Survey," _Review of Educational Research_, 1974, 44, 1-67.

Kulik, J.A., "Integrating Findings from Different Levels of Instruction," paper presented at AERA Conference, Los Angeles, April, 1981.

Kulik, J.A., R.L. Bangert, and G.W. Williams, "Effects of Computer-Based Teaching on Secondary School Students," Journal of Educational Psychology, 1983, 75(1), 19-26.

Roblyer, M.D., and F.J. King, "Reasonable Expectations for Computer-Based Instruction in Basic Reading Skills," paper presented at meeting of Association for Educational Communications and Technology, January 1983.

Steinberg, E.R., "Reviewing the Instructional Effectiveness of Computer Coursework," Educational Technology, 1983, 23(1), 17-19.

Taber, F.M., Microcomputers in Special Education, Reston, Virginia, CEC, 1983.

Torgesen, J.K., and K.A. Young, "Priorities for the Use of Microcomputers With Learning Disabled Children," Journal of Learning Disabilities, 1983, 16(4), 234-237.

Vanderheiden, G., "Computers Can Play a Dual Role for Disabled Individuals," Byte, 1982, 7(9), 136-162.

Whitney, R., and A.M. Hofmeister, "Monitor: A Computer Based Management Information System for Special Education," Association for Educational Data Systems,1981 Convention Proceedings, Minneapolis, Minnesota, May, 1981, 279-286.

INDIVIDUAL CASE STUDY REPORTS

WASHINGTON COUNTY SCHOOL DISTRICT
Abingdon, Virginia

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Washington County contains 571 square miles of farmland, woodlands and mountainside, and lies 40 miles east of Kingsport, Tennessee, and 130 miles west of Roanoke in southwest Virginia. Agriculture is the major industry, but Washington County is also campaigning to attract small business to the area. The 1981 population is listed at 46,487, which marks an increase of 5,652 people since 1970. Three colleges are located in the vicinity of Abingdon, Virginia, the site for this case study.

There are 17 schools in Washington County: 13 elementary and 4 secondary schools. The schools are relatively isolated due to the size of the county and its rural, mountainous characteristics. The current enrollment of approximately 8,800 students, of whom 730 are designated special education students, reflects an ethnic composition of 93 percent white, 7 percent Black, and 2 percent from other racial origins. One or more special education classes are in each of the 17 schools. All schools have one special education class and provide speech therapy. A county-wide curriculum is used for regular education students. A core curriculum for EMR students is used in one high school.

The school district has been experiencing a declining budget in recent years which has resulted in the consolidation of administrative assignments. The Superintendent of Schools, for example, also serves as the director of secondary education. One person is both assistant superintendent and the director of vocational education. Similarly, the director of federal programs is also the coordinator of testing/evaluation. The supervisor of special education is responsible for all administrative and curricular functions related to special education. All teachers, including the 45 special education teachers, are (most directly) responsible to their building principals. Other than building level principals and assistant principals, the only additional administrative staff consist of two supervisors in the areas of reading and math.

The district currently has a total of 46 microcomputers. Half of these (23) were purchased for special education through a Title IV-C federal grant. These microcomputers were the subject of this case study.

Washington County has 23 additional microcomputers for regular education use which were not part of this current investigation. Three of the high schools each have one Apple

II-Plus, 48/64K with disk drives, purchased through ESEA Title IV-B funds. Abingdon High School also has one Franklin ACE 1000 microcomputer purchased with Distributive Education Department funds, and an Apple III purchased with general funds that is used for class scheduling and word processing. John Battle and Holston High Schools each purchased one TRS-80 in the 1981-82 school year through School Club (math and science) funds. Abingdon Elementary's PTA purchased four Texas Instrument-99 microcomputers in November 1982. Twelve Apple II-Plus microcomputers were purchased in November 1982 through Chapter II Funds; four each are located in John Battle and Holston High Schools, and one in each of the four elementary schools.

Overview of Microcomputers Studied

All but one of special education's 23 Apple II-Plus microcomputers are located in computer labs in two high schools (11 units in each lab). The project coordinator for the grant uses the one additional Apple II-Plus for adapting and developing software. These 23 Apples are used for a variety of instructional purposes:

- The special education teachers at both schools use Milliken Math Series software for computer-assisted-instruction with 70 special education students enrolled in math classes. The micro-computers are used more than 50 percent of class time to develop the specific math skills outlined in students' IEPs.

- Approximately 16 regular education students at Patrick Henry High School, in 11-12th grades, participate in a one-semester elective computer programming course.

- The computers are also used after school for an eight-week class in computer literacy where basic computer programming skills are taught to 7th graders. About 70-80 regular education and gifted/talented students participate in this 12-hour course which is coordinated by the super-visor of elementary mathematics.

- Informal exploration and work on individual pro-jects by interested students takes place before school for approximately one hour and in unsched-led periods during the day. These sessions are supervised by the regular education math teachers.

● The University of Virginia Extension Campus uses
  the Abingdon High School computers to offer three
  evening programming courses for community residents.

Chronology

The microcomputers purchased for the special education pro-
gram were the first ones acquired by the Washington County
School District. In the fall of 1979, the industrial arts
teacher at Patrick Henry High School asked a special education
teacher to co-author a proposal for an ESEA Title IV-C Innova-
tive Projects grant. The director of federal programs approved
the effort, and the two teachers sought funding.

A three-year grant was awarded in June 1980, which included
a pilot year followed by two years of implementation. The pri-
mary goal of the project was to determine the effects of micro-
computer use on math achievement and school attitude of EMR/LD
students at the secondary level. During the fall of 1980, the
first microcomputer purchases were made, and software for mathe-
matics instruction was adapted and developed. A computer lab
was established at Patrick Henry High School, equipped with 11
Apple II-Plus microcomputers.

Student instruction began in March 1981. In May 1982, a
second computer lab was created at Abingdon High School and
equipped with an additional 11 Apple II-Plus microcomputers.
(The case study occurred in the third and final year of the
project.)

The project initially served 20 special education students,
but was expanded to include 70. Students were exposed to a
developmentally-based, sequentially organized, computerized pro-
gram designed to teach general mathematical skills, with lesson
objectives based on instructional materials in the Milliken
Mathematics Series. Each lesson guided the student in perfor-
mance of a task until the student's responses reached a mastery
criterion. Control groups receiving regular special education
mathematics instruction were formed at Holston, John Battle, and
Abingdon High Schools.

The evaluation plan included in the project proposal stipu-
lated a pre/post test, control group design. Self-evaluation
and third party evaluations were also conducted to assess
whether project objectives had been accomplished. The findings
of the 1981-1982 Third Party Evaluation Report were neutral or
positive regarding specific outcomes of the first full year of
implementation. The Report concluded, however, that students
exposed to microcomputer assisted instruction appeared to exper-
ience achievement gains in mathematics during the school year

and that they seemed to have more positive attitudes than similarly handicapped students not exposed to microcomputers.

Supervision for the project was provided by the director of federal programs, assisted by the supervisor of special education and the director of vocational education. These three individuals report directly to the Superintendent. During the implementation of the project an industrial arts teacher (one of the original proposal co-authors) was named project coordinator and maintained responsibility for coordination of the microcomputers. He also received requests for software purchases and forwarded them, through the director of federal programs, to the Superintendent for approval. Use and scheduling of the computers were strictly stipulated in the grant guidelines. In addition, the project coordinator distributed all Title IV-C software to the two participating high schools and provided technical assistance to users. He worked closely with the special education teacher (and proposal co-author) who implemented the project with her students.

These two teachers have worked together throughout the project, while continuing their teaching responsibilities. However, the supporting administrative staff has changed. In September 1981, the director of vocational education assumed the additional duty of assistant superintendent of Washington County Public Schools. As the Title IV-C project administrator, he worked closely with the coordinator of evaluation and research who is the Title IV-C project director. The assistant superintendent recommended budget amendments regarding charges for equipment, salaries, instructional materials, supplies, travel, and inservice. He forwarded these proposed changes to the Superintendent. The amendments were approved by the state director of federal programs, and by the state coordinator of special projects and grants. The ESEA Title IV-C Administrative Manual stipulates that the project director is required to present, at the end of the first year, an itemized budget showing anticipated funds needed for the next year's operation. Subsequent budget amendments were needed to remain within the range of allocated grant monies.

Four additional special education teachers are now participating in the project--three at Abingdon High School and one at Patrick Henry High School. The participating teachers received inservice training on how to incorporate the microcomputers in their math instruction. Lesson objectives were correlated with Milliken Mathematics software and with Mathematics for Individual Achievement, a basal mathematics textbook.

In 1982, Washington County secured additional federal funding for 19 microcomputers that, unlike the Title IV-C microcomputers, were not designated for special education use. The

success of the IV-C project appears to have served as a catalyst
for the county's decision to introduce microcomputers into regu-
lar education.

The major events in the implementation of microcomputers in
Washington County School District are presented in Table 1.

Table 1: Chronology of Implementation

Washington
County
School
District

Date Month-Year	Event
1979-1980 Academic Year	
Nov. 1979	Two teachers discussed the possibilities of microcomputers as instructional tools for EMR/LD students.
Dec. 1979	Submission of Title IV-C proposal requesting 13 microcomputers.
June 1980	Acceptance of proposal with state recommended revision designating the first year as a pilot/planning year. The purchase of two microcomputers was authorized.
Aug. 1980	Purchase of two Apple II-Plus microcomputers with printers.
1980-1981 Academic Year	
Sept.-Feb.	Project planning, development and purchase of software.
Jan. 1981	Participating special education teacher attends computer course.
Feb. 1981	Title IV-C self-evaluation conducted.
Feb. 1981	Evaluation plan drafted by external evaluator.
March 1981	Pilot project with student instruction begins.
March 1981	On-site visit by state evaluation team.

May 1981   Evaluation report submitted.

June 1981   State Title IV-C office approves
                                  purchase of three additional Apple
                                  II-Plus microcomputers with un-
                                  spent salary, inservice, and tra-
                                  vel funds.

June 1981   Three Apple II-Plus microcomputers
                                  purchased.

July 1981   Ten additional microcomputers re-
                                  quested (was approved).

1981-1982 Academic Year

Oct. 1981   Purchase of seven Apple II-Plus
                                  microcomputers (Authorized 7/81);
                                  computer lab with 11 work sta-
                                  tions set up.

May 1982   Evaluation report submitted.

May 1982   State Title IV-C office author-
                                  ized purchase of five Apple II-
                                  Plus microcomputers with unspent
                                  funds.

May 1982   Purchase of three Apple II-Plus
                                  microcomputers (authorized 7/81)
                                  and five Apple II-Plus units
                                  (authorized 5/82) to enable expan-
                                  sion to a second site.

1982-1983 Academic Year

Aug. 1982   1-1/2 day inservice training for
                                  30 special education teachers.

Sept. 1982   Computer lab with eight Apple II-
                                  Plus computers established at
                                  second high school.

Sept. 1982   Six hours of after-school instruc-
                                  tion provided for three special
                                  education teachers participating
                                  at the second site.

Oct. 1982   Four hours of additional instruc-

tion provided for the above three
teachers.

Nov. 1982

Three additional Apple II-Plus
microcomputers were authorized
and purchased; total of 11 micro-
computers in each computer lab.

II. FEATURES OF THE MICROCOMPUTER SYSTEM

Introduction

The microcomputers studied in Washington County were 23 Apple II-Plus units, each equipped with a disk drive and a color monitor. The project coordinator uses one Apple II-Plus computer with a Centronics 779 printer in his office. The remaining microcomputers are located in two computer labs (11 units in each) at two high schools, Patrick Henry and Abingdon. One microcomputer in each lab has a dual disk drive. There is a Paper Tiger printer in one lab and an Epson MX-80 printer in the other.

The computer lab at Patrick Henry High School is located in a small room that previously was designated as storage for the physical education department. Access to the lab is possible only by exiting through a rear door of the school and walking a short distance out of doors. Eleven Apple II-Plus microcomputers are arranged at individual work stations, lining three walls of the room, with the last two units filling the space in the center of the room. These units, together with the teacher's desk and a bookshelf for software storage, completely fill the room.

The 11 microcomputers in the lab at Abingdon High School are placed on long tables lining opposite walls of the room. Several tables, arranged end-to-end in the middle of the room, provide a central location for distributing materials. A large metal cabinet is used for storing software. The lab is located on the second floor of the high school in the science and math wing of the building. The large room was previously used as a science fair workroom.

Five special education teachers and 70 special education students use the microcomputers regularly for math instruction. There are several periods each day when the labs are not scheduled for special education math instruction. During one of these open periods at Patrick Henry, a math teacher teaches programming to 16 upper-level regular education math students. During the two unscheduled periods at Abingdon, the lab is open to students with passes who are working on independent programming projects (approximately 25 students participate). Supervision is provided by regular education math teachers. An eight-week computer literacy program for gifted/talented seventh graders is held after school for approximately 70 students. Both labs are used for this program. At the Abingdon computer lab, three evening programming courses are conducted by the University of Virginia Extension Campus.

Management of the Microcomputers

The supervisor of special education is responsible for all
administrative and curricular functions related to special edu-
cation in Washington County. The present supervisor, unlike her
predecessor, is not directly involved in decisions regarding the
Title IV-C microcomputers. She is informed of project progress,
but devotes most of her time and attention to direct supervision
of teachers and administration of services for special education
students.

Most of the decisions regarding use of the ESEA Title IV-C
microcomputers and software purchases are made by the co-authors
of the Title IV-C grant. Decisions are communicated to the
director of federal programs and the Superintendent for approv-
al. Requests for purchasing additional microcomputers come from
the project director and administrator and must be approved by
the State Title IV-C program office. Use of the microcomputers
must comply with Title IV-C guidelines both during and after the
grant period. The principals and assistant principals at the
two high schools have been involved in decisions concerning
space allocation, scheduling of classes, and security proce-
dures. After-school use of the labs is arranged with the build-
ing principal by the using group and with permission from the
Superintendent.

During the first year of the project, both teachers main-
tained their full-time teaching assignments. The project coor-
dinator (the industrial arts teacher) received a salary for an
additional 5-8 hours per week devoted to after-school planning
and program development activities. During the second and third
years, the project coordinator's courseload was reduced by one
class. For the last two years, the special education teacher
was allocated five hours per week, after school time, for pro-
ject implementation. This year both teachers share study-hall
responsibilities during the same period, allowing them addition-
al time to coordinate project activities.

Illustrative Applications

To provide an idea of how the microcomputers are being used
in Abingdon, three illustrative applications are described be-
low.

Computer-Assisted-Instruction--Mathematics. Several teach-
ers commented that microcomputers have enabled them to manage
more successfully the on-going individualization of a student's
math instruction. In one class, nine students can work at nine

different ability levels ranging from second grade to eighth
grade. One teacher reported that microcomputers have eliminated
the occasional "dead times" in which one or more students
required specific information before they could continue an
activity or move on to the next. One teacher noted that the
interest shown by the advanced level math students to attend a
computer programming class in the special education room has had
an unexpected positive effect on the special education students.
Several regular education students have asked to be in special
education so that they might have access to the microcomputers.

   In a class that was observed in the computer lab at Patrick
Henry High School, eight special education students arrived and
began loading their disks. The teacher made some general an-
nouncements and pointed out individual assignments on the black-
board. Students returned to their various (computer assisted)
lessons in subtraction, multiplication, and division that they
had been working on the previous day. The teacher pointed out
that this was ordinarily a time also used for individual confer-
encing with students. Students in her class spend half of a
class period using the microcomputer. The other time is divided
among activities such as conferences, pencil and paper math ac-
tivities, and math games.

   Computer Literacy--Gifted/Talented. This is the second
year that an after-school computer literacy course has been
offered to gifted/talented seventh-graders. The eight-week
course is held once a year and is coordinated by the supervisor
of elementary mathematics. The Title IV-C project staff and the
director of evaluation/testing have served as instructors during
both years of the program. This year there are seven instruc-
tors and approximately 70 students involved in this 12-hour
course. Instructors have met on one occasion to discuss the
topics to be covered. A course syllabus is being considered,
but in the meantime the instructors, most of whom are elementary
math teachers, prepare course lessons independently. The
courses are held at Patrick Henry High School and Abingdon High
School computer labs. The course develops basic knowledge of
what a computer is, how it works, and what it can and cannot do,
as well as providing opportunity to acquire basic programming
skills.

   During an observed class session at Abingdon, all ten stu-
dents worked individually at their own microcomputers. Their
attention to the screen was interrupted only occasionally when
they would seek assistance from the teacher, make a brief
exchange with a neighbor, or return to the central table to
exchange activity cards. The teacher circulated around the room
answering questions and expressing her approval of students'
work. At 5 p.m. (dismissal time), students had to be reminded
several times by the teacher that it was time to pack up and go

home. One student delayed until he had a printout of the program he had been working on. He was planning to finish writing the program on his computer at home.

Computer Programming Instruction--High School. Patrick Henry High School added a computer programming course to its high school curriculum during the school year 1982-83. This course is offered for one semester as an elective to 11th and 12th graders who have completed Algebra II. Classroom enrollment is limited to 16 due to the small size of the computer lab. Two students can work together at no more than five microcomputers. A course outline was developed by the math teacher and approved by the school board. The course is offered during a period when the microcomputers are not being used by the special education classes. There is presently a waiting list of students who would like to enroll in this course.

During observation of the class, students walked in and immediately began to load what appeared to be independent projects they had been working on. After all the students had arrived, the teacher directed them to their textbooks. Following a short presentation on a new concept, students were given a programming assignment. When students finished their assignment, they returned to the independent projects c which they had been working.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

Administrative and curricular functions related to special
education are monitored by the supervisor of special education,
who is directly responsible to the assistant superintendent.
The supervisor of special education manages the special educa-
tion teachers and support staff and monitors responsibilities
related to P.L. 94-142 implementation. Most of the decisions
regarding the administration of the Title IV-C microcomputers
are recommended by the co-authors of the proposal and approved
by the project director and assistant superintendent. Budget
amendments are accepted by the state director of federal pro-
grams, and by the state special projects and grants coordinator.

The initial adoption of the microcomputers was highly
centralized. Because all the computers were purchased with
Title IV-C funds, it was mandated that high priority use be
given to special education students for basic math skills im-
provement. The evaluation component of the project further
defined the specific software to be used and the manner in which
the math lessons would be conducted.

The Title IV-C project will end in July 1983, and staff in-
dicated that the centralizing effect of the grant has decreased
over time. The supervisor of special education does not plan to
implement any procedures next year that would restrict or
control use of the Title IV-C computers. The position of
project coordinator will also end with the project and the
present coordinator does not anticipate being able to give much
time to similar activities next year. No administrator or
faculty member has been delegated the responsibility for
coordinating the use of these microcomputers in the future.
Administrators would like a computer coordinator position to be
developed, but they don't anticipate that funds will be
available for such a position.

In two years, the number of microcomputers in the Washing-
ton County School district increased from 0 to 46. Although
administrators are interested in centralizing procedures such as
software acquisition/distribution, the only centralized action
currently underway is the provision for an employee to be
trained in equipment maintenance. Use of other microcomputers
in the district is decentralized -- directed at classroom or
school building levels.

Special and Regular Education Interaction

The original Title IV-C proposal addressed specific colla-
borative activities between regular and special education
teachers. The plan was for special and regular education teach-
ers to team with the Title IV-C project director to carry out
IEP math objectives using CAI-math and to coordinate its use
with mainstreamed handicapped students in regular education
classes, the library, and special education rooms. When the
State IV-C office recommended that the project be revised to
make the first year a planning/pilot year, the initial purchase
of microcomputers was reduced from 13 to 2. The pilot project
concentrated on CAI-math instruction in one special education
teacher's classroom, and the first year budget for inservice
training was significantly reduced. Evaluation of this pilot
project indicated that the experimental group (12 EMR students)
were not likely candidates for mainstreaming at the secondary
level. Therefore, the original emphasis on mainstreaming and
subsequent collaboration between special and regular education
teachers was reduced. Extensive training of one regular educa-
tion math teacher and one special education teacher in the first
year was not retained. The targeted math teacher did, however,
receive training during a school-wide inservice. This math
teacher has collaborated with the special education teachers in
scheduling use of the computer lab; he is presently teaching a
programming course to upper level math students during a class
period when the microcomputers are not used by special education
students.

Although the Title IV-C microcomputers were initially
intended strictly for special education use, informal collabo-
ration for scheduling and shared use with regular education now
occurs. The proposal guidelines enforce use for special
education students as needed, but allow for the availability of
the microcomputers to other students and staff with the approval
and clearance by the Title IV-C coordinator and staff.

At Abingdon High School, three special education teachers
participating in the Title IV-C project have met with the math
and science department chairmen to schedule use of the special
education computer lab. These are the only five staff who have
keys to the lab (which is located in the math and science wing
of the high school). It was decided that during the two class
periods per day when there were no special education math
classes scheduled, the lab would be open to students with passes
and supervised by a math or science teacher. Several special
education teachers expressed concern and uncertainty as to
whether there will be major changes in how the lab will be
scheduled for use next year when the Title IV-C project is over.
One regular education teacher mentioned the possibility of one
or more programming courses being offered next year. The high
school presently owns one Apple II-Plus microcomputer for in-

structional use that has not been purchased with Title IV-C project funds. This microcomputer is wheeled on a cart to classrooms and then returned to the special education computer lab.

Administrative and Instructional Applications

There are no administrative applications of the Title IV-C microcomputers at the Abingdon High School lab. The principal of Abingdon HIgh School recently purchased a separate Apple III microcomputer to be used for administrative purposes -- class scheduling and word processing. At Patrick Henry High School, the only administrative application is the production of student mailing labels by the Title IV-C project director, who volunteered to perform this task on his Apple-II microcomputer.

I

The first five special education teachers to participate in the Title IV-C project attended four two-hour inservice sessions conducted by the grant co-authors. The inservice covered a basic introduction to computers, history, and lab sessions for practice in running BASIC programs. Thirty other special education teachers (district-wide) have attended a 1-1/2 day inservice focused on using microcomputers as instructional tools that was also conducted by the project staff. The training was made possible through Title IV-C funds.

Recommended revisions to the original proposal designated the first year as a pilot and planning year. Funds originally allocated for inservice were carried over to the second year, and the State Title IV-C office approved additional hardware purchases with these unspent funds. Subsequent budget revisions reduced allocations for inservice during the second and third years.

Emerging Roles

Even though the number of Title IV-C microcomputers has grown from two in one school to 23 in two schools, the time allocated for managing the labs by the director has not increased. During implementation of the Title IV-C project one of the original co-authors (the industrial arts teacher) was named coordinator and given responsibility for coordinating the microcomputers. Teacher requests for additional software are received and reviewed by the special education teacher (project co-author), who forwards them to the director of federal projects for approval. Both the project coordinator

and the special education teacher have offered inservice training and technical assistance to the other teachers. During the first year, the project coordinator maintained his full-time teaching assignments, and received an additional salary for 5-8 hours per week for after-school planning and development activities. During the second and third years, the coordinator's course load was reduced by one class. The special education teacher who implemented the pilot project in her classroom was given five hours per week after-school time for project implementation. This year, both teachers use their regular planning time, during a shared study-hall period, for coordinating project activities. Now that the Title IV-C project is ending (July 1983), the project coordinator will return to his full-time, industrial arts position in the fall and, although desired by administrators and teachers, the continuation of a computer coordinator position is not expected.

INDEPENDENT SCHOOL DISTRICT OF BOISE CITY
Boise, Idaho

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Boise is the capital and largest city in the state of
Idaho. The state depends on agriculture, mining, lumber, and
tourism for most of its income. Light industry, including elec-
tronics manufacturing, is also present. The legislature is con-
servative, and per pupil expenditures on education are among the
lowest in the country.

Boise is a predominantly white, middle-class city surround-
ed by sparsely populated lands, and it is possible to reach
rural areas within ten minutes from any part of town. Boise
State University occupies a large campus near the center of
Boise, but Boise does not strike the visitor as primarily a
college town.

The Independent School District of Boise City covers all of
Boise and extends beyond the city boundaries. It is not very
large geographically, however, and it is possible to drive from
one end to the other in 15 minutes. It is by far the largest
district in the state of Idaho, and includes over 22,000 stu-
dents housed in 38 different schools: 28 elementary schools, 6
junior high schools, 3 high schools, and 1 special education
school.

The major problems faced in the Boise schools are finan-
cial. With per-pupil expenditures ranking 48th or 49th in the
nation, it is difficult to find funds for hardware purchases or
for the personnel to develop new microcomputer applications.
Nevertheless, special projects, parent groups, and individual
teachers have managed to provide a variety of microcomputers
over the past four years, and the district is now in the middle
of a program to expand microcomputer implementations in the
schools.

The Boise City school district is large enough to have a
rather complex organizational structure. Four "directors" are
each responsible to three assistant superintendents. One of
these directors is responsible for all pupil personnel services,
including special education. Under this director, four super-
visors are specifically responsible for the special education
program. In addition, there are three consulting teachers, who
each provide support to special education teachers in one of
three geographic regions. Each consulting teacher is supervised
by two or more of the four special education supervisors. In
general, authority within the district is relatively decentral-
ized, with a substantial amount of autonomy at the building
level.

In Boise, 166 special education teachers and other personnel serve a total of 1,889 special education students. In addition, the special education staff includes ten "facilitators" (teachers) who serve 374 gifted/talented students.

There are 11 microcomputers in the Boise school district that are used for special education services, including the gifted/talented program. These microcomputers, and their uses, were the subject of this case study.

In addition there are a variety of other microcomputers in Boise, most of which have been purchased by parent groups or individual teachers and which represent independent applications. There is no major systematic use of these other microcomputers by special education students.

Boise does not have its own mainframe computer. For administrative tasks, the district uses the state educational computer service. Many administrators express interest in using the microcomputers for administrative applications, but only a few such applications have been implemented to date.

Overview of Microcomputers Studied

Special education (which includes both handicapped and gifted/talented students in Boise) has acquired a total of 11 microcomputers. The microcomputers are used primarily for instructional purposes. Among the applications are:

- Communication aids for a severely handicapped student, the microcomputer is fitted with a keyboard guard; applications are being developed for communication skills with hearing-impaired students at a high school;

- Basic skills instruction for speech-impaired students in a special education school, for orthopedically handicapped students in an elementary school classroom, and for special education students in a junior high school resource room;

- Computer literacy for gifted/talented students in the elementary schools.

In addition to these instructional applications, administrative uses of the microcomputers have also been established. The consulting teacher has implemented these applications using available time on one of the Apples:

- generating bus lists for the special education students;

- maintaining an inventory of software;

- preparing summer program transportation lists.

Chronology

The use of microcomputers with special education students in Boise's schools began in the 1979-80 academic year. A year earlier, a high school student suffered a fall from a horse that left her almost completely paralyzed. She retained limited control of her head and right arm, but no speech. After many months of hospitalization and rehabilitation, she started attending the separate special education school in Boise for the severely handicapped.

At first, she made little progress because she simply could not communicate. One of the district's three consulting teachers obtained district special education funds and, in the spring of 1980, bought a Bell and Howell "Black Apple" microcomputer that the student has used ever since with excellent results. Although the consulting teacher had no previous background in microcomputers, he invested his own time in learning about both hardware and software, and he quickly became the microcomputer resource person for special education.

Other special education teachers soon became actively interested in the potential of microcomputers in their own classes. A special education home economics teacher obtained a grant for a 1981 summer course at the University of Idaho in Moscow. She learned BASIC programming and, at the end of the course, was allowed to take one of the microcomputers back to her school. The teacher has used the Apple microcomputer to control food inventory in her food services class, and finds that many of her special education students can update inventories and prepare shopping lists with the microcomputer. In 1982, Hewlett Packard donated an HP-85 microcomputer to the school, and the special education teacher is now using that unit to help students take orders for food and to make change.

Also in the 1982-83 school year, three other special education teachers began to develop microcomputer uses. Another teacher at the special education school began to investigate basic skills instructional programs for use with her speech impaired students. A teacher at an elementary school, began using an Apple to teach basic skills to her orthopedically handicapped students. The resource room teacher at a junior high began taking her students to the TRS-80 computer lab in the next

classroom. These teachers worked independently of each other, but the consulting teacher provided support for all three.

Currently (spring 1983), these three teachers are continuing to use the microcomputers with their students. A special education kindergarten teacher is also now using an Apple microcomputer to teach basic skills and computer literacy. At a junior high, the resource room teacher has recently acquired an Apple microcomputer for her own classroom, as well as one of the TRS-80 units belonging to the school. (With two computers available there, special education has been able to loan one Apple briefly to a family with a handicapped student, so that the family can try out microcomputer applications in the home.)

In the winter of 1982, an Apple microcomputer was acquired for the hearing impaired students at one high school. Plans for its use are currently being implemented.

Microcomputer uses with gifted/talented students started in an elementary school where, in 1978-79, a sixth-grade teacher began on his own to use computer terminals and borrowed microcomputers in his classroom. The following year, a "facilitator" for the gifted/talented program became interested in microcomputer applications. These two put together several proposals to purchase microcomputers and, in the spring of 1980, the school's Parent Teacher Organization (PTO) provided them with a Bell and Howell "Black Apple" microcomputer.

Both of these teachers used the microcomputer to teach computer literacy and programming in 1980-81. During 1981-82, all ten "facilitators" in the district's gifted/talented program pooled their equipment budgets and bought another Apple microcomputer. With this equipment, they began a larger scale project to teach computer literacy and programming.

By the winter of 1982-83, the gifted/talented program had acquired another Apple and two Commodore 64 microcomputers of its own and was also making use of several microcomputers belonging to different schools. The facilitators take the microcomputers to different schools on different days of the week. Gifted/talented students from several surrounding schools come to each school for their programming sessions. The microcomputer course is now organized in the form of 12-week workshops available to all of the gifted/talented elementary students.

The major events in the implementation of special education microcomputers in the Boise City School District are presented in Table 1.

Table 1: Chronology of Implementation   Boise City
                                                School District

Date Month-Year	Event
1978-79 Academic Year	
Fall 1978	Sixth-grade teacher puts terminal in classroom.
1979-80 Academic Year	
Spring 1980	Consulting teacher purchases microcomputer for severely handicapped student with Title VI-B funds.
Spring 1980	Teacher goes to Minnesota computer conference. PTO buys one Bell and Howell "Apple" for elementary school.
1980-81 Academic Year	
Spring 1981	School Board orders district study of microcomputer needs.
Summer 1981	Food services teacher takes microcomputer course and acquires Apple microcomputer.
1981-82 Academic Year	
Fall 1982	Gifted/talented program purchases one Apple microcomputer.
	Special education teacher acquires Apple unit equipped with sound.
Spring 1982	Teacher of speech-impaired students trains with new Apple microcomputer.
	Special education teacher takes

inservice.

1982-83 Academic Year

Fall 1982   Teacher of speech-impaired stu-
                                    dents implements CAI on Apple
                                    Apple microcomputer.

                                    Food services teacher implements
                                    HP-85 microcomputer.

                                    Special education teacher gets
                                    Apple microcomputer in resource
                                    room.

Winter 1982   Gifted/talented program purchases
                                    two Commodore 64 microcomputers.
                                    Teacher for hearing-impaired
                                    students aquires Apple unit.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Of the 49 microcomputers in Boise, the 11 special education microcomputers were the focus of this study. Seven of these are used by handicapped students and are located in six different classroooms, in four schools. Four microcomputers are used to teach computer literacy and programming to gifted/talented elementary students.

The microcomputers are as follows:

- A Bell and Howell "Black Apple", fitted with keyboard guard located in the special education school; used full-time by a severely handicapped student.

- An Apple II-Plus equipped with disk drive and printer located in the food services room of the special education school.

- A Hewlett Packard-85 used during lunch for for an hour or two each day, plus additional practice time for some students.

- An Apple II-Plus with color monitor, disk drive, printer, and joy stick located in a self-contained classroom at the special education school and used most of the time for individualized instruction.

- An Apple II with disk drive and audio cassette tape with interface in a classroom at the elementary school is used with orthopedically handicapped students. The unit is also shared with special education kindergarten students.

- An Apple II-Plus located in a resource room at a junior high school. This microcomputer was temporarily on loan to one family so that they could experiment at home before buying their own micro- computer.

- An Apple II-Plus with disk drive located at a high school is used with hearing im- paired students.

- Two Apple II and two Commodore 64 micro-
  computers belonging to the special edu-
  cation department, and a Bell and Howell
  "Black Apple" belonging to an elementary
  school are used with gifted/talented stu-
  dents.

Management of the Microcomputers

The special education microcomputers are relatively
independent of centralized, district-level coordination.
Nevertheless, the School Board has conducted a series of
"computer needs" studies involving district-wide committees,
outside consultants, and district task forces. These studies
have resulted in: (a) the establishment of computer labs at the
three district high schools; (b) preparation for a pilot ele-
mentary school lab to begin operation in fall 1983; and (c)
plans for a task force to study computer needs at the junior
high school level.

The special education microcomputers, like most of the
microcomputers now in use in the district, were obtained pri-
marily due to efforts of individual teachers. These teachers
have been required to go through normal district channels in
purchasing any equipment with school funds.

Special education is managed by the director of pupil
personnel services. He is also responsible for psychological
services, counseling and records services, social work services,
nursing services, and attendance services. Each of these
departments has its own administrative head.

Special education includes both handicapped students and
gifted/talented students. It is administered by four
supervisors: two who divide the district geographically; one
responsible for all communication disorders services, and one
who is the principal of the special education school.

Under these four supervisors, there are three consulting
teachers who serve as resource persons for the special education
teachers in the schools. The consulting teachers are not
supervisors in any sense. That is, they have no line respon-
sibility. They are each responsible for about one-third of the
district, but their areas are not the same as those of the
supervisors, each consulting teacher is responsible to two or
more of the supervisors. The first two supervisors (above) and
the three consulting teachers all work with teachers of both
handicapped and gifted/talented students.

The technical resource person for microcomputer uses in
special education is one of the three consulting teachers. He

holds this unofficial position because he was the first special educator to become interested in microcomputer uses and took the initiative to learn about them. 'The other two consulting teachers have not become extensively involved in uses of microcomputers, and there is no organized use of microcomputers by the special education teachers in the schools that they serve.

Requests for new equipment are initiated by the teachers and the consulting teacher. These teachers prepare a written rationale for their intended application and submit it to the appropriate supervisor. If it is approved by the supervisor, it is passed on to the director of pupil personnel services and then on to the assistant superintendent for instruction and the director of business. Microcomputer purchases from district funds must be conducted through "bids" from approved vendors. The lowest bid for acceptable equipment is then funded and acquired. This is why, for example, the less expensive Bell and Howell "Black Apple" microcomputers were purchased.

The ultimate management of the microcomputer applications is highly decentralized. Individual teachers who use the microcomputers determine the specific applications in their classrooms. The gifted/talented facilitators (teachers) manage the applications, across schools, for their program. The consulting teacher supports all these teachers--with new software, technical assistance, and transportation of equipment when necessary.

Illustrative Applications

Adaptive Communication Aide for Severely Handicapped Student. This microcomputer was the first unit for special education in the district. It was also the consulting teacher's first microcomputer project, and he has continued to be the driving force for special education applications of microcomputers in the district.

The application itself is very straightforward. A severely handicapped high school student uses the microcomputer to type everything that she wishes to communicate. She was injured in a fall from a horse in July 1978, and she is now quadriplegic with limited use of one arm, limited head control, and no speech. Intellectually, she is quite normal, but until she started using the microcomputer three years ago, communication of any kind was very difficult.

The microcomputer is a Bell and Howell "Black Apple." The only modification is a keyboard guard. This guard is a raised panel that covers the entire keyboard. It has holes over each key so that the student can rest her hand on the guard and use a finger or pencil to press the keys. Without the guard, she does

not have enough muscular control to press the desired keys without hitting other keys as well.

The student attends the special education school regularly and has the use of the microcomputer most of the day. When she is not using it, it is borrowed for other special education uses in the school.

Computer-Assisted-Instruction with Hearing and Speech Impaired Students. A special program for hearing and speech impaired students was implemented three years ago in a classroom at the special education school. The teacher now has seven students, all without speech and all with varying levels of retardation. Most of the students are of junior high school age, and they will stay at this school until they leave the district or reach 21 years old.

The classroom is large with several learning centers sectioned along the walls. One of these centers features an Apple II-Plus microcomputer with a color monitor, disk drive, printer, and joy stick. The equipment is all standard except for a cloth panel that can be attached to the keyboard with Velcro to cover the alphabetic keys. This cover simplifies the tasks for those students who use only the numeric keys and find the other keys to be a distraction.

An autistic student, demonstrates a program that teaches number recognition and matching. A large number appears on the screen and he presses the corresponding key on the microcomputer keyboard. The screen indicates that he is correct and displays a new number. This student concentrates well and gets most of the answers correct. He obviously enjoys what he is doing, and his teacher points out that he will concentrate much longer on the computer exercise than he will on paper and pencil tasks.

Other students demonstrate their skills at other, more difficult tasks. Several are working on the early parts of the Milliken K-6 curricula in math readiness, addition, subtraction, and alphabetization. The teacher brings out computer-generated record sheets that show their progress through increasingly difficult objectives over a period of weeks. She remarks that she is continually surprised at the level of difficulty with which the students can cope and at the length of time that they will concentrate on the microcomputer lessons.

The microcomputer is in use much of the day as one student at a time works on arithmetic, language, or reading. The teacher likes the Milliken programs and the Math Machine (by South West Educational Psychology Services) because they keep track of student progress as well as providing appropriate learning materials.

Microcomputers in the Special Education Food Services
Program. For most of the day the special education food serv-
ices room looks much like any other home economics classroom.
At midday, however, it takes on the appearance of a restaurant
as teachers and staff from the special education school converge
to buy lunch. Virtually all the work of preparing and serving
the hot and cold sandwiches, soups, drinks, and other items is
done by the students. Now, with the aid of two microcomputers,
the students also do much of the work in maintaining inventory
lists, ordering supplies, taking orders for food, and making
change for the customers.

The inventory and shopping lists are prepared on an Apple
II-Plus (with a B&W monitor, disk drive, and printer), using the
Apple Marketing and Personal Shopping System (MAPS). Several of
the students are able to enter the amounts of items used so that
the computer can produce an updated inventory and shopping list.
When new supplies are purchased, the quantities are entered into
the microcomputer, and the microcomputer updates the inventory
again.

The newest addition to the food services room is an HP-85
microcomputer that is used like a cash register in a fast food
store. Using a program written by the teacher, the microcom-
puter first prints out a menu. Then, when the customer makes
his or her selections, a student enters them into the microcom-
puter and a receipt is printed out. Finally, when the customer
pays, the amount tendered is entered by the student and the
microcomputer shows not only the change due to the customer but
also the combination of coins needed to make up the change. In
the past, making change has been too complicated for most of the
students in the class. The teacher opes that, with practice
provided by the microcomputer, some of the students will learn
to make change on their own. In the mean time, the
microcomputer lets the students perform a task that they were
not able to do before.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The special. eduation microcomputers constitute a highly
decentralized system, when viewed in relationship to the
district as a whole. Within special education, one consulting
teacher has acted to develop and support microcomputer applica-
tions in the schools where he provides technical assistance. He
has assumed the role of informal coordinator because of his own
interests and skills; his microcomputer activities are not part
of his formal job description.

Most applications of microcomputers in special education
are specific to particular classrooms and teachers, and they
have been implemented because of the special needs and interests
of the individual teachers involved. There is a high level of .
coordination within the gifted/talented component of special
education, where ten facilitator/teachers have cooperated to
obtain equipment and establish computer literacy and programming
workshops for gifted/talented students. However, this applica-
tion involves only four special education microcomputers at the
present time, and it was initiated by the teachers involved
rather than as a part of a centralized district or special
education project.

Beginning in 1981, the district has been taking steps to
develop microcomputer applications that are coordinated at the
district level. However, the special education applications
have so far been independent of the district-coordinated micro-
computer activities. While some of the special education
microcomputer users have been included in the district planning
activities, they have not played key roles. Both current and
planned district applications are different from those in
special education.

The district director of pupil personnel services, who is
responsible for special education, indicates that he views
microcomputers as only one of many tools for use in special
education, and he has no immediate plans to establish a formal
position of "microcomputer coordinator." Instead, he wants to
see all of the special education consulting teachers and super-
visors become more familiar with microcomputers so that they can
deal with microcomputer applications in the normal course of
their duties.

Special and Regular Education Interaction

There is very little formal collaboration between special
and regular education in the use of microcomputers. In part,

this is because much of the special education microcomputer
activity occurs at the self-contained special education school.
Another factor is differences in the brands of microcomputers
used in special and regular education.

Two microcomputers for special education students are
located in regular schools. In both of these cases, the
individual teachers have had some interaction with the regular
school teachers. In one case, first grade students are brought
into a classroom for the orthopedically handicapped and make
some minimal use of the special education microcomputer. In the
other case, a special education teacher has taken her junior
high school students to the school microcomputer lab. The
teacher in charge of the lab has helped the special education
teacher with software and hardware problems.

This year, the special education teacher has borrowed one
of the lab's microcomputers while the special education micro-
computer has been in use elsewhere.

The gifted/talented program has established a formal
process of cooperation with regular education. The gifted/-
talented program has several microcomputers that they move from
school to school each day to conduct the gifted/talented
workshops on computer literacy and programming. In some schools
where the workshops are held, the gifted/talented staff have
arranged for the use of the microcomputers belonging to the
school, so that there will be enough microcomputers to serve all
the students.

Administrative and Instructional Applications

The division between instructional and administrative uses
of microcoputers has not been an issue in Boise. The district
uses a state-wide time sharing system for administrative pur-
poses, and, while many administrators have studied the possi-
bility of acquiring microcomputers, no actions have yet been
taken.

Within special education, the microcomputers are almost all
used either for computer-assisted-instruction or for teaching
computer literacy and programming. One exception is a Bell and
Howell "Apple" computer that is used on a limited basis for
creating bus lists and software inventories. Special education
personnel would like to expand the management applications but
they do not have the time or resources to develop any major
projects very quickly. Since personnel time (rather than
microcomputer time) has been the limiting factor, no serious
conflicts have occurred in scheduling the microcomputers.

Training

Inservice training has been organized as needed by the
individuals involved with the microcomputers. Some of the
teachers have taken computer courses at Boise State University
or at the University of Idaho in Moscow. Others have had back-
grounds or outside experiences with computers. Much of the
training for the five teachers working with handicapped students
has been provided by the consulting teacher, on an individual,
as-needed basis.

The facilitator/teachers in the gifted/talented program
organized their own training. In 1980-81, they particiapted in
a computer literacy course presented by a district sixth-grade
teacher. The next year, the gifted/talented teacher from one
elementary school provided an additional semester of inservice.
All of them now have a basic understanding of the microcompu-
ters. Several have become skilled computer literacy teachers
and programmers.

With the development of district-wide microcomputer pro-
jects, additional inservice training is becoming available. For
example, in the school that will house the district's pilot lab
for elementary schools, most teachers, including the special
education teachers, have already received some inservice train-
ing. With the advent of the new lab, additional training will
also be provided for teachers from other schools.

Emerging Roles

The role of one of three special education consulting
teachers has enlarged with the growth of microcomputer applica-
tions in special education. He now acts as the technical sup-
port person. This remains an informal position. Since there is
no formal microcomputer system in special education, there is no
administrative role. The same consulting teacher does, however,
assist in coordinating the special education and gifted/talented
applications. Within the program for gifted/talented students,
the planning, purchasing, and coordination are group activities
conducted by the ten facilitator/teachers.

At the district level, the math supervisor for the district
is the head of the computer committee. However, this committee
has not been extensively involved with the special education
uses of microcomputers.

LARAMIE COUNTY SCHOOL DISTRICT NUMBER ONE

Cheyenne, Wyoming

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Cheyenne, the capital of Wyoming, is a low-density, urban
community with a population of about 47,000. It is situated on
flat and slightly rolling terrain, east of the Rocky Mountains,
in Southern Wyoming. The community contains a mix of profes-
sional, clerical, light-industry, and military personnel. Major
employers are the state government, a nearby military base, and
the public schools.

Laramie County School District Number One provides
educational services for all students in Cheyenne and some from
the surrounding areas (including children of personnel at the
nearby military base). The district has 23 elementary schools,
3 high schools, and 3 junior high schools. The current school
enrollment of about 13,000 represents a slight decline (about
1,000) over the past few years. The student population is 79
percent white, 12 percent Hispanic, 7 percent Black, and 1
percent each, Asian and Native American.

Special education in the district is provided by the
Research and Pupil Personnel Services division. The central
administration of this division includes a director and an
executive director. There are variety of support personnel,
including 58 special education teachers, 12 diagnosticians, and
13 school nurses. The division also includes an Educational
Resource Center (E.R.C.) which provides technical assistance,
materials, and training to special education teachers and staff
in the schools. Special education services are provided to
1,486 students.

There are a variety of computers and computer uses in the
school district. District administration has used mainframe
time-sharing and presently uses a Burroughs computer for
payroll, accounting, student records, and other administrative
functions. At one time, computer science courses in the high
school used time-sharing terminals connected to a university
computer and, later, terminals linked to the district's central
computer. Currently, however, instructional applications rely
solely on the microcomputers that have been acquired during the
past six years.

For instructional applications, there are two distinct·
groups of users in the school district. One of these is the
Vocational Education Department. They purchase their own
equipment (microcomputers and minicomputers) and plan and
coordinate its use in business education, vocational education,

and industrial arts. There is a committee established to plan
and supervise the Vocational Education computer applications.

The other group of users consists of all of the other
teachers in the district who are currently using microcomputers.
These teachers use microcomputers for secondary math and
computer science courses, for computer-assisted instruction and
computer literacy at both elementary and secondary levels, and
for individualized instruction in special education. Altogeth-
er, this group currently has about 130 microcomputers: 63 in
high schools, 36 in junior high schools, 26 in elementary
schools, and 5 in district instructional offices.

Overview of Microcomputers Studied

The 130 microcomputers that are used for instructional
purposes have been acquired over a six-year period and include a
variety of different types. There are 66 TRS-80 units, 44 Apple
units, 14 Commodores, and 6 others (Altair, MTI, 3M). Most of
the units (99) are located in junior and senior high schools.
Implementation in secondary schools has been the major focus in
the district, although elementary applications are growing.

Special education programs in all secondary schools have
microcomputers. Two of these--including the first microcomputer
for special education -were funded by the local chapter of the
Association for Children with Learning Disabilities (ACLD). The
remainder were funded with district special education funds.
The Educational Resource Center (E.R.C.), in the district's
Research and Pupil Personnel Services division, has distributed
these units to special education teachers and has provided some
training and technical assistance regarding their use.

The microcomputers are used for a variety of applications,
which include the following:

- Individualized instruction for secondary spe-
  cial education students--learning labs in each
  of the six secondary schools use microcomputers
  to support educational objectives and reinforce
  (with mainstreamed students) curriculum topics
  from regular education programs.

- Each of the secondary schools includes training
  in the use of computers as an elective area. At
  the high schools, this instruction includes
  courses in advanced programming.

- In both elementary and secondary schools, some

teachers are using microcomputers for computer-
assisted instruction in academic areas.

● At one high school, word processing programs on
microcomputers are used to improve students'
composition for English courses, and in journal-
ism classes and projects (e.g., the student
newspaper and yearbook).

● Some secondary schools have microcomputers and
software collections in the school libraries.
Students and teachers can use the equipment to
familiarize themselves with computer operations,
or to learn or practice skills through computer-
assisted instruction.

Chronology

The first microcomputer in the district was an Altair pur-
chased in 1977 with school building funds for the math program
at a high school. A year later this same math program acquired
another Altair, plus a Radio Shack Model II. The high school
math programs had been using time-sharing terminals, connected
initially to a university's mainframe system and, later,
conducted through time-sharing with the district's own
(Burroughs) computer. Beginning in 1979, other secondary
schools also began acquiring microcomputers for math and com-
puter courses. In 1981, one high school cut its link with time-
sharing and batch processing systems, and switched completely to
microcomputers for instructional use. By 1983, all secondary
math/computer programs were relying solely on microcomputers.

The first two microcomputers acquired for
computer-assisted instruction (CAI) and computer literacy --
outside secondary math/computer science courses -- were
purchased with district funds for: 1) a junior high school
teacher (spring 1978) and 2) a fifth-grade elementary teacher
(spring 1979). These teachers were very interested in the
potential instructional value of microcomputers, and also felt
it was important to introduce the students to this new
technology.

The first microcomputer used for instruction in special
education was acquired by a high school resource room teacher in
May 1980. A TRS-80 Model I was purchased with funds provided by
the local chapter of the Association for Children with Learning
Disabilities (ACLD).

All of these early applications of microcomputers in the
district were initiated by teachers, and decisions regarding

implementation and use were highly decentralized. The only
major exception to this was a district-wide planning of
curriculum standards for the high school computer science
courses, which occurred in spring 1979. At that time, however,
most of the computer courses relied heavily on time-sharing and
batch processing computer systems. The focus of the planning
was on programming languages, rather than on equipment (e.g.,
microcomputers).

By the fall of 1980, however, microcomputer implementation
was in place and the district began to take steps to organize
and support it. A coordinator of mathematics and computers was
hired and given the responsibility to direct and assist computer
implementation in the schools. Two committees (one elementary
and one secondary) were formed to plan future instructional uses
of the microcomputers. In spring 1981, the first district-wide
inservice training on microcomputers was offered. Instruction
was provided by the coordinator, and teachers received recerti-
fication credit for their participation.

During the 1981-1982 school year, use of microcomputers
increased, but efforts to coordinate applications were not
successful. For one thing, a great variety of different types
of units were in use in the district. Users felt they benefited
more from interaction with others who used the same equipment,
than from more general inservice training or technical support.
The elementary and secondary planning committees were
reorganized into TRS-80 and Apple "users groups." Additionally,
many schools were developing their own directions in implemen-
tation, usually with the impetus of one or two local teachers
who were enthusiastic and experienced in microcomputer
applications. With Altairs, TRS-80s, and Apples already in use
in the district, one high school, in fall 1981, purchased 12
Commodore PETs for instructional applications. A Title IV-C
experimental project, using word processing to improve student
composition skills, was initiated at one high school.

In the spring of 1982, the Superintendent placed a "freeze"
on additional microcomputer purchases with district funds until
better organization and planning for instructional applications
could be obtained. A centralized district planning committee
for instructional use of microcomputers was established. Indi-
vidual representatives from each school participated in this
committee which met regularly during the fall of 1982. In
February 1983, this group, under the direction of the district
coordinator, submitted a planning report for future use of
microcomputers.

The major events in the implementation of microcomputers in
the Laramie County School District are presented in Table 1.

Table 1:   Chronology of Implementation   Laramie County
                                                 School District

Date
Month-Year   Event
_____

1977-1978 Academic Year

Fall 1977   First microcomputer, Altair, pur-
                                chased for high school math pro-
                                gram.

Spring 1978   First microcomputer in a junior high
                                school,

1978-1979 Academic Year

Fall 1978   Second Altair microcomputer and
                                TRS-80 Model II purchased for high
                                school math program.

Spring 1979   District-wide planning committee for
                                high school computer science programs.

May 1979   First microcomputer in an elementary
                                school.

1979-1980 Academic Year

Fall 1979   Microcomputers introduced in math/com-
                                puter science courses at a second high
                                school.

May 1980   Microcomputer acquired for CAI in spe-
                                cial education at a high school.

1980-1981 Academic Year

Fall 1980   Additional microcomputers acquired for
                                secondary math/computer science cour-
                                ses.

Fall 1980   District hires coordinator of mathema-
                                tics and computer science.

Fall 1980	Two committees (elementary, secondary) formed to plan future instructional uses of computers.
Spring 1981	First district-wide inservice training on computers offered.

1981-1982 Academic Year

Fall 1981	Second microcomputer acquired for special education at a high school.
Fall 1981	Twelve Commodore Pets purchased with basic skills grant for "alternative" high school.
Fall 1981	Title IV-C experimental project initiated using microcomputers as word processors.
Fall 1981	Computer science program at one high school switches from district mainframe computer to microcomputers.
Fall 1981	District-wide planning committees reorganized into "Apple Users" and "TRS-80 Users."
Spring 1982	Cheyenne Teachers Education Association presents Saturday morning workshops on microcomputers.
Spring 1982	District special education administrative offices purchase TRS-80 Model III.
Spring 1982	High school student computer club offers evening computer classes for adults.
Spring 1982	Superintendent places a "freeze" on district-funded microcomputer purchases.
Spring 1982	Centralized district planning committee established.
Summer 1982	Local teachers present a one-day workshop on microcomputers for Wyoming State Department of Education staff.

1982-1983 Academic Year

Fall 1982-Winter 1983   Microcomputers provided by E.R.C to secondary special education programs.

Sept. 1982   Computer coordinators designated at one junior and one senior high school.

Fall 1982   Additional microcomputers purchased for secondary math/computer science programs.

Fall 1982   Microcomputers purchased with PTA and school building funds in elementary schools.

Feb 1983   Comprehensive Planning Report completed by district planning committee and present to the Board of Trustees.

April   District-wide inservice training offered on "advanced uses of microcomputers.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The instructional microcomputers in Laramie County School District Number One are located in all 6 secondary schools and in 17 (of 23) elementary schools. In addition to·the microcomputers in the schools, five units are located in central administrative offices for instructional assistance (software review, special education records, and technical assistance).

In secondary schools, the predominant·use, of microcomputers is for computer literacy,and computer programming courses. All three high schools and two of the junior highs have microcomputer "labs" where numbers of units are located. The other junior high school has five microcomputers that are distributed among math classrooms but can be brought together for group instruction.

Special education programs, in each of the secondary schools also have one or two microcomputers per building. Special education teachers share these units and use them for individualized instruction. The type of equipment, software, and methods used for computer-assisted instruction in secondary special education varies from building to building. In all situations, however, the particular applications are geared to the specific needs and educational objectives of the students. In the elementary schools, some special education teachers are also using microcomputers for individualized instruction with their students. In those cases, however, the microcomputers have not been specifically allocated to the special education teachers, but are available for use by both special and regular education.

In general, microcomputers in the secondary schools are stationary and dedicated for use in the particular instructional program that has acquired them; in math/computer labs, in special education rooms, in libraries, in word processing centers, etc. In elementary schools, where there are markedly fewer microcomputers--only about one per school--they are made available to many teachers and students in each building. In some cases the microcomputers are on carts that can be wheeled between classrooms and storage locations. In one elementary school, three microcomputers are located in a partitioned section of the library. Small groups of students and teachers are scheduled to use these units during each period of the school day.

The extent to which the microcomputers are utilized varies

across the district. Microcomputers in math/computer labs in
the secondary schools are in use almost constantly during the
school day. Microcomputers in secondary special education
classrooms are also used heavily, about 50 percent of the day.
The lowest utilization of microcomputers occurs in elementary
schools, where most implementation has been initiated only in
the last year. In at least one elementary school, use was very
extensive and the three units in a media center were utilized
regularly every day. In other elementary schools, however,
teachers are just beginning to learn how to use the equipment
and use of some microcomputers is limited to a few hours' each
week. Across the district, it was estimated that about 100
teachers and about 2,800 students were making instructional use
of the microcomputers.

Management of the Microcomputers:

During the six years that microcomputers have been in use
in Laramie District, management of the applications has been
highly decentralized. For the most part, individual users,
and/or instructional programs within specific schools, have
determined the type of equipment to be purchased and the use
that would be made of it.

This is true even where a similar purpose is common to
applications across a number of schools. For example, computer
literacy/programming courses and special education programs in
all secondary schools use microcomputers. Nevertheless, in each
school the applications are essentially unique and the equipment
is different. This incompatibility of equipment has been a
disincentive to mutual planning and sharing of resources.

From 1980 to 1982, district efforts to coordinate
microcomputer applications consisted largely of providing
technical assistance, inservice training, and general support to
users. During the past year, however, the Superintendent and
the coordinator of mathematics and computers have taken further
steps to provide a stronger role for central administration in
management of the computers. One example of this is the recent
(1982) policy that all decisions on microcomputer acquisition
with district funds be managed by the coordinator. Another
aspect of this centralized management is the establishment of a
planning committee for instructional use of microcomputers.
This group has produced a three-year plan for instructional use
of microcomputers in the schools.

In addition, some building principals are formalizing the
management of microcomputers in their own schools, by
identifying one key person to coordinate applications across
classes. During the 1982-1983 school year, two school-based

"coordinators" were appointed by principals.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Cheyenne schools, three illustrative applications are described below.

Computer-Assisted Instruction in Junior High School Learning Lab. The special education program at a junior high school has two TRS-80 Model III microcomputers with disk drives and printers. One is located in a self-contained classroom; another is in the learning lab.

Approximately 50 students use the learning lab each day; but no more than 10 at a time. The lab is staffed with two special education teachers and a teacher assistant. The microcomputer is scheduled in half-hour blocks for each student. Specific educational software which reflects individualized educational objective is selected for each student. New students are scheduled for a one-hour introductory lesson on computer operations. There are also posters, on the wall near the microcomputer, that remind students of the steps required to operate the unit.

The educational software is kept in ring-binders and organized by subject area. In addition to curricular drill-and-practice materials (in mathematics, spelling, vocabulary, reading), the teacher also uses word processing software with the students to improve their composition skills. She also has commercial software on typing-training.

When it is time for a student to use the microcomputer, the teacher gives the student a small card identifying the software to be used. The card also indicates the number of times each instructional package should be run. In most cases, the students are required to run each CAI program at least twice--the teacher feels that repetition of the materials is useful.

After using the microcomputer, the student returns this card to the teacher with marks indicating that the lessons were completed. The teacher uses these cards to maintain a record of the CAI that each student has completed.

CAI/Computer Literacy in Elementary School Media Center. The impetus for microcomputers at one elementary school actually came from a local parents group, "Parents That Care" (PTC). They wanted microcomputers in the school and the principal actively supported their initiative. The PTC provided some seed

money towards the purchase of the first unit; district and school funds were used to provide the rest. Three Apple II units with disk drives and one printer were purchased.

The microcomputers were set up on tables in a corner of the school library, creating a "computer nook." The students are scheduled for half-hour periods throughout the day to use the microcomputers. The teacher told us that the microcomputers are treated as "our" program--the school's and the students'--and "everyone is responsible" for them. All users are on an "honor system" and there is usually no direct supervision in the library.

The coordinating teacher for the microcomputers is a second grade teacher. When the school received the computers, she set up a "multiplier effect" inservice and student training program. She individually taught each teacher (19) how to use the microcomputers. Each teacher came to the media center during a free period, along with five students from the teacher's class. These initial students were then required to each train one other student. As each student was trained, they in turn had to train another student, until all (430) students in the elementary school knew how to use the equipment. Now, all teachers use the microcomputers for instructional support with their students and participate in the regular scheduling of students to the computer lab.

CAI/Word Processing for High School English Classes. A Title IV-C experimental project uses microcomputers as word processors to enrich high school students' composition skills. The project started in fall of 1981 and the first year (1981-1982) was a pilot study--with only fifteen students. During the second year, 36 students participated officially along with a number of other students and teachers.

The originator of this "Developing Computer Software to Teach Writing Skills" project was a high school English teacher/department chairperson. During the 1982-1983 school year, he was appointed "computer coordinator" for the school and provides technical assistance to other users. Beginning in fall 1983, half of his time will be devoted to computer applications in the high school.

'The project is very straightforward. Students are trained to use a word processor (Scripsit) to write their compositions for English classes. There are four microcomputers in this program. Each is a TRS-80 Model III with dual disk drives. There are also two letter-quality printers. Three of the micro-computers are in a converted counselor's office; the fourth is in the teacher's office.

Students use the microcomputers during free periods or study hall periods. Students can schedule themselves for use of the computers or can drop by to see if one is available. The teacher reported that the program has been very successful: student use of the microcomputers for word processing is high; definite improvements in composition skills have been evidenced; students are producing more writing now than before using the microcomputers.

An additional effect of the project has been the recent introduction of microcomputers with word processors into the journalism courses at the high school. The English teacher has trained the journalism teachers. Two more TRS-80 Model III units were purchased. The microcomputers are used not only in the journalism courses but also to compose the school's student newspaper.

III.   ORGANIZATIONAL ISSUES

Centralization and Decentralization

The purchase of microcomputers appears to be the most centralized aspect of microcomputer implementation in the district.   Purchase of equipment with district funds requires final approval by the Superintendent. Teachers' requests for microcomputers are first screened by the district's planning committee which includes representatives from each school. Based on the teachers' specified interests and needs, additional microcomputers are purchased and allocated. Once a microcomputer is allocated to a school or teacher, its specific location and use are determined by the principal or teachers within the school. In two schools, computer coordinators have been appointed by the principals.

Microcomputer purchases are not handled by the district's committee if special funding is involved. "Special education microcomputer purchases are coordinated separately by the Educational Resource Center. The microcomputers are allocated to special education classrooms in specific schools. However, once the microcomputers are in the special education classrooms, their scheduling and use is determined by the special education teachers.

Efforts to coordinate the district's microcomputers have included various computer committees established by the coordinator of mathematics and computers. The original computer committee was organized into groups of elementary and secondary teachers to discuss educational applications of the microcomputers. The following year, the committee regrouped into "Apple users" and "TRS-80 users" to facilitate the sharing of resources and software. The most recent committee was organized at the Superintendent's reques in the fall of 1982, to design a three-year plan for microcomputer use in the district. The Superintendent desired more centralization because some microcomputers in the district were not fully used, even though teachers kept requesting more units. Also, he was concerned about the problem of software incompatibility with so many different kinds of hardware in the schools. The committee's plan, completed in February 1983, outlines a purchasing schedule and implementation plan for future microcomputers, with recommendations for hardware types and software, training, and coordination procedures.

The Vocational Education Department has a separate but similar committee for planning and coordination, as the director sees their microcomputer needs as being different. The special

education administration also has some separate coordination efforts through the Educational Resource Center, which has acquired microcomputers for each secondary school's special education department and has a software collection in a central resource library.

Another centralization step supported by the district coordinator and the planning committee is the identification within schools of "resident experts" in microcomputers. These key persons would act as computer coordinators for the staff by providing technical assistance, informal training, new software programs, and other resources. At two schools, computer coordinator positions have been formalized by the principals and time has been allocated to computer responsibilities for these coordinators. Through the computer coordinators at each site, the district's coordinator hopes to manage the district's computer programs more effectively. In addition, communication between schools about microcomputer use is expected to improve.

The district's coordinator has attempted to centralize the district's software. He would like to consolidate all the programs into a master collection with a catalog, but the schools have not yet provided him with their software listings. Presently, individual teachers or departments within each school have separate software collections. School software can be acquired with building funds or classroom supply monies.

The coordinator feels that this difficulty in consolidating the software reflects the basic decentralization of actual microcomputer implementation in each school. It has been his philosophy to simply provide resources and support to interested teachers, and not to control the process. (In 1981, a Title I grant required some teachers to adopt microcomputers and attend training sessions. This resulted in negative feelings and unused equipment.) Basically, the coordinator handles purchase requests, acquires new software, provides some "hands-on" experience to new users, coordinates some training, and organizes computer committees.

Special and Regular Education

No unusual collaboration occurred between special and regular education in the adoption of microcomputers. One of the first microcomputer users in the district was a high school special education teacher. She secured funding in 1980 from the Association for Students with Learning Disabilities (ACLD) to purchase a TRS-80 Model I. Apart from a math/computer science teacher, she was the only other staff person at the high school with a microcomputer and, at that time, the only special education teacher in the district to utilize the new technology.

Based. on her success in using the microcomputer for computer-
assisted-instruction in basic skills with her students, other
teachers soon became interested in microcomputers.

As more. microcomputers were purchased at this high school,
the special education teacher was instrumental in providing
introductory training and securing software on an informal basis
for the new users. The computer science teacher was also a
resource to the other teachers. He provided technical assis-
tance, helped with software, and equipment maintenance. Both
regular and special education teachers continue to rely on these
initial users for training and technical assistance.

In the fall of 1981, the special education teacher worked
with the other teachers and with the district's coordinator to
establish a TRS-80 users group in the district. The purpose of
this group was to informally discuss applications and software
programs, and to share resources. Both regular and special
education teachers in the district participated and no distinc-
tion was made between the two staffs.

The director of pupil personnel services, who is respon-
sible for special education services, decided in 1982, to
provide all secondary special education learning labs with at
least one microcomputer. Several high school special education
teachers had already acquired units and there was expressed
interest among the others for microcomputers. The funding and
purchase of the special education microcomputers was coordinated
by the director of the Educational Resource Center. The E.R.C.
is a district-wide curriculum and resource library for special
education teachers. There are plans for the E.R.C. to extend
its resources and services to include microcomputer use and
special education software programs. However, to date only one
education resource specialist is adequately prepared to provide
training and software. Consequently, special education teachers
still rely, to some degree, on the district coordinator and on
other teachers for assistance. They attend the general training
sessions provided by the district. There has been no inservice
training specifically tailored to special education applica-
tions.

The E.R.C. purchases and allocates microcomputers in spe-
cial education independently from other district purchases.
Management and use of the microcomputers are left up to the
individual special education teachers. At the school level,
collaboration occurs informally between regular and special
education teachers: they exchange software, resources, and
experiences. In two secondary schools, the "computer coordi-
nators" assist special education as well as other teachers with
operating instructions, purchasing software, and maintenance.
This assistance and informal collaboration between teachers has

been important to the utilization of the microcomputers in th
secondary school learning labs.

There is very little use of microcomputers by elementary spec
education teachers. None of the elementary special education
teachers have acquired their own microcomputers. Use of micr
computers by elementary special education students is limited
those schools where interest among the special education staf
leads to shared use of the available equipment.

Administrative and Instructional Applications

The district has not developed plans to use microcompute
for administrative applications. A mainframe system has beer
used for administrative functions. After using the Universit
of Wyoming's mainframe computer on a time-sharing basis for
computer science courses in the high school, the district
decided to purchase its own computer system. The district's
computer (Burroughs) was acquired for central administration
for computer programming courses at the high schools (but for
other instructional purposes). With increasing use of the
computer for administrative functions, secondary programming
courses have transferred completely to reliance on
microcomputers.

There are a few instances in the district where micro-
computers acquired for instructional purposes are also being
used for some administrative tasks. In the elementary school:
the microcomputers are used almost exclusively by the teache:
for, computer-assisted instruction: drill-and-practice,
reinforcement, and skill games. However, a few teachers are
also using the microcomputers for classroom management tasks
such as grade reporting and curriculum inventories. At the
junior high level, the microcomputers are used for computer-
assisted-instruction in computer labs or in special educatio
learning labs. However, one junior high school has a
microcomputer in the office for student records and attendan
and the special education teachers use their microcomputer f
student evaluation data and for scheduling IEP meetings. A
teachers are using word processing with microcomputers to wr
curricula. Microcomputers in the high schools are also used
career counseling and for cataloging short story collections
the high school library.

The history of microcomputer adoption in the district e
plains to some degree the emphasis on instructional usage.
first microcomputers in Cheyenne were acquired, without dist
involvement, by individual teachers using a variety of local
funding sources. Acting independently of each other, these
initial adopters were interested in using microcomputers for

instructional purposes (computer literacy/programming and CAI) in their classrooms. The successful classroom use of the first microcomputers generated interest among other teachers who then requested the district to purchase more microcomputers. In response to these decentralized developments, the Superintendent created the position of coordinator of mathematics and computers. The new role clearly placed microcomputer use within curriculum and instructional areas.

At the same time, central administration began budgeting funds for the purchase of microcomputers for instructional use. It was the coordinator's responsibility, in conjunction with the district's planning committee, to review teachers' requests for microcomputers and, in turn, to coordinate the allocation of units for instructional purposes. Most of the software purchased by the district (both public domain and commercial) has been educational in nature.

Training

The initial adopters of microcomputers in the Cheyenne schools were either self-taught or received training outside of the district. It was not until the position of coordinator of mathematics and computers was created that district-sponsored training was offered to the teachers. Beginning in the fall of 1980, the coordinator has regularly provided some introductory orientation and training in computer operations to individual teachers acquiring new microcomputers. Introductory training also has been provided by the coordinator in after-school sessions at the high school computer labs. The workshops covered computer operating instructions and were oriented towards either TRS-80 or Apple microcomputer users. The coordinator also has offered evening courses in programming tha could be taken by teachers for recertification credit. Initially, the courses were too advanced for the teachers' experience and interest. Now, however, teachers are interested in learning programming and the course will be re-offered in th fall of 1983.

In the spring of 1982, two initial users of microcomputers in the district (a high school computer science teacher and an elementary teacher) offered a series of two four-hour, Saturday morning workshops to 22 teachers. These workshops, which were repeated in the fall, were sponsored by the Cheyenne Teachers Education Association. The workshops included an introduction to computer operations and BASIC programming, and demonstration on debugging programs and adapting software to meet instructional needs. The district now sponsors the workshops four times a year and provides substitute teachers so they can be held during the school week. It is estimated that over 200

teachers have attended at least one of the workshops.

High school students have been teaching a five-week evening course in computer literacy and BASIC programming as a fund-raising event for their computer club. The course, first offered in the spring of 1982, has been heavily subscribed by both teachers and residents in the district. The introductory course has been taught five times and is now followed by a new course in advanced programming.

In fall 1982, a high school English teacher, who initiated an experimental project on using microcomputers to develop students' writing skills, started providing word processing workshops to teachers. The positive response among staff members has resulted in three additional word processing in-service sessions this year.

In addition to these training opportunities, the University of Wyoming offers a semester course in BASIC programming, and the Wyoming State Department of Education in Cheyenne provides state-wide workshops on microcomputer use and educational appli-cations. Another source of training in the district has been the informal assistance provided by teachers to each other in the schools. Teachers active in using microcomputers have served as a resource to other staff on an individual need basis. In one junior high school, a teacher is responsible for ongoing training as part of his allotted time to the school's micro-computer program.

The "resident expert" in microcomputers at an elementary school has taught every teacher, aide, secretary and the principal during her free periods to operate the microcomputers. She also trained five students at each grade level, who in turn each trained more students until everyone in the school was able to utilize the microcomputers.

Emerging Roles

In the fall of 1980, the Superintendent created the posi-tion of coordinator of mathematics and computers as part of his efforts to centralize the district's computer programs. The Superintendent believed that someone was needed to begin deter-mining the district's microcomputer needs and to coordinate the acquisition and allocation of new equipment.

The coordinator divides his time between the district's mathematics programs and managing the microcomputer use in the schools. Part of his main responsibility is the coordination of all microcomputer purchases with district funds. All requests for microcomputers are reviewed by a planning committee and the coordinator, before final purchasing decisions are made. Once

microcomputers are allocated to teachers, the coordinator
provides some introductory training and technical assistance.
He has presented district-wide workshops on computer literacy
and operations, and several evening courses on microcomputer
programming for teachers.

The coordinator has been collecting and reviewing public
domain software which he makes available to the schools. Also,
he purchases and reviews commercial software for a district
master collection. The coordinator has plans to set up a
library of software with a catalogue for the teachers.

In addition, the coordinator has been instrumental in
organizing several committees over the last three years to
assist microcomputer implementation in the district. The first
committee consisted of elementary and secondary groups of
teachers, representing each school, who discussed the possible
use of microcomputers in the schools. Later, committees were
organized of microcomputer users with different hardware types
so they could share software and resources. Presently, the
coordinator chairs a committee of teachers that has developed a
three-year plan for microcomputer purchases and programs in the
district. It is the coordinator's responsibility to insure the
implementation of the plan's guidelines and recommendations.

The only other new roles in the district are those of
computer coordinators in a few schools. Usually, an early
adopter of microcomputers or a computer enthusiast informally
takes on the role by serving as a resource to the other staff.
In two schools, the position has been formalized with time
allocated to computer responsibilities including training,
maintenance, technical assistance, and acquiring new software
programs. The three-year microcomputer plan recommends that
each school designate a key teacher as coordinator with
scheduled time for computer assistance.

COMMACK UNION FREE SCHOOL DISTRICT
Commack, New York

Case Study Report

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I.   SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Commack School District is located in Suffolk County on
Long Island, New York. The district serves a community of ap-
proximately 41,000, with the majority of the residents repre-
senting socio-economic levels ranging from upper-middle to
lower-middle class. The district does not have any industry
within its boundaries, so employment is found in neighboring
areas of Long Island or within New York City.

The current student enrollment in the Commack School
District is 9,200, reflecting a predominiately white ethnic
composition. This student population has declined at both the
elementary and secondary levels. Eleven years earlier, in the
year of the district's highest enrollment, it had a total of
15,200 students and 21 school buildings. The steady decline in
enrollment has resulted in staff layoffs and school closings.
The district is now housed in seven elementary schools, two
junior high schools, and two high schools, with administrative
offices in an old school site.

Approximately 600 students receive special education ser-
vices in the district, from a staff of 35 special education
teachers and 40 teacher assistants. Each of the elementary
schools has a resource room and reading lab to serve special
education students, and five of the seven elementary schools
have a self-contained classroom as part of their special educa-
tion program. At the secondary level, all the schools have a
resource room and self-contained classrooms for their special
education students.

The district makes extensive use of several different com-
puter systems, some directly serving students with special
needs. The district's largest system, two Hewlett-Packard 300
minicomputers with 70 interactive terminals and 21 printers, is
used primarily by special education and remedial students for
drill and practice and problem-solving in reading, language arts
and mathematics. Some of the terminals are used in the high
schools for programming courses and in the guidance offices for
career counseling programs. There are also ten time-sharing
terminals that are part of the BOCES/LIRICS instructional
computer system. These are used by high school students in both
secondary schools for advanced programming and by special
education students in one elementary school for basic skills
instruction.

The district also has 70 microcomputers (55 Commodore PETs,

1 Texas Instrument, 13 Compucolors, and 1 Apple II-Plus), which
are used for a variety of instructional applications with spe-
cial and regular education students. Of these, 57 can be con-
sidered part of the same organizational system: the 55 Commodore
PETs, the 1 Texas Instrument, and the one Apple II-Plus. The 13
Compucolors are a separate system located at the high schools
for computer science courses.

In addition, the district has two Commodore 8032s in the
central office, which are used by the director of student ser-
vices for administrative and management functions.

Overview of Microcomputers Studied

Of the 70 microcomputers in the Commack School District,
this case study focused on the 57 used primarily with special
education and remedial students. Because the district has a
separate computer system for formal compensatory education
(drill and practice and problem-solving) and computer-managed-
instruction, the microcomputers tend to be used more for indi-
vidualized or innovative purposes. Among the applications are:

- In one elementary school resource room, two second-
  grade and five sixth-grade special education students
  are learning to write their own computer programs in
  BASIC.

- Junior high special education and remedial students
  are using Commodore PETs for word processing to de-
  velop their written expression skills. The students
  have used this process to produce several magazines
  of their stories.

- Elementary students are using district-developed
  "early-learning" software that focuses on the basics
  of reading and mathematics. The "early learning"
  programs involve such skills as memory activities,
  problem solving, visual discrimination, likenesses
  and differences, and spatial relationships.

- All math students at the junior high level attend a
  ten-day computer awareness course which includes
  "hands-on" experience in operating the computer and
  an introduction to programming.

- Kindergarten and first-grade students are learning
  LOGO language on a Texas Instrument microcomputer
  located in a resource room.

Chronology

In the fall of 1977, a high school computer teacher and an elementary special education teacher proposed a pilot program to introduce computers to elementary students. Prior to that time, computer use in the Commack school district had been limited to teaching computer science in the high schools.

With Title IV-C funds, Project CAL (Computerized Accelerated Learning) was established at one elementary school. All students in grades K-6 had access to a BOCES/LIRICS computer terminal in a resource room for basic skill instruction. (BOCES/LIRICS is an instructional computer system with on-line, time-sharing service for participating districts in Suffolk County.)

Based on the positive results of the pilot project, the district decided to expand the program to all the elementary schools in the following school year. However, the cost of more time-sharing BOCES/LIRICS terminals was prohibitive, so the district purchased ten Commodore PET microcomputers with Title IV-B funds instead. A microcomputer was placed in each elementary school's resource room. The special education teacher originally involved in the pilot project was responsible for training one staff member at each school in computer operations. Parent volunteers were in turn trained during afternoon workshops to assist in the resource rooms.

The lack of appropriate software prompted the district to develop its own microcomputer programs. During the summer of 1979, the special education teacher developed approximately 80 "developmentally sequenced, multi-sensory" software programs. High school students were then hired to program these to the developed specifications. (The programs are now sold to other districts through a non-profit corporation, COMCAL, established by the district in 1980. The revenues are reinvested into the district's educational programs.)

As Commack's computer activities continued to expand, a part-time district position of computer curriculum specialist was created for the special education teacher in the fall of 1979. In this position, under the direction of the director of student services, she is responsible for developing computer projects, providing staff development, and coordinating the purchase, allocation, and use of equipment. (The special education teacher retained her teaching responsibilities for the rest of the time.)

The computer curriculum specialist offered the first

teacher training session on computer awareness in the spring of, 1980. Presently, five computer courses are available to teachers, including computer awareness, programming, word processing, and computer graphics. In the summer of 1980, the computer curriculum specialist was instrumental in establishing a regional committee of teachers and administrators to develop a comprehensive K-12 computer literacy program.

In the fall of 1980, additional Commodore PET microcomputers were purchased with Title IV-B funds for the resource rooms at the junior and senior high schools. Word processing and programming were implemented for the special education and remedial students served by the resource rooms. At the same time, the district was awarded a state grant, using (SEA) Part B (P.L. 94-142) flow-through and ESEA Chapter 1 funds, to purchase two Hewlett-Packard minicomputers and 74 terminals for a computer assisted instructional system with management capabilities in reading, math, language arts and problem-solving. About 1500 students in grades 1-12 use the terminals for drill and practice and diagnostic analysis of skills. Since the terminals are devoted exclusively to the STRIDE/DOLPHIN program, it allows the microcomputers to be used for applications not requiring recordkeeping of students' performance.

In the academic year 1981-82, more Commodore PET microcomputers were purchased for the elementary schools, with ECIA-Chapter II and PTA funds. The microcomputers were placed on carts to be used in each teacher's classroom on a rotating schedule. Additional computers were purchased with ECIA-Chapter II funds to equip the junior high schools with computer labs, to be used by all math students for a ten-day computer literacy course.

During the same year, programming activities were extended to elementary school resource rooms. A programming course was implemented under Project APT, a Nassau County BOCES Title VI research program, for elementary, gifted handicapped students. It has since expanded to an intermediate, self-contained special education classroom. Instruction is provided by a federally funded computer intern who is a graduate student from a local college. In addition, a multi-year research and curriculum writing study was started, to teach LOGO to primary grade students.

The Huntington/Commack Collaborative Education Software Project was initiated in the 1982-83 school year to review and evaluate commercial software programs. In September 1982, a special session on computer awareness was held for the elementary and secondary principals. Four workshops, each covering one aspect of the computer program, were conducted for the district's administrators. Both inservices were intended to inform those in leadership positions of the district's computer ac-

tivities, and to encourage further involvement and support.

The major events in the implementation of microcomputers in the Commack School District are presented in Table 1.

Table 1: Chronology of Implementation   Commack

Date Month-Year	Event
1977-1978 Academic Year	
Sept. 1978	Project CAL (Computerized Accel- erated Learning) provided a BOCES/ LIRICS computer terminal in one elementary school.
June 1978	Project CAL - N.Y. State Title IV-C mini-grant for software program de- velopment by gifted high school stu- dents under the direction of the special education teacher.
1978-1979 Academic Year	
Sept. 1978	Expansion of Project CAL, with pur- chase of ten Commodore PETs for ele- mentary-level, special education re- source rooms.
June 1979	Software programs coded in BASIC for microcomputers were developed by the special education teacher using dis- trict-paid high school students to program them.
1979-1980 Academic Year	
Sept. 1979	Creation of part-time position of computer curriculum specialist for elementary special education teacher.
March 1980	First teacher training sessions on computer awareness, BASIC program- ming, word processing, and computer graphics (14 hours).
April 1980	Establishment of nonprofit corpora- tion, COMCAL, to sell microcomputer software.

June 1980	Participated in regional K-12 computer education committee to develop comprehensive computer literacy curriculum.

1980-1981 Academic Year

Sept. 1980	Expansion of microcomputers with Title IV-B funds to junior and senior high school resource rooms.
Sept. 1980	Purchase o_ two Hewlett-Packard minicomputers and 70 terminals for computer-managed-instruction.
April 1981	Purchase of printers and disk drives for microcomputers in junior high school resource rooms for word processing. .

1981-1982 Academic Year

Sept. 1981	Project APT: Programming course for elementary gifted handicapped students.
Sept. 1981	Adult education courses offered in programming on microcomputers.
March 1982	Inservice sessions for district administrators on word processing, Big Trak, LOGO, and Hewlett Packard system.

1982-1983 Academic Year

Sept. 1982	District inservice for elementary and secondary principals on computer awareness.
Sept. 1982	Purchase of microcomputers for computer labs in the two junior high schools.
Sept. 1982	Expansion of Project APT to programming course for intermediate, self-contained classroom in special education.

Sept. 1982	Word processing pilot program in one elementary school.
Sept. 1982	Huntington/Commack Collaborative Education Software project established to evaluate commercial programs.

II. FEATURES OF THE MICROCOMPUTERS

troduction

Of the entire array of computers and microcomputers in the
mmack School District, 57 microcomputers are the focus of this
se study. These include the 55 Commodore PET microcomputers,
uipped with either cassette players or disk drives and seven
ablo MX-100 printers. The other two microcomputers are one
xas Instrument and one Apple II-Plus.

Most of the 55 Commodore PETs are located in the resource
oms of all the elementary and secondary schools. In addition,
ch elementary school has several mobile Commodore PETs, loca-
d on carts, that are rotated among all the classrooms on a
e-set schedule. One of the elementary schools has a lab that
ntains three Commodore PETs.

Both junior high schools have computer labs equipped with
ght to ten Commodore PET microcomputers in their math
partments. Two Commodore PETs are located in the district's
ifted/talented program, which is housed at the central ad-
inistration building.

The Texas Instrument unit is located in the elementary com-
ter lab. The Apple II-Plus microcomputer is located in one of
e elementary school resource rooms.

Microcomputer use in the elementary school resource rooms
by special education, compensatory education, and remedial
tudents. The students are sent to the resource rooms by their
lassroom teachers on an individual basis throughout the school
ay, for basic skills, word processing, and programming instruc-
ion. The computers are in constant use, and there is even a
efore-school and after-school schedule in most resource rooms
r additional computer time.

The mobile microcomputers in the elementary schools are
cheduled for one classroom for an entire day, so that each stu-
ent has some access to a microcomputer on a regular basis. All
indergarten students have time each week to learn a primitive
OGO language, Big Trak. The two Commodore PETs in the
istrict's gifted/talented program are utilized on a daily basis
y students learning programming.

The Commodore PETs in the junior high and high school re-
ource rooms are used in the same way as the elementary school
esource rooms' microcomputers, and there is evidence of contin-
ous use. In one junior high resource room, all of the students

are using the microcomputers for word processing and computer
graphics. The computer labs in the junior high schools are uti-
lized by all the math students for a ten-day computer literacy
course.

One of the distinctive features of microcomputer use in the
district is the substantial assistance given to students by oth-
er teachers and specialists--e.g., parent volunteers, teacher
assistants, or the student intern. In all the special education
applications, there was at least one adult working with every
two or three students, talking with the student and reinforcing
the information being presented by the microcomputer. Such
intensive use of human instruction seems to be an important way
of enriching the microcomputer learning experience.

Management of the Microcomputers

The Commack School District has been reducing its staff
over the past few years in response to its declining enrollment.
As this has happened, more general positions, such as the direc-
tor of student services, have emerged and replaced more special-
ized positions. Thus, the director of student services is re-
sponsible for functions related to special education as well as
federal funds, compensatory education, pupil personnel services,
curriculum development, and computer programs. Before the
administrative consolidation, his position had been limited to
being the director of pupil personnel services. The director of
student services reports directly to the Superintendent re-
garding his special education and other activities. He is re-
sponsible, in conjunction with the principals, for supervising
the special education teachers. In addition, the special educa-
tion psychologist, a lead reading teacher, and the computer cur-
riculum specialist all report directly to him.

With regard to the management of the microcomputers, there
are two key positions--the director of student services and the
computer curriculum specialist--who jointly make the decisions
to purchase and locate the microcomputers, and to initiate spe-
cific funding applications. Once the hardware is determined and
sources of funding are secured, the two then get the Superinten-
dent's approval. After the microcomputers are installed, the
computer curriculum specialist, who is responsible for the
development of new computer programs in the district, usually
coordinates the use of the microcomputers and monitors new
applications with the teachers on an informal basis.

There has been some isolated adoption of microcomputers
when a principal, in conjunction with the PTA, has decided to
purchase units for a school. However, because the computer cur-
riculum specialist is so involved in the computer use in the
schools, she is usually consulted on these purchases and is in-
volved in the ensuing implementation.

Illustrative Applications

To provide an idea of how the microcomputers are being used in Commack's schools, two illustrative applications are described below.

Computer Education in Elementary Schools. Kindergarten students in the district are approaching problem-solving tasks by using a robot-like tank (Big Trak) that can be programmed to follow directions. It is part of an early-learning research project to teach space and shape concepts in preparation for learning more abstract concepts with the LOGO language on a microcomputer. Specific learning objectives have been established for this early childhood computer education project and each student is monitored according to the number of attempts needed to master each skill. Students are asked to program the robot to solve simple problems like moving a certain distance or manuevering through a maze.

The kindergarten students proceed to microcomputers and the LOGO language in the first grade. Learning LOGO requires a transfer of learning from the concrete to the abstract by moving from a toy robot to the symbols on the microcomputer screen. First grade students are taught the concepts of space, angles, shapes, and grids using Turtle graphics. The computer activities present situations in which students have to analyze their thinking and develop problem-solving skills.

The Texas Instruments microcomputer in the elementary resource room is used to teach LOGO to the students. Students are sent individually to the resource room during a scheduled time each week for twenty minutes to receive instruction from either the computer intern or a trained parent volunteer. All of the first grade teachers will soon be trained in the curriculum developed for the LOGO program.

Computer Programming and Word Processing. Simple programming and word processing are being taught to special education and remedial students at one of the junior high schools. This application began three years ago when one Commodore PET was delivered to the resource room. Students started by using some typewriters in conjunction with a simple computer typing program to learn the keyboard and gain some facility in operating the computer. The next step involved learning to load and run some of the district-developed software programs in various skill areas. The students used different programs for drill and practice in math facts, spelling, and vocabulary, and for practicing eye-hand coordination and visual discrimination. The students were required to read directions independently and to demonstrate and explain programs to other students.

The microcomputer was used by students individually or in pairs on a rotating schedule. The number of students in the resource room varies at any given time but is usually around ten or twelve. Three special education teachers and one teacher assistant provide constant direction and individual instruction with the microcomputer.

When three additional Commodore PETS, equipped with disk drives and printers, were provided to the resource room, students wanted to do more than utilize the available software. With an added word processing capability, it was decided to produce a magazine containing stories and graphics. Each student planned a graphic design (rock bands, spaceships, names, cartoon characters, etc.) on graph paper that was transferred to the computer screen. Working in pairs, students entered their designs into the computer using a simple editing process. Students used the word processing program to write their stories and essays which they edited and printed for the final product.

Centralization and Decentralization

Any judgement regarding the degree of centralization or decentralization of the microcomputer system must be based on an aggregation of several characteristics: the initial decision to adopt, the decisions to assign and locate the microcomputers, the degree of coordination in using the microcomputers, and the organization of the software resources.

The decision to adopt microcomputers in the district fol-lowed a one-year, pilot project with BOCES/LIRICS system (an on-line, time-sharing terminal instructional system) at an elemen-tary school. The project, funded under Title IV-C, was known as Project CAL (Computer Accelerated Learning), and was aimed at showing the feasibility of using computers for elementary level instruction.

The decision to adopt the initial set of microcomputers seems to have been made at three levels within the district, but with the degree of initiative unclear among the levels. Among the principals, the principal of one elementary school had been encouraging the use of computers, especially in initiating and supporting Project CAL. This initial involvement on the principal's part led to recommendations to the Superintendent and the other principals. At the teaching level, Project CAL had been directed by an elementary special education teacher, and she was instrumental in initiating the use of microcompu-ters. (Later, she took on the role as the district's computer curriculum specialist.) At the district level, the decision to acquire the first set of microcomputers, using Title IV-B funds, had to have been approved by the Superintendent, who had also approved the pilot project.

The first ten microcomputers (Commodore PETs) were each as-signed to one of the elementary schools in the district. Coor-dination of the system was monitored in terms of scheduling and use during the first year by the computer curriculum specialist. Initially, at least one staff member at each school was trained in computer awareness and the operation of the microcomputers. (By now, of course, many of the teachers have had the opportunity to participate in seven-week computer courses on computer awareness and programming.) Beyond the initial train-ing and some intensive consultation where necessary, the coor-dination has been less obtrusive. For instance, there is no single collection of software or any software catalogue except for the list of the district's own developed programs--which, however, have been systematically duplicated for every

microcomputer unit. Finally, maintenance problems have been
rare, so little coordination has been needed.

This pattern of implementation appears to have been fol-
lowed in subsequent purchases of microcomputers in the district.
The potential uses of new computers are first identified by the
computer curriculum specialist for the district, and the appro-
priate hardware is determined and approved in consultation with
the director of student services. In the past, the two have
gotten the Superintendent to apply for funding for the pur-
chases, and simply had the microcomputers delivered to the ap-
propriate schools.

Because decisions to purchase, to locate the microcompu-
ters, and to initiate specific applications all tend to be made
by the computer curriculum specialist and the director of stu-
dent services, one would regard the system as generally being
centralized.

The centralized characterization is reinforced by the func-
tions of these persons with regard to related systems--e.g., the
Hewlett-Packard instructional system and the microcomputers used
at the central office for administrative functions--as well as
other educational technology in the schools. All of these uses
appear to be orchestrated in a manner that points to central
decisionmaking and planning.

However, the system does have certain decentralized fea-
tures. This is mainly due to the fact that the district staff
is lean, and much control over school activities is at the
building level. Thus, active PTAs can and have sponsored the
purchase of new microcomputers; and their use may not necessari-
ly be coordinated by the district. Similarly, the specific uses
by teachers involve considerable discretion, which the district
attempts to promote rather than suppress.

Special and Regular Education Interaction

Microcomputer use began in the district as the result of an
interest by an elementary special education teacher and a prin-
cipal. Because both persons were intensely interested and ori-
ented toward the education of students with special needs, the
original set of ten microcomputers was assigned to the resource
room in each elementary school. Thus, the microcomputer system
in Commack began as a system mainly oriented toward special
education.

However, it should also be noted that the resource rooms
are not limited to special education students. Compensatory ed-
ucation students as well as students needing remedial work are

also assigned to resource rooms. In this sense, the micro-
computer system has never been limited solely to use by special
education students.

Microcomputer utilization continues to be oriented primar-
ily toward special eduation, as does the Hewlett-Packard mini-
computer system (which again is used by special education as
well as compensatory education and remedial students). At the
teaching level, the special education and regular education
staffs tend to be separate, and the special education teachers
have probably dealt more frequently with microcomputers than
have regular education teachers.

However, microcomputers are gradually being used by regular
education students and teachers. The director of student ser-
vices and the computer curriculum specialist (which is a posi-
tion held by the special education teacher originally involved
in microcomputers) have looked at funding sources and potential
applications from both special and regular education points of
view. Similarly, when an application such as word processing
appears to be succesful for special education situations, the
same application is considered for use in regular education.
Thus, as the district has acquired and installed new
microcomputers, it has done so in the interest of both special
and regular education students. In this sense, there has been
an increased integration of special education with regular
education.

During the past year, for instance, sufficient numbers of
microcomputers have finally been installed so that one educa-
tional goal is to have every student able to have some microcom-
puter time during the school year.

Administrative and Instructional Applications

Each set of microcomputers that has been acquired has been
designated for specific uses, not all of them the same. The de-
signations depend upon the prior experiences of the computer
curriculum specialist, who tests new types of instructional ap-
plications each year. When the applications appear successful
in her own school, she recommends them for broader utilization
throughout the district.

The set of applications for the initial purchase of ten
Commodore PETs was related to computer-assisted instruction for
elementary school students. The microcomputers were assigned to
the resource room of each elementary school, and were used for
individualized instruction, ranging from computer awareness to
programming. Later, applications that became prominent with
further purchases included word processing, graphics, computer

awareness for a larger portion of the student body, and the expansion of the original CAI applications at both the elementary and secondary level. It must be noted, however, that the Commodore PET microcomputers are not used for computer-managed instruction, which is carried out on the two Hewlett-Packard minicomputers and their accompanying 70 on-line terminals.

When considerably different applications have emerged, different computers have been acquired. Thus, the initiation of a project teaching LOGO language required the acquisition of a Texas Instruments microcomputer. Where administrative applications have emerged, this same pattern has been followed, and thus the instructional and administrative applications exist on different microcomputer systems. (For the administrative applications, two Commodore 8032s were purchased for use at the central office, for maintaining special education and gifted/talented student enrollment projections, inventories, mailing lists, general word processing, budget development, and personnel records.)

The district made a deliberate decision to separate the instructional and administrative systems. Several reasons were given by the director of student services for such a clear demarcation, including the awareness that:

- in a mixed system, administrative functions gradually displace instructional ones;

- a mixed system creates security problems because students may try to gain access to the administrative data;

- no single type of hardware necessarily serves both the instructional and administrative applications in the most efficient manner.

Other than the purchase of the Commodore 8032 microcomputers, all resources have been allocated toward the acquisition of microcomputers for instructional purposes. There are no administrative applications at the school-building level. Thus all the microcomputers in our case study have been dedicated to instructional uses only.

Training

Initially, when the first set of ten microcomputers was introduced into the elementary schools, one resource staff member was trained in each school. The computer curriculum specialist assigned the microcomputers to each site, along with

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copies of the district's software programs, and provided some
introductory orientation and training in computer operations.
The progress of each resource room's microcomputer use was then
monitored in an informal manner to insure continued support and
smooth implementation.

With the introduction of microcomputers into the secondary
school resource rooms and subsequent expansion into the elemen-
tary schools, the need for staff training increased substan-
tially. As a result, the first inservice course on computer
awareness was offered in the spring of 1980. The course
covered: 1) basic knowledge and operation of the computer,
2) integration of computer use into the curriculum, and 3) in-
troductory programming skills to enable teachers to modify or
create instructional programs.

Later, additional courses were developed and provided to
interested staff in BASIC programming, advanced BASIC program-
ming, word processing, and computer graphics. The courses are
usually taught by the computer curriculum specialist, several
other teachers in the district, and outside computer experts.
All of the courses are offered on a regular basis throughout
each academic year and consist of seven sessions for a total of
14 hours. Approximately 250 teachers, teacher assistants, and
parent volunteers have completed one or more of the courses.

In addition, a workshop on computer awareness was given in
September 1982, to the elementary and secondary principals to
increase their knowledge and active participation in their
schools' computer programs. Principals also have been encour-
aged to attend the district's inservice courses. In the spring
of 1982, four workshops on different microcomputer applications
in the schools were conducted for the district's administrators
to develop their awareness and support.

The Commack School District also offers adult education
classes in programming on microcomputers. Many parents who act
as computer assistants in the resource rooms have taken the
classes. Other parent volunteers have attended the afternoon
workshops on computer awareness at each school as part of the
assistance program.

Emerging Roles

The only new role that has been formally created for the
district is one of computer curriculum specialist, which
occurred in the fall of 1979. The position is held by the ele-
mentary special education teacher who initiated the use of
microcomputers in Commack. Working out of a computer lab in one
of the elementary schools, she coordinates the district-wide

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computer program. Under the guidance of the director of student
services, she is responsible for all the computer programs in
the district and has been instrumental in introducing new compu-
ter projects and applications in the schools.

As computer curriculum specialist, she is involved with
other district administrators in determining computer purchases,
allocations, and possible applications. She coordinates the
actual installation of new microcomputers and provides intro-
ductory training to staff members. For new applications, the
computer curriculum specialist usually monitors the implementa-
tion process on an informal basis for the first year.

In this position, she has organized a project to review and
evaluate software and has been instrumental in the development
of new educational software programs in Commack. In addition,
she was involved in the creation of a regional K-12 Computer
Committee to develop a comprehensive computer education curri-
culum and implementation plan.

Apart from the computer curriculum specialist, there are
computer assistant roles that have emerged to support the com-
puter programs. Each resource room is staffed with assistants
to work with students individually at the microcomputers. Many
parent volunteers have been trained to serve in this capacity in
the resource rooms. High school computer science students have
been bussed to the elementary schools to act as computer
assistants and even as programming instructors for the gifted
students. An internship position has been created for a
graduate student to assist in several schools in teaching pro-
gramming to gifted/talented students.

HOPKINS SCHOOL DISTRICT NUMBER 270
Hopkins, Minnesota

Case Study Report

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The School District

Hopkins School District Number 270 is located in Hopkins, Minnesota, approximately 20 miles west of the metropolitan area of Minneapolis. The school district covers about 30 square miles. There are a wide variety of businesses including merchandising, tourism, and light industry in this suburban area. Several high technology corporations such as Control Data Corporation and Honeywell are located in Hopkins.

The school district serves a residential population of 52,825 from seven municipalities, with a student population of 6,927 (about 97 percent white) during the 1982-1983 academic year. There are six elementary schools, two junior high schools, and one high school. The district offices are located in a former high school complex, which was closed in 1982 due to consolidation, but is now utilized by the city as a community center.

Educational services for the 800 special education students in the district are provided by the special services department. The department offers a full range of special education services, including programs for educable mentally retarded, emotionally disturbed, multiply handicapped, students with speech and language problems, and students with "special learning and behavior problems." Vocational/technical programs are offered to special education students through a teaming arrangement with an adjacent school district. The special services department also provides comprehensive child study services to the community. The child study team in Hopkins consists of the classroom teacher, the building principal, a counselor, a psychologist, a speech and language pathologist, a resource teacher, and other optional building staff members.

The director of special services is responsible for the administration of the special education program. The special education staff consists of a supervisor of special education, special education building chairpersons at the secondary schools, a department lead teacher for the elementary schools, and 31 special education teachers. The special education staff is assisted by 15 counselors, 14 social workers, 6 psychologists, 8 speech and language pathologists, and a variety of other staff, including a preschool screening specialist, an occupational therapist, and an adaptive physical education teacher.

Computers have been used in educational programs in Hopkins since the early 1960's. Initial instructional applications

utilized a district mainframe computer. With the advent of
microcomputers in the late seventies, the district planned and
implemented district-wide use of microcomputers for
instructional and some administrative applications.

Overview of the Microcomputers Studied

There are 120 microcomputers in use in the district. Nine
of these units were purchased with special education funds, but
district policy is that all equipment be utilized by the entire
population and the equipment is not departmentalized. Nine
units are in administrative offices, 47 are in classrooms, and
64 are in media centers. Eighteen units are at the district
central complex, 38 are in the high school, 30 are in the junior
high schools, and 34 are in the elementary schools. Across the
district, the microcomputers are used for a wide variety of
purposes, including:

- computer-assisted instruction (CAI) including drill-
  and-practice, simulations, tutorials, and problem
  solving;

- computer literacy and computer programming;

- business education course (word processing,
  accounting, keyboarding, etc.);

- instructional management;

- administrative applications (teacher gradebook,
  attendance, class scheduling);

- music composition with electronic keyboards in
  elementary music classes; and

- library/media operations.

Much of the software for the microcomputers is produced
locally. Additional software is acquired from the Minnesota
Educational Computer Consortium (MECC), the Total Information
Educational Systems (TIES), and commercial vendors.

Since 1967, Hopkins has worked with 60 other school
districts to provide data processing services though TIES. As
microcomputers have become available in member districts, TIES
has reorganized its services to accommodate the decreasing
mainframe needs and the increasing needs for microcomputer
support.

The school district has also developed a proposal for the
1983-1984 school year to establish "The School of Tommorrow
Today." The plan calls for a demonstration learning cen-
ter/classroom in an elementary school. The purpose of this
center would be to establish a learning environment, incorpora-
ting the latest technological advances in curriculum programs,
instructional methods, and teacher-student interaction skills.

Chronology

Computers were used in the educational program since the
early 1960's. However, microcomputers were not introduced until
1978. In that year, the Hopkins evaluation center purchased a
TRS-80 microcomputer. In November 1978, a technology task force
for the district was established. The committee members were
selected because of their interest in the field, and to
represent a variety of district programs, although not all
curriculm areas or all district school buildings were initially
represented.

The first meeting of the task force was held with similar
committees from two neighboring school districts. At this
meeting, demonstrations were given on several types of computer
hardware. Three microcomputers--Radio Shack TRS-80, Apple II,
and Commodore PET--were available for examination.

At the next meeting of the Hopkins task force, the members
developed a list of instructional and management needs. A third
task force meeing provided the opportunity for members to hear
a report on the implemenation of a Commodore PET microcomputer
in another school district. The committee developed a position
paper that ultimately made the following recommendations:

- that the district curriculum council be responsible
  for final decisions involving the implementation of
  microcomputers and other technologies;

- that a person be made available at the district level
  to assist building personnel in implementation and
  utilization; and

- that a person be appointed in each school building to
  be responsible for the implementation, maintenance,
  and development of technology.

Other recommendations concerned the selection and
distribution of microcomputers and related equipment, as well as
a recommendation that the district continue to be involved in
existing consortiums (TIES, MECC) to share computer programs and

materials.

The task force requested and obtained district money to
purchase 17 Apple II microcomputers in 1979. Since that time,
additional microcomputers have been purchased with building
funds, Title IV-B, Special Projects funds, and money raised by
the parent teacher organizations. The first 17 microcomputers
were placed in a building lounge for the first half of the
school year and, in December 1979, distributed to other schools.

In subsequent years microcomputer use has expanded
throughout the district. In 1980-1981, 34 Apples were added; in
1981-1982, 17 more; and in 1982-1983, 25 Apples, plus 20
additional printers. Currently there are 117 Apple microcom-
puters, 3 Texas Instruments microcomputers, and a wide variety
of peripherals in the district. Most microcomputers are
equipped with disk drives and color monitors. Of these, 103
units are used mostly for instructional applications; 17 for
administrative.

A wide variety of training opportunities have accompanied
the growth of microcomputers in Hopkins. Inservice course
offerings have included: "Advanced Apple II Computer Program-
ming," "Beginning BASIC for the Apple II," "Computer Independent
Study," "Intermediate BASIC Computing," and "Use of the Computer
with Cooperative Learning."

Hopkins has been the site of several innovative projects
advancing the use of microcomputers. CAM (Comprehensive
Achievement Monitoring) an instructional management tool to
monitor student progress, has been used since the early 1970's
and was initially based on a mainframe computer. In 1978 the
district made CAM available for microcomputers.

Project ASSIST, (Automated Special Services and Student
Tracking) was implemented in 1981, with a Title IV-C grant.
This project uses microcomputers to manage the data essential to
various special education reports and records. It also keeps
track of special services personnel and budget information.

In the spring of 1982, Hopkins was selected as a National
Diffusion Network Lighthouse Project. This project allows the
staff to share with other districts, and has been refunded for
the 1983-1984 academic year.

The major events in the history of microcomputer implemen-
tation in the Hopkins School District are presented in Table 1.

Table 1:   Chronology of Implementation   Hopkins School
                                                 District
                                                 Number 270

Date
Month/Year   Event

1978-1979 Academic Year

Fall 1978 -   Evaluation Center purchased one
                                  TRS-80 microcomputer.

Nov. 1978   Technology task force established
                                  to recommend district guidelines
                                  regarding technology implementa-
                                  tion. Orientation for planning
                                  group provided.

Fall 1978   District makes CAM available for
                                  microcomputers.

Dec. 1978   District-sponsored inservice
                                  training on calculators and micro-
                                  computers.

1979-1980 Academic Year

Sept. 1979   Purchased 17 Apple II microcom-
                                  puters with district funds.

Dec. 1979   17 microcomputers distributed to
                                  classrooms and media centers in
                                  the schools.

Dec. 1979   District initiates series of in-
                                  service training courses on BASIC
                                  programming.

Summer 1980   Three positions established:
                                  data processing and dissemination
                                  specialist, programmer analyst
                                  consultant, and instructional
                                  computer consultant.

1980-1981 Academic Year

Fall 1980   Building purchases totaling 34
                                • Apple II microcomputers.

March 1981   Inservice training on "cooperative
                                    learning" with microcomputers.

1981-1982 Academic Year

Fall 1981   Building purchases totaling 17
                                    Apple II microcomputers.

                                    District implements Project
                                    ASSIST, initially funded through
                                    Title IV-C.

Spring 1982   Hopkins School District selected
                                    as National Diffusion Network
                                    Lighthouse Project.

Summer 1982   Part-time position for CAM micro-
                                    computer implementation associate
                                    established.

1982-1983 Academic Year

Fall 1982   Building purchases totaling 25
                                    Apple II-Plus units as well as
                                    20 additional printers.

Jan. 1983   Technology task force reconvened
                                    to review district goals regarding
                                    technology implementation.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

There are currently 117 Apple II microcomputers and three Texas Instruments units in the Hopkins School District. Eighty percent of the microcomputers have color monitors, 20 percent of the microcomputers have dual disk drives, and 20 percent have printers. Additional hardware in the district includes an electronic keyboard for music composition, a voice synthesizer, and a graphics tablet.

There are 34 Apple microcomputers distributed to six elementary schools. The microcomputers are in media centers and can be checked out to individual classrooms. The media specialist at each school is responsible for the equipment and for cataloging the software. The child study secretaries use the microcomputers for ASSIST applications. Three microcomputers are located in elementary school administrative offices.

There are 15 Apple II microcomputers at each of the two junior high schools, placed in classrooms and in the media centers. Most instructional applications use the MECC software. Some students write courseware at teachers' requests as part of their independent study projects.

At the high school, nine Apple II microcomputers are used for upper level math and programming; seven in business education for keyboarding, accounting, and bookkeeping; several in the media center and science classrooms; and two units in the office for budget and accounting work. Daily announcements are assembled on a microcomputer in the office and are made available to students on monitors located throughout the building.

The microcomputers in media centers and classrooms are used almost constantly during the school day, including the lunch periods. The units in the administrative offices are reserved for administrative use and generally not available to students. The microcomputers are available for teachers, parents, and administrators to check out during weekends, holidays, and summer vacation.

There are 17 microcomputers at the district building. Nine of the microcomputers are divided among the following offices: business, special services, food services, community services, building and grounds, and district media center. They are used for one or more of the following applications: budget, accounting, food inventory, meal planning, Project ASSIST, word

processing, energy audit, and media inventory. Eight of the
microcomputers in the evaluation center are used for developing
instructional and administrative software. (The Software
produced at the evaluation center has been purchased by more
than 100 school districts around the country). The
microcomputers are also used for instructional support and
training.

Management of the Microcomputers

Media specialists within each school are responsible for
the implementation and management of the microcomputers. The
district's instructional computer consultant provides training
to media specialists, teachers, and parents. He assists the
media specialists in maintenance and use of computers. He also
coordinates compiliation of appropriate software.

In the spring of 1983, the evaluation center began
receiving all purchase requests (hardware and software) by the
schools. New acquisitions are received at the evaluation center
for inventory and inspection and then sent to the school that
had purchased the equipment. Authority for the allocation of
microcomputers within schools, and for the nature and extent of
applications in schools, is delegated to the building
principals.

Illustrative Applications

To provide an idea of how the microcomputers are being used
in the Hopkins schools, three illustrative applications are
described below.

Special Education Database Management--Project ASSIST. This
administratice application makes it possible to review seniority
dates, to publish staff directories by department or building,
and to review salary and funding sources. Other components
contain student demographic data and educational records.

The primary users of this application are the child study
secretaries in each building, and the special services secretary
at the district office, the director of special services, and
the coordinator of special education. This project involves 11
Apple II microcomputers on a part-time basis, which are located
in media centers or offices of each school. Backup disks for
each file and a 132-column printer for report generation are
also used. Software for Project ASSIST includes three
locally-developed programs and a commercial product, D.B. Master
Data Base Management Software.

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Project ASSIST has enhanced the district's ability to maintain all necessary district, state and federal information. All participants in the project have expressed satisfaction with its implementation and outcome. In particular, the director of special services and the coordinator of special education reported that its major impact has been in reducing the amount of time now required for special education anministrative tasks.

Introductory Computer Programming/LOGO. The instructional computer consultant from the evaluation center and the cooperative learning coordinator are team-teaching with a fifth grade teacher. Her students are learning LOGO in the context of a "cooperative learning model."

The teacher introduces the lesson and uses a student to help demonstrate by playing "turtle." The other students give the turtle/student the correct commands that help him or her walk in a square. The commands are then translated into the special (but similar) language commands that are acceptable in LOGO graphics.

After this demonstration, the class is divided into work groups of four students each, who then implement this lesson on the microcomputers. Specific tasks are assigned to the children. Each student has a responsibility to help the group work effectively and productively. Roles that are delegated include chairperson, recorder, and "encourager." Each group produces a square (or other figure) using the "turtle commands." After each group has completed the task, the students return to their assigned workspaces and another group uses the microcomputer. Each group provides feedback to individual group members as to how well they assumed their assigned roles.

Computer-Assisted Instruction in a Special Education Resource Room. Two teachers in an elementary resource room received a microcomputer during 1980-81, for use with approximately 30 special education students. The microcomputer is an Apple II with a disk drive and printer, and is used primarily for math and language arts instruction. There is Milliken math and language arts, MECC, and Houghton Mifflin Wordwise software available in the room, and additional software available from the media center.

The teachers have decided that students should use the computer "as needed" and have worked out a system of student negotiation for scheduling use. The teachers believe that the negotiation technique encourages socialization in the classroom. Typically, if one student is working on the microcomputer, a student needing the unit must negotiate for a stopping time with the student already using the unit. The second student must then sign up for the amount of time needed to complete his/her

assignment.

Informal schedules are kept for lunch hour use of the microcomputer. Students are also assigned a day on which they can bring a friend in during lunch hour. This "reverse mainstreaming" technique often brings regular education students into the special education classroom.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The microcomputers in the Hopkins School District are characterized by both centralized and decentralized features. Purchasing decisions for both software and hardware are made at the building level. However, the district's evaluation center has emerged as a "regulatory agency," as it must approve all purchases. This provides quality control by the experts employed there and also serves to monitor the technological developments in the district.

Administrative applications, including CAM, MMS, and Project ASSIST, are coordinated at the district level and reports are pooled into a central data base for reporting. Nevertheless, even though administrative applications are coordinated at the district office, the degree of implementation at each school remains a building decision. The same philosophy prevails with instructional applications.

A district-organized technology task force was formed in 1979 to plan and coordinate the initial purchase of 17 micro-computers. In January, 1983, the task force was reconvened to check progress in the district and to see if the original guidelines were still applicable. A new position paper is now being prepared to serve as a blue-print for future developments. As for software, curriculum groups at the building level meet and discuss software needs. These groups consider suggestions from the evaluation center staff, preview materials, and make the final purchase decisions, with approval by the principal.

The district also uses the services of TIES for mainframe computer-supported budget and accounting applications. There has recently been a reorganization of the TIES services to incorporate microcomputer technology and, therefore, conflict between mainframe and microcomputer users has been avoided.

Special and Regular Education

The introduction of microcomputers has not had any effect on the working relationships between special and regular education teachers beyond what any other building-wide project might entail. Good working relationships are reported and special education teachers typically spend as much as one period per day in regular education classrooms where they team-teach and also assist mainstreamed students.

The media specialist in each school has been responsible
for implementing and coordinating the local microcomputers.
Special education teachers' involvement has not differed from
that of regular education teachers. Each classroom has
scheduled times for using the microcomputers, whether the
classrooms are special or regular education.

Several special education classrooms, however, have their
own microcomputers. Arrangements can be made for regular
education students-to schedule use, if this is important to an
individual student's program. The term "reverse mainstreaming"
was used on several occasions to explain the opportunity that a
special education student has to invite a regular education
friend to use the special education computer on a specified day
during the lunch hour.

One special education teacher, who is the cooperative
learning coordinator, demonstrates "cooperative learning models"
to elementary teachers in several schools, in a teaming
arrangement with the district instructional computer consultant.
Together, they present inservice training and make classroom
presentations. They instruct teachers in the use of the micro-
computer for problem-solving activities in which children learn
how to work cooperatively in groups.

The project is sponsored by the federal government
(SEP/DE), and Hopkins is one of three district regional centers
in Minnesota. One regular education teacher commented that the
special education department provided "new blood" and an
innovative spirit to the district.

Administrative and Instructional Applications

Presently, there are 103 microcomputers primarily used for
instructional purposes and 17 primarily for administrative
purposes. An example of the shared use of microcomputers--
between administrative and instructional applications--occurs in
Project ASSIST. For some schools, the district evaluation
center only provided double disk drives for microcomputers
already allocated to the schools' media centers. (Two disk
drives are required for Project ASSIST's administrative
applications.) In these buildings, the child study secretaries
are scheduled to use the available units part of the day for the
Project ASSIST application; during other periods of the day the
equipment remains available for instructional applications. In
each case, the scheduling and extent of administrative uses are
determined by the building principals.

commercial software packages, and the production of catalogs
which are available to staff members with up-to-date information
on materials for classroom use.

Training

There have been 28 district-wide inservice training
programs on nine different computer topics. In addition, the
instructional computer consultant has conducted building-level
training and classroom demonstrations, together with the
cooperative learning model teacher. Adult education classes
have also been available for parents and their children. Summer
school classes also provide microcomputer experiences for
students.

The district provided inservice training to members of the
first technology task force--both prior to and during the time
they served on this committee which led to the first district
purchases of microcomputers in 1979. All staff have been given
the opportunity to receive training. The first microcomputers
in the district were initially placed in teachers' lounges for
half a year. Teachers participating in any of the district
training can receive either a stipend or one "Hopkins Board
Credit" which is added to their salary schedule.

The child study secretaries working with Project ASSIST
meet monthly for training and "trouble-shooting" sessions. They
have also received individual instruction and assistance in
entering child data during the initial implementation of the

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application. There were no indications that microcomputers were being underused or staff were experiencing difficulties that could be attributed to lack of training opportunities.

Emerging Roles

The media specialists in each school are responsible for implementing the microcomputers. In at least one elementary school, the media specialist is requesting a computer lab aide because the program has grown beyond what she and her present staff can handle without sacrificing other learning programs. The computer lab aide would be a full-time position with responsibilities for coordinating daily activities in the lab. This would include acquisition and maintenance of both hardware and software.

Presently, the district has three full-time and one part-time, district-level computer support positions. Three positions were established in the summer of 1980:

1. Data processing and dissemination specialist-- responsibilities include implementation and oper- ation of the TIES management information and in- struction systems, as well as coordination and development of management applications using the microcomputers.

2. Programmer analyst consultant--responsibilities include development of microcomputer software for both instructional and management applications.

3. Instructional computer consultant--responsibilities include providing inservice training sessions for teachers, media specialists, and parents, assisting media specialists in the maintenance and use of the microcomputers, coordinating compilations of ap- propriate software; and, with the programmer, identi- fying software needs. He also assists in the review and revision of the district's computer curriculum.

The fourth position, was established in the summer of 1982:

4. CAM microcomputer implementation associate--this is a part-time position. District responsibilities include coordination of junior high level CAM use and test score processing; assistance in classroom implementa- tion of microcomputers, particularly at the junior high level. Additional assignments included training and the development of materials.

MINUTEMAN REGIONAL VOCATIONAL TECHNICAL SCHOOL DISTRICT
Lexington, Massachusetts

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Minuteman Regional Vocational Technical School District is
a one-building (secondary school) district, established in 1975
by agreement of 16 neighboring towns. The school is located on
65 acres of woods and fields in Lexington and Lincoln, ten miles
west of Boston. Admission to the school is open to any student
within its member towns and serves as an option to the general
local high schools.

Currently, 1252 students attend grades 9-12, earning a high
school diploma and a technical certificate in one of 25 occupa-
tional areas. The school program operates on a "week about"
schedule, in which one full week is spent in academic subjects
and the following week in a lab or shop. Thus, academic and
vocational weeks are alternated throughout the school year.

Special education services are provided to 450 of these
students. Such students are admitted to the school if they pos-
sess pre-vocational academic skills and can function in voca-
tional training. The special education students are assigned to
a resource teacher for educational support and guidance.

The special education program has a director of special
education services who reports directly to the Superintendent.
Within the special education division are ten resource teachers,
a school psychologist, a social worker, a speech therapist, an
occupational therapist, and a job placement counselor.

The vocational-technical programs are organized into nine
clusters: building trades, commercial services, electronics,
graphics, health services, metal fabrication, power mechanics,
distributive education/child care, and technology. Each cluster
represents several departments focusing on a particular trade or
skill area, with required courses for each grade level. Stu-
dents gain practical experience in their vocational area through
the shops and services operated by the school for the public,
such as a restaurant, bakery, beauty salon, service station,
child care center, and landscaping service. The academic areas
covered are English, mathematics, science, social studies, busi-
ness, language, physical education, and a few electives.

In many of the academic areas as well as the vocational-
technical shops, microcomputers and on-line terminals can be
seen in use by teachers and students. Minuteman has a total of
27 microcomputers, of which 22 are Apple II-Plus units and 5 are
Zenith Heathkit models. In addition, the school has three Digi-

tal PDP-11 minicomputers with terminals for both administrative and instructional functions.

Overview of Microcomputers Studied

Of Minuteman's 22 Apple II-Plus microcomputers, 15 are located in offices or individual classrooms and 7 are in a microcomputer center in the library. The microcomputers are used for a wide variety of purposes, mostly instructional rather than administrative, with over 100 pieces of software integrated into the curriculum. Examples of microcomputer use are:

- In science, microcomputer programs are used for tutorial instruction in chemistry, biology, and physics. Students in basic science receive reading and spelling instruction related to their coursework on the microcomputer.

- Electronics students learn to write BASIC and Pascal programs on the microcomputer, and also receive CAI in math. Some students are learning to use Data Base Management software, while others create games using graphics.

- The microcomputer center provides basic skill instruction to any student in areas such as math, spelling, grammar, reading, and social studies. The microcomputers are also used to train all freshman students in computer use and some senior students in basic programming.

- The culinary arts department uses a microcomputer to operate a daily, shop-inventory-control program for the student-run bakery.

- A joint vocational shops project, "Super Insulated House" is underway, combining the student expertise of the instrumentation department in using the microcomputers for environmental monitoring and control and the skills of the building trades department for construction.

In addition, the school's staff developed microcomputer-based lessons in spelling, vocabulary, literature, and history, to assist students in their academic courses.

Administrative uses of the microcomputer include:

- capital inventory control for each department;

- staff attendance records;

- student test data records; and

- some word processing.

 Finally, the Superintendent uses his microcomputer for
inancial planning and simulations for contract negotiations.
ie microcomputer also provides data and graphics for the Super-
itendent's work with public hearings and finance committees.

ironology

It was the Superintendent who first brought the idea of
icrocomputer use into the school in the beginning of 1980. He
iewed the new technology as an invaluable teaching tool that
successfully combined patience with interactive learning." The
iterest of other teachers was solicited through a note posted
y the Superintendent. Within several weeks, a committee of
taff members was formed to investigate the use of microcompu-
ers at other schools and to make recommendations for purchasing
ardware.

By the late fall of 1980, nine Apple II-Plus microcomputers
nd software had been purchased, primarily with Occupational
ducation Entitlement funds (P.L. 94-482), and 60 staff members
ompleted inservice training on microcomputer operations. The
osition of microcomputer master teacher was created by the
uperintendent to act as a resource to the new users. In addi-
ion, several teachers were given the opportunity to develop
heir own programs over the summer.

The first microcomputers were allocated to the staff mem-
ers who had shown the most interest and were likely to have
uccess with implementation. However, the innovation was not
andated by the Superintendent, nor were any departments pres-
ured to adopt microcomputers. In distributing the first units,
he Superintendent also favored both decentralized and central-
zed approaches. He wanted students to experience microcompu-
ers in the context of their vocational or technical area and
ot just in a center or in a reading or math department. As a
esult, the units in the microcomputer center are considered the
entralized part of the microcomputer system, and the units in
he individual shops and classrooms represent the decentralized
art.

In September of 1981, the Superintendent, in consu
with the microcomputer master teacher, purchased nine a
Apple II-Plus microcomputers. The microcomputer center
to accommodate seven units, and a teacher was assigned
tion of microcomputer specialist to manage the center's
ties. The school's software collection, purchased with
funds, was indexed and catalogued for a printed "Microc
Program Guide." Additional inservice training was prov
the microcomputer master teacher, to meet the growing i
and needs of the staff.

Decisions on the distribution of the new units aga
made on the basis of a teacher demonstrating an ability
the machine for either instructional or administrative
A written plan for use is considered inadequate; the ac
demonstration of need consists of running programs in 1
source center, writing new software, or exhibiting new
tions for others. Insufficient use of a unit is ground
having a microcomputer removed, which has occurred once
past. The Superintendent's attitude and involvement cc
to be one of "I will provide the means to support the 1
microcomputers, if you prove how to make use of them."

The major events in the implementation of microcor
Minuteman Regional Vocational Technical School are pres
Table 1.

Table 1: Chronology of Implementation ζ Minuteman
                                                           School
                                                           District

Date Month-Year	Event
1979-1980 Academic Year	
Dec. 1979	Superintendent saw microcomputers on a visit to California.
Jan. 1980	Committee of interested persons formed to recommend hardware.
June 1980	Purchased one TRS-80 and one Apple II-Plus, and software.
1980-1981 Academic Year	
Sept. 1980	Microcomputer duties allocated to one teacher.
Oct. 1980	First teacher training offered (15 hours).
Nov. 1980	Purchased nine Apple II-Plus and two printers; designed and built work stations.
April 1981	Purchased one Apple II-Plus.
June 1981	Five teachers paid over summer to develop software programs.
1981-1982 Academic Year	
Sept. 1981	Half time position of micro-computer master teacher created.
Sept. 1981	Purchased nine Apple II-Plus units and printers.
Sept. 1981	Set up microcomputer center in I.R.C. with four Apples and microcomputer specialist.

Nov. 1981   Printed "Microcomputer Guide."

1982-1983 Academic Year

Sept. 1982   Purchased one Apple II-Plus
                                   and upgraded all microcomputers
                                   to 64K.

Sept. 1982   Formalized computer orientation
                                   program for all freshmen.

Sept. 1982   Purchased Corvus hard disk drive.

N . 1982   Purchased Cavri system and two
                                   video cassettes.

Nov. 1982   Formed micro/mini computer co-
                                   ordination committee.

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II. FEATURES OF THE MICROCOMPUTERS

Introduction

Presently, there are 22 Apple II-Plus microcomputers in the
school. Most of the units have color monitors, and several have
double disk drives. There are eight dot matrix printers and one
printer of letter quality. A few of the microcomputers are
equipped with either a graphic drawing tablet, a light pen, or
paddles for special applications.

The school has recently acquired a Corvus hard disk drive
for a future software project, as well as a Cavri system inter--
active, video-cassette display.

Five vocational areas--culinary arts, machine shop, carpen-
try, distributive education, and instrumentation--each have a
microcomputer located in their work space. The English depart-
ment has one unit placed in a small workroom. In the science
department, one microcomputer is moved around to different
classrooms. There is one microcomputer in the developmental
math lab. The guidance office has one unit, and the Superinten-
dent has a unit in his office. The microcomputer office, which
also functions as a resource room, has three of the microcompu-
ter units and one printer. Seven of the units and two printers
are in the microcomputer center, which is a section of the
library/media center, and to which teachers can send their stu-
dents for microcomputer use during class time.

Regarding the level of use, only estimates exist. It is
believed that 80 of the 130 vocational and academic teachers use
the microcomputers on a regular basis. Of the ten resource
teachers (special education), six are said to use the microcom-
puters with their students in the microcomputer office or cen--
ter. Among district personnel, the Superintendent is the only
user, and none of the school administrators use microcomputers
in their work.

According to the microcomputer master teacher, approxi-
mately half of the students (about 600) use the microcomputers
on a regular basis in connection with their shop skills or
academic learning. It is estimated that at least 50 percent
(300) of these users are special education students. Further-
more, all freshmen students are given introductory training in
computer literacy.

In terms of use, the microcomputer center, for example,
averages 70 or more students per day. With its seven microcom-
puters, the center serves students from all the resource rooms

in addition to the overflow from several departments, including:
math, carpentry, English, and electronics. The microcomputer
specialist in charge says that it is rare to have a free micro-
computer in the center during any period in a given day. The
microcomputer in the developmental math lab is used by 140 spe-
cial education students for 40 minutes once a week. Each
department with a microcomputer has a similar schedule that
suggests constant use.

Management of the Microcomputers

The Superintendent makes all final decisions about micro-
computer purchases and budgets, with approval from the school
board. These purchasing decisions are made in conjunction with
the microcomputer master teacher, who prepares the appropriate
estimates based on his experience with the district's needs.
This master teacher is part of the special education staff, and
thus has no formal organizational relationship to the vocationa.
education staff. However, the master teacher acts in an infor-
mal manner to assure that all of the district's needs are satis-
fied.

Nevertheless, the lack of formal coordination means that
other hardware decisions can be made independently of the micro-
computer master teacher. This occurred recently when the voca-
tional education staff acquired five Heathkit microcomputers fo:
its electronics "cluster," without consulting the master teach-
er, but with the Superintendent's final approval. In summary,
the master teacher reviews most purchases and coordinates the
use of the Apple microcomputers, but the other microcomputers
fall outside of his responsibilities.

Microcomputer software decisions are made in a different
manner. The software purchases are made from existing library
and departmental budgets for materials. Individual teachers ma
suggest software to be purchased, and these suggestions may the
be reviewed by the resource center teacher, by the various
departments, or by the microcomputer master teacher before a
decision is made to purchase.

Maintenance decisions are made by the Superintendent and
the microcomputer master teacher. In mid 1982-1983, the main-
tenance contract was discontinued (due to high cost), and the
master teacher now personally performs any necessary mainten-
ance.

Illustrative Applications

To provide an idea of how the microcomputers are being use

in Minuteman, three illustrative applications are described below.

Individualized Instruction--Special Education. In this application, three students work at a time in the microcomputer office, which also serves as a resource room for special education students.

Along two sides of the small room are three microcomputers with disk drives and one printer. A metal file cabinet contains a selection of software. One student may work on a math program of word problems that uses a game-like format. The emphasis is on whole-number operations as well as reading skills. The teacher indicates that the program is typical of most of the math drill-and-practice software used in building basic skills. Another student may have recently become interested in microcomputers and is spending his time learning the basic elements of programming. These students are part of a program for special education students that provides individualized instruction on microcomputers, with an additional emphasis on computer literacy. Students are selected for the program based on their resource teachers' recommendation and the learning objectives contained in their Individual Education Plans (IEPs.). The program is taught by the microcomputer master teacher who also acts as a resource teacher for special education students.

The microcomputer master teacher says that at the beginning of his course none of the students could even operate a microcomputer. After he works with each of the 20 to 30 students for approximately 40 minutes (for eight weeks), the students can use "canned" software independently, and most of them can write simple programs. In accordance with the students IEP's, they use drill-and-practice programs, strategic games, and simulations to help develop academic skills, visual perception, and decision-making strategies.

Computer-Assisted Instruction in Science. In this application, each planet, one by one, is slowly drawn on the screen in a colorful display before the student. The orbits of the planets, the orbits of comets, and the planets' sizes in relation to the others also are brilliantly animated. This particular program, by Synergistic Software, is actually a mini-movie about the solar system, in which the student is given information on individual planets and their moons, about comets and asteroids, and other illustrations of complex orbital relationships.

Students usually work individually at the microcomputer with a program that corresponds to the curriculum material presented in class. The teachers first use this program as a demonstration to the entire class. The science department's

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single microcomputer is on wheels, and can be moved from one
classroom to the next. It is used at the front of the room for
the entire classroom and moved into a quiet corner for indivi-
dual use. Only the interested students continue using the pro-
gram, once demonstrated, for both practice and reinforcement.
The science teacher is adamant about no one being forced to use
the microcomputer. However, some students who are absent or
behind in their work are urged to use it.

The science teacher says that the microcomputer is popular
with most of the students and can be found in use every day in
the basic science class for special education students. Fiftee
students attend the science class for a double period, so each
student can use the microcomputer at least once a week for
approximately 20 minutes.

Record Keeping System (C.M.I.). In this application, an
English teacher, interested in the administrative uses of the
microcomputer, has developed a record keeping system for the
entire department. With the microcomputer master teacher's
assistance, an existing computer program (P.F.S.) was adapted t
code in various test scores pertinent to the curriculum.

The English teacher was responsible for the initial data
entry on all the students in the fall of 1982. Once the system
was established, she taught the other four English teachers how
to enter and retrieve information. The actual records are
utilized in a number of ways. Teachers can enter student iden-
tification numbers and receive a listing of each student's test
scores and grades. Lists of students who have completed compe-
tency requirements can be searched and printed. Students who
lack a specific skill or need certain courses can also be iden-
tified in the system.

This system replaces manual files on each student, kept by
different teachers, that were not coordinated and that demanded
unnecessary duplication. It is the first attempt at maintainir
a central information file on testing in the school and is ex-
pected to be adopted by the math department next year.

Once a year, the records are printed, with the data disks
being updated throughout the school year. The printing has
created some problems because the English department's microcor
puter is not equipped with a printer and time has to be sche-
duled on the printers in the microcomputer center and office.
It is expected that a printer will soon be purchased because it
is a major part of the application.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The microcomputers in Minuteman exemplify two different
issues regarding centralization and decentralization. First,
within the microcomputer system, there has been a deliberate
attempt to mix centralized and decentralized patterns of leader-
ship. On the one hand, the Superintendent and microcomputer
master teacher have exercised strong, central control in deter-
mining the microcomputer acquisition patterns. On the other
hand, teachers do not simply receive microcomputers for their
classrooms, but must first demonstrate their ability to use and
integrate the microcomputers in their classroom plans. Similar-
ly, some microcomputers are located in centralized places (e.g.,
the media center), but other microcomputers are decentralized
and located in individual classrooms.

Second, the centralization and decentralization issue is
relevant outside of the microcomputer system. Thus, in addition
to the 22 Apple II-Plus microcomputers, the district's computer
center (an administrative unit) has three Digital PDP-11 mini-
computers. These are replacements for two minicomputers that
had been in operation through 1981-1982. Terminals to the mini-
computer system are located in the data processing department
(an instructional unit) and in the special education, guidance,
nurse and dean's offices, serving three major groups of func-
tions:

- student use: students in the data processing
  department of the electronics cluster have full
  use of one minicomputer, in conjunction with
  their computer lab (for programming and tech-
  nician training);

- student information: all of the district's
  attendance, grade reports, warning lists,
  student medical information, student informa-
  tion system, special education student data,
  special education quarterly reports, and class
  scheduling are done by the minicomputers; and

- administration: the payroll, accounts pay-
  able, budget, and related records (including
  service to the Town of Lincoln) are done by
  the minicomputers.

These large and diverse functions have created constant overloading of the minicomputer system, especially because it relies on disk drives of limited capacity (RLO-2's), and as a result the system has frequent down-time. This problem was not as severe in previous years, because the disk drives in the older system had greater capacity.

The problem of down-time, coupled with tight schedules for access time, have led some minicomputer users to begin developing a preference for microcomputers. For example, the guidance office now uses a microcomputer in addition to the minicomputer terminal, for easier and more flexible management of certain student data and attendance records.

Originally, the minicomputer staff in the computer center had little or nothing to do with the microcomputer system. The microcomputer master teacher noted that, "the computer center along with the data processing department have realized, but only in the last few months, that the microcomputers are a powe to be used." Also, this year, some need to coordinate has emerged over the acquisition of new equipment, such as a printe that needed to be compatible with both systems. Such needs hav resulted in some initial collaborative efforts--e.g., the micro computer master teacher and computer center director recently formed a "coordinating committee."

Special and Regular Education Interaction

Minuteman is a vocational-technical school and there is relatively little distinction between the special and regular education services. Special education students are mainstreame into the entire program.

However, every special education student is assigned to a resource teacher for at least one academic period a day. More time is spent in the resource room, depending on a student's skill levels and ability to take the regular academic subjects. Special education students with poor reading and math skills ar assigned to the developmental labs for remedial work. Overall, these distinctions have nevertheless not led to any clear dif- ferences regarding the use of microcomputers for special educa- tion as opposed to vocational education.

One characteristic worth reiterating, however, is that the microcomputers have largely been purchased with non-special edu cation (i.e., Occupational Education) funds.

Administrative and Instructional Applications

This is not a major issue, even though a few administrative
applications exist. In general, the microcomputers are dedica-
ted to instructional applications, with the administrative uses
having only recently emerged. The single major exception is the
one microcomputer assigned to the Superintendent, who uses it
for administrative purposes. (The dominance of the instruction-
al applications was one reason for selecting this site in the
first place.)

Training

The first microcomputer inservice training took place in
the fall of 1980, after the school's first purchase of two
microcomputers. The course was open to all staff members and
ran for two hours, once a week after school, for a period of 15
weeks. Under the tutelage of the Superintendent and with
assistance from the microcomputer master teacher and the hard-
ware supplier, 60 teachers learned the rudiments of microcompu-
ter use. The course covered system operation, evaluation and
selection of software, and lesson development (using Apple Pilot
and Aristotle's Apple).

As an extension of the training, six of the most interested
and proficient inservice graduates were paid during the summer
of 1981 to develop instructional software in their academic or
trade areas. These efforts resulted in a vocational aptitude
evaluation package for the guidance office, computer-assisted-
instruction programs for the distributive education and culinary
arts department, and software on grammar and sentence construc-
tion for the English students.

Training currently takes place on a regular basis through
mini-courses which are conducted every five weeks after school
for two-hour sessions. Each course is a basic introduction of
the use of microcomputers and the use to instructional and
administrative applications. Fifty staff members completed the
two courses offered in the fall of 1982.

The master teacher's microcomputer office is used for
training on a continual, informal basis. Teachers request time
with the master teacher during free periods or after school, to
learn anything from simple computer operations to basic pro-
gramming.

Emerging Roles

To assist the initiation of microcomputer use in the district, the Superintendent created two new roles in the fall of 1981.

First, the Superintendent assigned one teacher the responsibility of being the "microcomputer master teacher". Previously a resource teacher in the developmental math lab, the master teacher now divides his responsibilities between his special education students and coordinating the microcomputer activitie in the school. This master teacher is responsible for providin inservice training, maintaining the equipment, and serving as a continuing resource to the staff members and students.

Second, a staff person in the media center/library became the "microcomputer specialist" for the microcomputer center. The main responsibilities of the microcomputer specialist include scheduling and managing the use of the center's microcomputers and maintaining the district's software library. The microcomputer specialist also provides general computer literac as well as independent computer projects to any interested student. In addition to his regular school hour functions, the microcomputer specialist also teaches adult education evening classes in computer literacy and a microcomputer summer camp at the school.

LINDEN SCHOOL DISTRICT
Linden, Michigan

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Linden School District is one of 21 independent school systems in Genesee County, Michigan. Linden is a small, rural district with a student population of 2,479 for the 1982-1983 academic year. The district occupies five buildings: a district building, two elementary schools (one building for grades 1-3 and one building for grades K, 4 and 5), a middle school for grades 6-8, and a high school for grades 9-12. In Linden, 99 percent of the students are white. The residential population numbers 11,744 persons.

Since 1981, the district has experienced slowly declining enrollment and a sharp decrease in public funds for education. The unemployment rate in the area is high (22 percent) due to layoffs in the automobile industry. These conditions have led to the consolidation of two schools, as well as reductions in "enrichment" courses (music, foreign languages, student news-papers, drama, etc.), athletic programs, guidance services, and teaching and non-teaching positions. At the present time there are no district-subsidized, extracurricular activities. In 1981, the school day was reduced by one hour.

There are 107 students served by the special education pro-gram district-wide. The special education supervisor is respon-sible for three school districts; he spends about one third of his time in Linden. The full-time staff consists of 11 special education teachers and 4 teacher aides. Three of the teachers are designated as teacher consultants; they provide assistance to mainstreamed special education students and act as internal consultants to the regular education teachers. All faculty mem-bers are responsible for maintenance of required special educa-tion reports on each assigned student. The district contracts for special student evaluations (psychological, etc.) with diag-nosticians employed by a neighboring district. Special educa-tion services are provided in both resource and self-contained classrooms in all buildings.

Microcomputers were introduced in Linden by the special ed-ucation program in 1979. Currently there are 14 microcomputers used for special education. In addition to these, the district has implemented other computer applications: a regular educa-tion microcomputer lab at the high school; access to a county-maintained mainframe computer for a career guidance program and for a variety of administrative functions (master scheduling, grade reporting, student records and payroll); and a minicompu-ter in the district office. Additional microcomputers at the

igh school are used for upper level math and computer literacy
istruction during school hours and for adult education computer
iteracy in the evening. The use of this technology is continu-
ig to expand, with the acquisition of hardware and software
ccurring as funds become available.

verview of Microcomputers Studied

At the time of the case study (March 1983) there were 23
icrocomputers in the district. Our investigation focused on
he 14 used for instructional applications with special educa-
ion students. These 14 microcomputers are located in special
ducation classrooms in e- ch of the four school buildings and
re only used for instru- .on of special education students.

- The two elementary schools each have one
  tape-driven Commodore PET, on which
  locally developed software in math and
  language arts is used.

- The middle school houses six Commodore
  PET and two Apple microcomputers dis-
  tributed among four classrooms. The Apple
  II-Plus units are complete with color
  monitors, disk drives, and dot-matrix
  printers

- Each of the two special education
  classrooms at the high school contains
  two Commodore PETs, a printer, and disk
  drive. The microcomputers are used
  for drill-and-practice in the math and
  language arts curriculum.

Chronology

In the fall of 1979, two special education teachers at the
middle school decided it would be useful to acquire microcompu-
ters for the instruction of special education students. With no
district funds available, and with approval from the special
education supervisor, the teachers wrote a proposal and justi-
fication to use special education (flow-through Part B) funds to
purchase one microcomputer. This request was granted. The
teachers then approached the student council for money from fund
raisers to purchase a second microcomputer and were also granted
the funds. The two sources of funds were combined and used to
acquire three microcomputers through a special "three-for-two"
offer available on Commodore PETs.

The three microcomputers were distributed upon arrival to individual special education classrooms at the middle school. Because this was the first microcomputer implementation in the district, the teachers had to learn on their own how to incorporate this new technology into their instructional programs.

The expansion of the special education system has been accomplished primarily through the further allocation of special education flow-through funds for additional hardware and software. In the fall of 1980, three additional Commodores were purchased and in the fall of 1981, six Commodore PETs were acquired and distributed throughout the district. In the fall of 1982, a complete Apple II-Plus unit was added to the system. An additional Apple II-Plus was ordered in February 1983, using money raised by the special education faculty through the sale of bagels before school and during lunch. "Bagel money" has been used since 1980 to acquire peripheral equipment (floppy disks, printers, disk-drives) for the system.

Other peripheral equipment has been purchased with a 1981 federal grant which supported a research project entitled "A Model Program in Microcomputer Utilization with Handicapped Students." The grant application was written by one of the teachers originally involved in acquiring microcomputers. The grant money was used for additional disk drives, printers, and commercially produced software for math instruction. The project also provided for the development of teacher manuals on the use of the microcomputer, and for the development of a math curriculum software package. This project was conducted jointly with two neighboring school districts.

The major events in the implementation of microcomputers in the Linden School District are presented in Table 1.

Table 1: Chronology of Implementation   Linden
                                                          School
                                                          District

Date Month-Year	Event
1979-1980 Academic Year	
Oct. 1979	Two interested teachers seek permission to use special education funds to buy a microcomputer.
Nov. 1979	Three Commodore PETs purchased for middle school (Part B and other funds).
March 1980	A dual-disk drive and printer purchased with special education funds for middle school.
1980-1981 Academic Year	
Sept. 1980	Three Commodore PETs purchased and distributed: one to middle school; two to high school.
Nov. 1980	Special Education teachers begin selling bagels to raise money for microcomputers. Began proposal for grant application.
Jan. 1981	Proposal submitted for federal project.
May 1981	One dot-matrix printer and one Apple II unit purchased for middle school. Bagel money used for purchases.
Aug. 1981	Grant for federal project approved.

1981-1982 Academic Year

Sept. 1981

Five printers and two disk drives purchased with grant money; five disk drives and six Commodore PETs purchased with special education flow-through funds.

Jan. 1982

Apple printer purchased with "bagel funds."

1982-1983 Academic Year

Sept. 1982

Apple II unit purchased with special education flow-through funds.

Feb. 1983

Apple II unit purchased with "bagel funds."

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The special education microcomputers are used solely by the special education faculty to provide computer-assisted-instruction (CAI). This application of the microcomputers in math and language arts areas has been integrated into almost every module of the curriculum for special education students. The software emphasizes drill-and-practice of skills introduced by the teacher. Experimentation with additional, special capabilities or potentials of the microcomputer is left to the individual teachers. Their initiative and levels of expertise with the technology determine the nature and extent of special applications made in each classroom.

There are currently 12 Commodore PETs and 2 Apple II-Plus microcomputers used in the Linden School District special education program. The Apple II systems are complete with disk drives, dot matrix printers, and color monitors. Seven of the Commodore PET microcomputers are equipped with disk drives and there are seven dot-matrix printers for use with the Commodore units.

At one elementary school the microcomputer is in the front portion of a "storage closet" inside the teacher consultant's classroom. At the other elementary school the computer is located in the back of a large classroom next to restrooms, drinking fountain, sink and counter. At the middle school the computers are distributed across four special education classrooms. Two rooms share two Commodore PETs with disk drives and printer and one Apple II unit. A third room contains two Commodore PETs with disk drives and a printer. The fourth room has two Commodore PET units with one dual disk drive and a printer. Each of the high school special education classrooms has two Commodore PETs, a disk drive, and a printer.

The microcomputers are used daily for CAI in math and language arts for special education students. No regular education teachers or administrators make regular use of these computers. Twenty-seven special education students in the elementary schools, 52 in the middle school, and 28 in the high school use the microcomputers.

Interviews with the special education teachers indicated that most of the microcomputers are in constant use during all scheduled class periods and that frequent requests to use the microcomputers during lunch periods are received and honored. The teachers indicated that all special education students

utilize the microcomputers for a portion of either language arts
or math instruction each week and many for both subject areas.

Management of the Microcomputers

The Linden School District special education program is
supervised by a one-third time director who reports to the
Superintendent. There are 11 special education faculty members
in the district, three of whom are designated teacher/consul-
tants--one for each academic level (elementary, middle, and se-
condary). One special education teacher at the elementary level
does not have a microcomputer.

The director of special education is responsible for and
makes recommendations concerning acquisition, maintenance, and
utilization of the microcomputers. These decisions must then be
approved by the Superintendent. One teacher at the middle
school has emerged informally as the district microcomputer spe-
cialist and his opinion is sought and considered in all deci-
sions concerning special education microcomputers. During the
course of the federal project, this microcomputer specialist was
primarily responsible for technical aspects of the project:
writing computer programs, purchasing equipment, providing
inservice to staff and students, and disseminating materials.
The principal of the middle school was primarily responsible for
fiscal matters, for administering the research design, and for
program evaluation. Now that the project has terminated, use of
the microcomputers is determined independently within each
school.

No standardized procedures exist for allocating hardware
and distributing software in the district. Some units were dis-
tributed to the elementary and high schools as a result of their
participation in the federally funded research project. These
microcomputers have remained in the schools where they were
placed.

The special education teachers at the middle school are the
only ones in the district who are currently working to secure
money for additional microcomputers and they will determine how
this equipment will be distributed. Software acquisitions are
coordinated informally. Interviews indicated that sometimes
there were duplications in the review and ordering of software
by teachers in different schools. Among the middle school
faculty, there was evidence of pooling budget money; informal
discussions also occurred regarding software purchases.

The 1981, federally funded project provided money for the
development of special education math software for the district,
the purchase of several commercial software math packag   d

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tant at an assigned time in the resource room for special instruction or counseling to supplement regular education classroom activities. Most of these students are mainstreamed in regular classrooms for the majority of each day. The teacher talks with the students about how things are going in class and then either tutors individual students on a problem area or sets up the microcomputer for a student to practice skills. The students work individually at the microcomputer with either the teacher or the teacher's aide also sitting at the terminal to offer encouragement and extra instruction.

The microcomputer is located in a small storage room inside the resource room and gives the user and teacher complete privacy. There are two chairs at the terminal, ample room for teacher and student to sit and work comfortably. After the lesson, the student's progress is checked and a written or verbal report given to the regular classroom teacher as appropriate. Commercial programs (Milliken Math Series) as well as locally developed software in math is used.

Computer Assisted Instruction in Middle School Special Education Classroom. The teacher uses the microcomputers for instruction, but also for behavior management--good conduct is rewarded with "free play" time on the microcomputer. The teacher comments that there have been significant improvements in student behavior.

One student is practicing a vocabulary lesson at one of the two Commodore PETs in the rear of the classroom. The student is given a choice of words on the right side of the monitor from which to select and fill in the blanks in sentences on the left. With each correct response a bright starburst design appears and the student usually smiles. At the end of the exercise the student is given feedback as to the number of correct and incorrect responses. The teacher indicated that each student in the class uses the microcomputer for a portion of all math and language arts modules.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

Microcomputer applications are mostly decentralized. Both the initiation and implementation of the system began at the classroom level. Although the director of special education prepares the special education budgets, he must divide his time among three districts and is not directly involved in day-to-da decisions regarding the microcomputers. The four building prin cipals are responsible for equipment assigned to their schools, and individually authorize teacher requests for hardware or software to be purchased through classroom supply money. The decentralized functioning of the system is well established wit no plans for centralized coordination or standardization, eithe at the building or district levels. There are no set procedure for sharing or distributing software, no district inventory of software housed in individual classrooms, and no mechanisms for evaluating software. Building principals are involved in coor-din⁻ ⁻⁻⁻qh the scheduling of classes.

⁻tivity involving centralized coo⁻ ⁻ination was the federally funded project which required the coordination of microcomputers at all four district school buildings. During this time, the special education teacher consultant (and grant co-author) informally emerged as the "district microcomputer specialist." His opinion was sought regarding machine use, functions and repair, software suggestions, and funding sources

The mainframe computer used by the Linden School District central office belongs to the Genesee County Intermediate Schoc District. This Burroughs 9000 is used for student records, master scheduling, payroll, budget, grade reporting, and a career guidance program in the high school. No interaction be-tween the microcomputers and the mainframe takes place.

Special and Regular Education Interaction

Special education students are mainstreamed to the extent their skills and abilities allow, and are assigned to special education resource rooms for intensive developmental and reme-dial work. This results in some students remaining in special education rooms for the entire day and others only for assigne periods. The special education teacher consultants interact with regular education faculty members about the needs of the mainstreamed students. These interactions may or may not in-clud consideration of the computer-assisted-instruction that

takes place in the special education classrooms.

Although there are additional microcomputers in the district, no appreciable collaboration over any aspect of use was evidenced. This is largely due to a strictly enforced regulation requiring that special education microcomputers be used by special education students only. The regular education microcomputers were only open to students taking upper level math and science instruction.

Nevertheless, a few examples of regular and special education interactions have occurred:

- A special education teacher was asked to demonstrate the microcomputers in regular education classrooms. Two requests were made.

- An elementary special education teacher distributed a list of public domain classroom software to all faculty members in the school, and offered to make copies r inter ed teachers. No requests were made.

- Conversations transpired between an el - mentary special education teacher and a third grade teacher regarding ways to use the computer for instructional pur- poses.

- A middle school special education teach- er was approached by a regular education home economics teacher with questions regarding the design of software for a nutrition class.

Administrative and Instructional Applications

Microcomputers are not used for administrative applications in the Linden School District. Two school principals, however, indicated that they recognized the future potential of such applications. Computer assisted administrative functions in the district are accomplished with a minicomputer and a mainframe terminal in the district office. There is no conflict or duplication of activities as a result of the introduction of micro- computers.

Training

The two teachers involved in planning for and initiating the special education microcomputers began reading about the us of microcomputers when approval for the purchase of micro- computers for the Linden School District was obtained. No for- mal training was provided by the district for the initial users of the system.

During the federally funded project, 1981-1982, 7 of the 2 teachers involved in the project received ten hours of computer literacy training and inservice training on the use of the spe- cially designed software for the project. Three of these teach ers were from the Linden School district. No other inservice training on using the microcomputers has been offered to the faculty. One special education teacher at the elementary schoc attended an inservice offered by the Genesee County Intermedial School District.

The Linden School District offers adult education classes in computer literacy. Several Linden school faculty members ar administrators completed the course and several others were en- rolled for future sessions. This course is available to schoo: employees at a reduced cost and teachers are encouraged to at- tend.

Emerging Ro

There have been no new organizational roles created in the Linden School District related to the implementation of micro- computers. Informally, one of the middle school special edu- cation teachers is considered the local expert and is frequent called by other microcomputer users for advice. At every leve in the district structure the opinion was expressed that if microcomputer technology is to expand and be effective in the schools, a "specialist" with time allotted to train and assist the users is needed. However, due to the financial constraint in the district at the present time, positions are being elimi nated, not created.

TOWNSHIP OF OCEAN SCHOOL DISTRICT
Oakhurst, New Jersey

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Ocean Township, a suburban, middle to upper-middle income residential community of 25,000, is made up of the towns of Oakhurst, Wanamassa, Wayside, and a number of smaller towns. Located on the New Jersey coast approximately fifty miles south of New York City, it is adjacent to the resort city of Asbury Park.

The community consists largely of professional, self-employed managerial, blue collar, and civil service personnel. Nearby electronic industries and the Army installation at Fort Monmouth employ a number of its citizens.

The Township of Ocean School District includes a district office building and five schools: a high school, an intermediate school, and three elementary schools. The present student population numbers 4,158. This enrollment represents a decline from a high of 4,900 several years ago. The school population is predominantly white, with approximately 5 percent Blacks and 5 percent Asians.

District administrators reported that school funding was "financially healthy" and that the local voters have approved all school funds requested in recent years. In New Jersey, the state education agency rates all school districts on the basis of their economic sufficiency, with a ten point scale from lowest to highest. Township of Ocean School District is rated at the ninth level.

The organization of special education programs is quite straightforward. The director of special services reports to the assistant superintendent of schools. Special education teachers and related personnel are responsible to the director and to their building principals. The special services program includes these personnel: director (1), learning-disability teacher consultants (5), nurses (5), physician (1), psychologists (2), social workers (2), speech therapists (3), special class teachers (8), resource room teachers (7), and supplemental teachers and aides (3).

Special services provides instruction within the district for 203 students with classified handicaps and 271 students who are "eligible for speech correction." Nineteen handicapped students are provided with instruction outside the district. In addition to special education, the district also offers instructional programs for basic skills students and for gifted/talent-

ed students.

At the time of the case study (February 1983), there were 48 microcomputer units in the district. Of these, 40 were part of a general, district-wide instructional program. The remaining eight microcomputers were used independently for administrative applications or for specific business education and industrial arts programs in the high school.

Overview of Microcomputers Studied

This case study focused on the 40 microcomputers that were used for general instructional applications. These include 37 Commodore PETs, a Commodore CBM, a Vic-20, and an Atari-800. The majority of these microcomputers are located in computer labs: 16 in the intermediate school lab and 13 in the high school lab. The remaining 10 are placed in individual classrooms and resource rooms. The Commodore CBM is located in the district special education office.

The microcomputers are used for a variety of purposes, but most of these fall into two major categories: (1) computer-assisted-instruction (CAI) and (2) computer literacy/programming. Examples of microcomputer use include the following:

o Special education teachers in all the schools use microcomputers for CAI to support educa-
tional objectives and reinforce (with main-
streamed students) curriculum topics from re-
gular education programs.

o Basic Skills (Title I) teachers use microcomputers to provide computer-assisted instruction in math, spelling, and reading. Teachers select software appropriate for each student and, where the software allows, customize the CAI by changing "difficulty" and "speed" levels for each student.

o Gifted/talented students in the intermediate and elementary schools are introduced to microcomputers through computer literacy and programming courses.

o Math teachers at the high school offer courses in both basic computer literacy (introduction) and advanced programming for secondary students. The courses are conducted in the high school computer labe and between 300-

400 students are instructed each year. The
lead teacher for 'this program plans on "full
computer literacy" for all district students
and is introducing computer courses at the
intermediate school as well.

- Throughout the district, regular education
  teachers are beginning to use available
  microcomputers for CAI with their students.
  The applications are in reading, math,
  science, and languages.

- The director of special services is devel-
  oping administrative applications for her
  department, using a Commodore CBM that was
  purchased specifically for that application.

The other computers (8) in the district are used for admin-
istrative applications and for business and industrial arts
courses in the high school.

Chronology

Microcomputer use began four years ago (fall 1979) when the
district math supervisor and several high school math teachers
approached the assistant superintendent of schools with a propo-
sal to purchase microcomputers for instructional purposes. Pre-
viously, computer programming had been taught by one of the high
school teachers for eight years using the school mainframe com-
puter. The assistant superintendent was enthusiastic.

Using funds from Title I, Title II, and gifted/talented
budgets, 14 Commodore PET microcomputers were purchased in
December 1979. A key decision was made not to distribute the
machines until the teachers had received adequate training in
their use. First, a district-wide awareness session was held on
an afternoon in January. Then a series of voluntary, 16-hour
inservice courses was initiated. To date, two-thirds (200) of
the district teachers have completed this training.

The original 14 microcomputers were allocated among the
three elementary schools, one intermediate school, and one high
school. During the remainder of the first year of the program
and throughout the second year, these computers were used by the
Title I, gifted/talented, and high school computer science stu-
dents. During the second year, however, most of the special
education teachers and administrators completed the inservice
training course. At the beginning of the third year (fall
1981), the special services division bought five Commodore PET

units, one for each of the five schools in the district, and a
Commodore CBM with dual disks and a letter quality printer for
the district office. The CBM is used for special education
paperwork, especially required correspondence with parents. In
addition, an ambitious project for automating part of the IEP
development process is under way. The Commodore PET microcompu-
ters at the elementary and high schools are located in special
education resource rooms and self-contained classrooms.

Along with the microcomputers purchased by special ser-
vices, additional equipment for all users in the district con-
tinued to grow. When the six special education computers were
purchased in the summer of 1981, eight additional Commodore PET
units were purchased for other purposes. A third set of 12 Com-
modore PET microcomputers was purchased in the summer of 1982.

Two factors that contributed to the expansion of microcom-
puters in the district were: (1) establishment of a core group
of persons to coordinate and assist others in using the micro-
computers; and (2) extensive provision of inservice training
opportunities for all teachers in the district. The core group
consists of a math teacher and the math supervisor, the assis-
tant superintendent, and the director of special projects. From
the initiation of microcomputer usage in the district (1979),
this group has worked together to support and guide adoption and
expansion of units in the district. One of their key roles has
been to provide training and technical assistance to the
teachers. This began with a district-wide awareness program in
January 1980, and has continued through a series of training
sessions. Not only has district training reached a majority of
the local teachers, but 400-500 educators from other districts
have participated in (and paid for) the training that the
district provides.

The major events in the implementation of microcomputers in
the Township of Ocean School District are presented in Table 1.

Table 1: Chronology of Implementation   Ocean School
                                                          District

Date Month-Year	Event
1979-1980 Academic Year	
Sept. 1979	Informal committee from math department meets with Superintendent and assistant superintendent to initiate planning for microcomputer implementation.
Fall 1979	Committee plans focus for initial application and identifies funding sources.
Dec. 1979	Delivery of first 14 microcomputers.
Jan. 1980	District-wide awareness session.
Feb. 1980	First training sessions for teachers (start of eight-week course, two hours per week).
Spring 1980	Committee establishes centralized software acquisition; math supervisor will coordinate all review and purchase of educational software.
1980-1981 Academic Year	
Throughout Year	First district-wide implementation of the microcomputers (after teachers had been trained): 6 in high school computer science 3 in intermediate school (gifted/talented program) 3 in one elementary school

	(gifted/talented program) 1 in each of two elementary schools (Title I labs-- "basic skills")

Spring 1981

Special education personnel take introductory computer inservice training provided especially for them.

1981-1982 Academic Year

Oct. 1981

Second major acquisition of microcomputers. Of 14, 6 are purchased with special education funds.

6 more to high school compu-
ter labs
1 to high school resource
room (spec. ed.)
3 more to intermediate
school computer lab
3 to the special education
rooms in the elementary
schools
1 Commodore CBM to the ad-
ministration building for
special education use

Feb. 1982

First edition of district newsletter published and distributed to the community. Contains extensive coverage of microcomputer activities.

1982-1983 Acaemic Year

Oct. 1982

Third major acquisition of (12) microcomputers. Most (8) are added to interme-diate school computer lab.

Oct. 1982

District initiates monthly orientation/training pro-grams for personnel from other districts.

Feb. 1983

Second edition of district newsletter.

Spring 1983

Microcomputer committee
plans linking curriculum
areas to educational software.

II.   FEATURES OF THE MICROCOMPUTERS

Introduction

The instructional microcomputers in Ocean Township are
located in all five schools in the district, but their highest
concentration is in the intermediate school (16) and the high
school (15).   Eight microcomputers are distributed across the
three elementary schools. One microcomputer is in the special
education office. This concentration of microcomputers at the
secondary level reflects the initial adoption for computer
literacy/programming classes. Nevertheless, in all buildings
microcomputer use is shared by teachers and students in dif-
ferent programs.

Each of the three elementary schools has one special educa-
tion computer. These computers were purchased with special
education funds and are located in special education rooms
(resource rooms or self-contained classrooms). Special educa-
tion students have priority use of these microcomputers and, in
general, appear to use them more than 50 percent of the time.
Special education students are mainstreamed to a great extent in
these schools, and some may use other computers in basic skills
classes. Two of the elementary schools also each have a micro-
computer located in a basic skills classroom. The third elemen-
tary school has three additional microcomputers that were pur-
chased with state gifted/talented funds and are used in the
local program for "enrichment."

At the intermediate school (grades 6-8), all 16 microcompu-
ters are located in a single computer lab. One of these compu-
ters was purchased with special education funds, but it is not
distinguished from the other microcomputers as far as the users
are concerned. Special education teachers schedule groups of
students into the lab. Basic skills (Title I), gifted/talented,
and regular classroom teachers also schedule time for their
classes in the lab.

The computer lab is located in a tiered, "lecture-hall
type" room. On each level there are long, curved tables with
swivel chairs attached. The lab is actually a small amphi-
theater. In front, there is a large-screen television which an
instructor can hook-up to a microcomputer for demonstration
purposes. Fourteen microcomputers (Commodore PETs) are arranged
around the tiered platforms. A Vic-20 microcomputer and an
Atari-800 microcomputer are kept in an adjoining office, and may
be brought into the lab for use or demonstration. A large soft-
ware library (about 150 programs) is kept in ring binders that
sit on a table at the front-left of the amphitheater.

This computer lab is in fairly constant use during the
school day. Based on prearranged scheduling (handled by the
school librarian), individual teachers bring their students into
the lab for class periods. The principle users of this resource
are the basic skills program, the gifted/talented program, and
the special education program in the intermediate school.
Priority availability of the microcomputers for these programs
was based on the fact that they funded the purchase of the
microcomputers.

At the high school, there is a computer lab with 13 units,
another microcomputer in a special education resource room, and
another in a basic skills classroom. The high school computer
lab is used almost exclusively for secondary computer science
courses (introductory computer literacy, basic and advanced
programming).

The high school has two resource room teachers who teach
alternate periods, sharing the single special education micro-
computer. The microcomputer is used about 50 percent of the
day, as one of many items in the resource room. The computer is
on wheels and, when not used for special education, it is bor-
rowed by foreign language or other regular education teachers.
There is also a classroom for the emotionally disturbed in the
high school, but they make very limited use of the microcompu-
ter.

In addition to the instructional microcomputers, special
education funds were used to purchase one Commodore CBM 8032
microcomputer with dual disk drives and a letter quality prin-
ter. This microcomputer is in the district office building and
is used as a word processor for preparing special education
materials and for processing mailings to parents. Currently,
special education teams are developing a system for this micro-
computer to prepare IEPs for special education students.

Management of the Microcomputers

During its four-year history of using microcomputers, the
school district has developed an informal but very active and
influential committee of key persons who coordinate and manage
the instructional use of microcomputers: the assistant superin-
tendent of schools, the director of special projects, the super-
visor of mathematics (K-12), and a math/computer science
teacher.

The Superintendent is not as directly involved in the day-
to-day operation of the microcomputers, but he fully supports
the implementation and has acted successfully to secure school

board support for the committee's efforts.

The informal committee exerts its influence over micro-computer implementation through the following mechanisms:

- The purchase, acquisition, and location of all microcomputer hardware is directed by the com-mittee; they also identify available funds that can be used for hardware purchases.

- Similarly, software purchases are also directed by them. In particular, the math supervisor reviews all requests for software, submits or-ders to developers/distributors, and reviews all software when it is first received. What she doesn't like, she sends back. The commit-tee also organizes and implements district-wide software reviews by teachers.

- The committee has established and regularly conducts extensive inservice training on micro-computers for teachers. Over two-thirds of the district personnel have participated in at least one of the courses. In addition, between 400-500 educators from outside the district have attended workshops or district-sponsored orientation sessions. Fees charged for atten-dance are used to purchase additional educational software in the district.

Illustrative Applications

To provide an idea of how the microcomputers are being use in the Township of Ocean School District, three illustrative applications are described below.

Computer-Assisted Instruction in an Elementary School Self Contained Classroom. A group of five neurologically impaired students is in the classroom, working individually with various instructional materials. A boy and a girl, about seven years old, are assigned to the microcomputer. With a little help fro the teacher, they select software from a box of about ten tape cassettes sitting on the table beside the microcomputer, and load it into the cassette tape drive.

The microcomputer displays a sequence of six or eight let-ters from the alphabet. One letter in the sequence is missing, replaced by a blank. The task is to determine which letter is missing and press the corresponding key. The two students take

turns, but they help each other when one seems to be having trouble.

Usually, they get the correct answer. When they do, stars immediately begin to appear one at a time, randomly scattered over the screen, until in a few seconds the entire screen is sprinkled with stars. The students' faces light up with excitement each time. Then they concentrate on the next set of letters that appears. When they make an occasional error, the program prompts them and gives them another chance.

After about ten minutes, the teacher directs the boy and girl to new tasks elsewhere in the room, and two other students take their places at the microcomputer. The new "users" load a program that teaches simple arithmetic skills and become absorbed in this activity while the teacher works with other students in the room.

Computer-Assisted Instruction in the Intermediate School Computer Lab. Six perceptually-impaired boys and girls are working in the computer lab. The lab is set up in a small , lecture hall off of the school's central library complex. The hall has five curved tiers of tables that run the width of the room, broken only by a single aisle in the middle. Seats are permanently mounted to the support posts of the tables and are spring loaded to swing under the tables when not in use.

The lecturer's area at the front of the room is dominated by a huge TV set with a 4-foot screen. The screen is dark at the moment, but can be connected to a microcomputer for demonstrations by the teacher. Behind the computer, against the front wall of the room, are two long tables on which are arranged about 150 cassette tapes in notebork-like holders. These tapes contain the wide variety of computer programs available for use by the students.

Fourteen Commodore PET microcomputers are spread out along the first three tiers of tables. Each is equipped with a cassette tape drive. Six of these are now in use by the special education students. Most are working on arithmetic or language skills and practice programs. Some of the programs make use of game-like formats, but the emphasis in all cases is on a serious approach to building basic skills. The teacher moves about the room, observing the students and helping out where needed.

One boy, about 13 years old, is working on a reading practice program. The microcomputer presents text at a rate that is partially under control of the student. The program is designed to develop sight reading skills, including correct left-to-right scanning techniques. A: the request of the teacher, the boy stops for a moment to explain some of the technicalities of the

computer sound system to the visitors. He is clearly very prou
of his knowledge of the complex equipment.

The teacher explains that she has 20 students assigned to
her special education resource room and that she schedules them
into the microcomputer lab/in small groups on a weekly basis.
She assigns computer tapes to the students from the assortment
of tapes on the tables at the front of the room, depending on
the individual needs of each student. However, the tapes have
been purchased to cover the complete range of students, from
special education to gifted/talented. Thus, not all of the
tapes are useful in her classes.

Computer-Assisted Instruction in a High School Resource
Room. Four teenagers, three boys and a girl, are working in a
small classroom. One boy and the girl are working on written
assignments at tables in different parts of the room. The
teacher works with the other two boys at the microcomputer, a
Commodore PET with a cassette tape drive.

The program that the boys are using is designed to teach
prefixes. It is one of about a dozen in the resource room. Tl
boys are working on the many meanings of the prefix "sub-" and
one finds the lesson quite difficult. Later, the teacher ex-
plains that he is good in math but has a serious problem with
reading.

The program presents a meaning of "sub-" ("under") follow(
by an example ("submarine") and a list of about ten possible
definitions. The task is to press the key corresponding to thi
correct definition. The boys take turns, and the teacher pro-
vides extra help for the one with the special reading problems
He has a hard time reading the long list of definitions, and ti
teacher gives him some prompts.

The complete lesson takes about fifteen minutes, and give
the boys a score at the end. One of the boys shows us how he
can list the computer program on the screen and change what th
program will display. He is enthusiatic about using the micro
computer for learning, and is also very interested in computer
programming.

The second boy, the one with special reading problems, sa
he doesn't really like using the microcomputer very much, but
says it is better than most things he has to do in school.
Afterwards, the teacher tells us that this boy has a very nega
tive attitude about school, and the microcomputer is one of th
few things that attracts his cooperation.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The district's use of microcomputers for instructional
purposes contains elements that are centralized and elements
that are decentralized. The informal, central committee
(assistant superintendent, math supervisor, director of special
projects, and math/computer science teacher) direct many impor-
tant functions:

- initial adoption and selection of hardware

- allocation of microcomputers to schools and teachers

- review and acquisition of educational software

- teacher training and technical assistance

On the other hand, actual instructional applications are
essentially decentralized. The central administration provides
the hardware, the software, and the technical "know-how," but
the teachers are very much left to determine their own particu-
lar use and application of these resources. The only minor
exception to this patt! rn occurs in the computer science
courses, which are planned by the math supervisor and the math/-
computer science teacher for the intermediate and high schools.

For the other instructional applications, individual
teachers (special education, basic skills, gifted/talented, some
regular education teachers) select the software they wish to use
and schedule their own applications. In many of these cases
(e.g., special education, basic skills) the software selection
is further individualized for each student.

The administration is highly cognizant of this ultimate de-
centralization (and uniqueness) of specific applications. They
expressed the opinion that this was important to encourage
microcomputer implementation and that this flexibility prompted
teachers to make more use of the technology. Nevertheless, they
now feel that some more coordination is necessary. However,
they stated that they hope new steps by the central administra-
tion, which they are now planning, would continue to support
rather than control use of the microcomputers. One feature they
would like to introduce would be a "curriculum guide" for educa-
tional software. They hope to link the district's educational
software with specific curriculum (grade, subject matter, task)

objectives. This would serve to foster more selective and appropriate utilization of software by the teachers. As part of this process, they would also like to communicate availability of software better to the teachers and get more control over the distribution of software.

This current planning is associated with some minor problems noted in the schools. For example, the software "library" in the intermediate laboratory does not have a formal "check-out" procedure. Teachers (and students) can take software for their use and leave no record of who has it or when it will be returned.

Another problem is that teachers are often not aware of software in the district that can be used by them. A particularly striking example of this occurred in the high school. Three teachers, with whom we spoke, expressed interest in a type of software that would allow them to present individualized "practice-type" material. One teacher had been attempting, unsucessfully, to identify commercial software for this purpose; another had purchased commercial software that proved useful; the third had worked with the math teacher (on the committee) to develop software for such an application. None of the three were aware of each others efforts. It is just this type of problem that the central committee is hoping to alleviate with better district-wide (and within-building) coordination and communication.

In terms of the centralization-decentralization of applications, it should also be noted the district has a centralized data processing department. Until about four years ago, the high school math teacher used the mainframe computer -- through batch processing -- to teach programming to students. This same math teacher is now one of the members of the district's informal coordinating committee. It was largely through his efforts that the initial decision to adopt microcomputers occurred. He was dissatisfied with the availability of time on the mainframe to support the needs of his students. He also felt that microcomputers were "able to do more" and represented a promising "personal tool for teachers and students."

The director of data processing is not directly involved in instructional uses of the microcomputers and feels that "as long as the microcomputers are serving those needs -- fine." However, he expressed concern over potential redundancies -- between mainframe and microcomputer applications -- in some of the administrative uses that are being planned or initiated in the district. He also believed that there should be more centralized control over the use of microcomputers and was concerned about eventual maintenance problems. However, his current obligations -- he is installing a new mainframe computer

-- prevent him from having much involvement with the
microcomputer applications.

Special and Regular Education Interaction

Special education students are extensively mainstreamed in
the district. There is no separate special education school and
the great majority of handicapped students also participate in
regular education. This strong level of interaction between the
two programs is reflected in sharing of the microcomputers. In
the elementary schools and in the high schools, regular educa-
tion teachers often use the microcomputers that are provided to
special education or basic skills classrooms. In the interme-
diate school, students from all programs use the computer lab.

A noteworthy aspect of this interaction was reported by a
number of special education teachers. Because most of the
microcomputers in the elementary and intermediate schools were
acquired with special education or Title I funds, and priority
usage of the equipment was given to students and teachers in
those programs, these students have, to date, had much more
experience with the microcomputers than the regular students
have had. They are also more knowledgeable about the hardware
and software. Teachers were very enthusiastic in telling us
that -- now that the regular education programs are beginning to
make use of the microcomputers -- the special education and
basic skills students often demonstrate and explain the technol-
ogy to their peers. This gives them a feeling of self-esteem
and confidence and also fosters respect and friendship among the
students. This was an unanticipated but welcome outcome for the
special educators.

Administrative and Instructional Applications

The major thrust for adoption and implementation of the
microcomputers has been to support instructional applications:
computer-assisted instruction (CAI) and computer literacy/pro-
gramming. In a few cases where administrative applications are
planned or have been initiated, separate microcomputers -- two
Apple II units in the business office; the Commodore CBM in the
special education office -- have been purchased for those
purposes. Consequently, to date there has been no competition
or conflict between administrative and instructional users. A
principal in an elementary school said that he had recently be-
come very interested in potential administrative applications
using microcomputers, through his exposure to the units in his
school. However, he also stated that he planned to acquire a
separate unit for such applications.

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Training

The training program is a major feature of the Ocean Township microcomputer program. A decision was made at the planning stage that no microcomputers would be distributed to the teachers until they had undergone enough training to enable them to use the equipment properly.

The first step in the training program took place in January 1980, shortly after the first microcomputers were delivered. This step consisted of an afternoon awareness session of about two hours to which all teachers, board members, and other potentially interested personnel were invited. The awareness session gave everyone a chance to see the microcomputers running educational software and to receive some "hands-on" experience with the microcomputers.

Shortly after the awareness session, an inservice training program for teachers was announced. The first group started in February of 1980. Five groups (up to 20 per group) took the course during the first year. At the present time, over 200 of the 300 teachers in the district have completed the course, and more teachers are signed up for future sessions. Members of the coordinating committee and other local "experts" teach the inservice courses. In addition, a series of workshops and orientation sessions has been conducted for personnel from outside the district.

The course for Ocean Township personnel consists of eight two-hour sessions, one session per week. When the course was first offered, the objective was to teach participants to write programs in BASIC. This turned out to be unrealistic for teachers with no previous experience, and the course has been changed to cover (a) computer operations and (b) evaluating commercial software. Participants must also complete a project that involves some practical use of the microcomputers within two weeks of the end of the course.

While the course is completely voluntary, motivation for teachers to take the course is three-fold. First, teachers must complete the course in order to use the microcomputers. Second, completion of the course satisfies a district requirement for inservice needed to receive salary increments. Third, while the district charges fifty dollars for the course, teachers are reimbursed upon successful completion, so the course is, in effect, free.

Teachers who took the original version of the course (focusing on BASIC programming) have been allowed to retake the new version that focuses on computer use and software evalua-

tion. In addition, an advanced : iservice course on microcompu-
ter programming is now offered.

For teachers from outside of the district, a shortened
version of the course is offered (four two-hour sessions). The
content is similar to the course for Ocean Township personnel,
but the emphasis is on introductory computer skills. The out-
side teachers are not required to complete a project or review
software.

Emerging Roles

The microcomputer system has created several new teaching
positions, both in high school computer science classes and in a
teacher inservice training program developed in the district.
However, the major new support role consists of an informal,
half-time position as district technical support person. This
position is held by a math teacher, who was a member of the in-
formal district coordinating committee. Beginning in the fall
of 1982, half of his work-day has been reassigned to e spent
helping microcomputer users in the district.

He has a regular weekly schedule for working with the
different users, but the particular tasks vary, depending on the
needs of the users at the time. He helps with selecting soft-
ware, setting up hardware, writing special-purpose programs, and
teaching programming to intermediate school gifted/talented
students. Virtually all users interviewed mentioned him as
their main source for technical assistance.

The major change to an existing role was the addition of
software coordination to the duties of the math supervisor. In
this role, she coordinates all software ordering for the dis-
trict, coordinates reviews of new software and returns items she
judges to be unsatisfactory, distributes new software to
appropriate users, and notifies other potential users about the
location of new programs. At a more general level, she is the
closest thing to a "supervisor of microcomputers" that exists in
the district, although she has no official title relating to
microcomputers. Additionally, microcomputer planning activities
have been added to the responsibilities of all of the planning
group members.

PITTSBURG UNIFIED SCHOOL DISTRICT
Pittsburg, California

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

Pittsburg, California, is situated about 20 miles east of Oakland and Berkeley. Although Pittsburg is only a ten minute drive from the relatively affluent towns of Concord and Walnut Creek, it is physically and psychologically isolated by a low range of rolling, grass-covered hills. Much of the population is poor, with a predominance of blue-collar workers and a high proportion of unemployed.

The Pittsburg Unified School District encompasses the entire town of Pittsburg. It includes about 6,000 students housed in ten schools: six elementary schools, two junior high schools, one high school, and one continuation school. The student population is not declining, and the schools are racially mixed, with roughly one-third Italians and other Caucasians, one-third Blacks, one-fifth Hispanics, and one-tenth Filipinos and other Asians. Within the past ten years, Pittsburg has been the scene of serious racial problems; now there is much less stress in the schools, and the staff is able to concentrate on improving the educational programs.

School funding in Pittsburg, as in all California schools, is perceived as a serious problem by school personnel. Budgets for both personnel and equipment are low, and items like microcomputers are paid for by state and federal grants, and parent donations.

Pittsburg is a small district and has a simple organizational structure. There are two assistant superintendents, one for instruction and one for personnel and business. The head of special education is the director of pupil personnel, who is responsible to the assistant superintendent for instruction. Special education personnel, serving 710 students, include 3 psychologists, a social worker, 13 special day class teachers, 10 resource specialists, 5 speech therapists, and 3 individual small group instructors. The special education classroom teachers and resource specialists have aides.

There are fourteen microcomputers used in Pittsburg for instructional and administrative applications coordinated by a high school counselor. Eleven of these units are in the high school, one is at the district office, and two are in elementary schools. These microcomputers are the subject of this case study.

A separate group of microcomputers has been located in the

Regional Occupation Program (ROP) classroom, some of them for
the past three to four years. The classroom is in the high
school, but the program is funded at the county level. Six
Superbrains, two Apple II-Plus units and a CompuPro with five
terminals are used to teach office skills, word processing,
computer literacy, and computer programming to adult and high
school students. High school computer literacy classes are
taught during the last two class periods of the day. Few spe-
cial education students are involved.

·Pittsburg does not have a mainframe system of any kind.
Financial and other business office computing is done via termi-
nals connected to a service system outside of the district. The
terminals are operated by two persons who report to the business
manager.

Overview of Microcomputers Studied

During the last two years, the district has acquired 14
microcomputers for instructional and administrative applica-
tions. Most of these were acquired with vocational education
funds, but two were purchased with special education funds. The
high school career counselor/work experience coordinator and the
district's assistant superintendent for instruction have been
the principal forces behind the implementation of these units.
The counselor/coordinator has also provided most of the training
and technical assistance to users. In spite of the small number
of microcomputers, a wide variety of applications are in place;
including:

- Computer literacy and computer programming in the
  high school career center, and elementary school.

- Computer-assisted-instruction for basic skills in
  the high school; in the learning lab; the home
  economics class and elementary school.

- High school attendance and other student records;

- Special education records;

- Computer assisted drafting (CAD).

Chronology

The use of microcomputers in Pittsburg began in the 1980-
1981 academic year. In the fall of that year, the Industry
Education Council (IEC) placed an Apple microcomputer in a

junior high school for use in the special education resource rooms. The IEC is a cooperative venture between industry and education, with member companies providing the funding. The main office for Northern California is in Burlingame, near San Francisco, but there are satelite branches in other counties. The Pittsburg assistant superintendent of instruction was the president of an East Contra Costa County branch in 1980-1981. He played a major role in developing the Pittsburg microcomputer project and he has maintained a continuing interest in micro-computers for the schools.

After a year in the junior high school, the IEC Apple unit was moved to an elementary school, where it was used by the spe-cial education resource teacher. In the spring of 1982, the IEC withdrew the Apple and placed it in another school district. The elementary special education teacher was deeply involved with microcomputer uses at the time, and the district special education services rented another unit for him for the rest of the school year. In 1982-1983, an Apple IIe was purchased for his classroom out of special education funds, although it did not arrive until late spring.

In mid 1980-1981, the same year that the IEC program began, the high school career counselor/work experience coordinator installed two terminals that were connected to the Eureka Cali-fornia Career Information System in nearby Pleasant Hill. The Eureka system was very effective and he became interested in the potential for microcomputers in the vocational and special edu-cation programs.

During the spring and summer of 1981, the counselor/coordi-nator took a series of courses at the local junior college covering computers and computer programming. In the fall and winter of the 1981-1982 school year, he worked with the assis-tant superintendent of instruction and with the head of special education to obtain four microcomputers: a TRS-80 Model II for administrative applications, plus three smaller TRS-80 Model III units for instructional uses. One of the smaller microcomputers was purchased with special education funds, while the others were financed through a state vocational education grant. All four were delivered in February, 1982.

The four new microcomputers in the high school sparked a considerable interest among teachers and administrators. From spring 1982 through spring 1983, vocational education purchased three more microcomputers to use in a microcomputer lab, plus two more for vocational education classrooms. Other microcompu-ters have been purchased and a larger lab with twenty new micro-computers is planned for the fall of 1983. The counselor/coor-dinator has played a central role in the purchases and has provided the technical support for all of these microcomputers.

The major events in the implementation of microcomputers in the Pittsburg Unified School District are presented in Table 1.

Table 1:   Chronology of Implementation   Pittsburg Unified
                                                  School District

Date
Month/Year   Event
_____

1980-1981 Academic Year

Sept. 1980   Pittsburg/IEC Apple microcompu-
                                    ter installed in a junior high
                                    special education resource room.

Dec. 1980   Eureka career information termi-
                                    nals installed in high school
                                    career center.

June 1981   Career center counselor/coordina-
                                    tor begins taking computer courses.

1981-1982 Academic Year

Sept. 1981   Pittsburg/IEC Apple microcompu-
                                    ter moved to elementary school
                                    special education resource room.

Feb. 1982   High school gets four TRS-80's
                                    (three vocational education and
                                    one special education funded).

May 1982   Pittsburg/IEC Apple microcomputer
                                    withdrawn by IEC. Special educa-
                                    tion rents replacement. High
                                    school buys TRS-80 microcomputer
                                    for the office (attendance).

1982-1983 Academic Year

Sept. 1982   Assistant superintendent for in-
                                    struction and career center coun-
                                    selor/coordinator begin to prepare
                                    multiple proposals for additional
                                    microcomputers.

Dec. 1982   Vocational education buys TRS-80
                                    microcomputer for home economics
                                    and drafting classes.

Feb. 1983
Vocational education buys three
new Apple II units; sets up com-
puter lab in library area. Special
education buys Apple microcomputer
for elementary school resource
room. First district sponsored
inservice training session.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

The case study focused on the microcomputers that have been implemented for special education. The assistant superintendent of instruction has been a driving force behind this implementation. Through his position as president of the East Contra Costa County Industry Education Council (IEC), in 1980-1981, he was able to acquire the first microcomputer for the district. Although that initial adoption proved unsuccessful, he subsequently worked with the high school career counselor/work experience coordinator to foster adoption over the past two years of the current microcomputers in Pittsburg. With additional support from the special education director principals (especially the high school principal), and parent groups, 14 microcomputers have been acquired.

The microcomputers can be divided into two categories--administrative and instructional--which have existed in parallel since the first four microcomputers were purchased (winter of 1981-82).

Administrative Microcomputers. There are three microcomputers in this group, all TRS-80 Model II units. They are to keep records and maintain budgets.

The career center microcomputer occupies a very small, glassed-in office in the career center, and is used by the career counselor/coordinator and his advanced computer students for keeping statistics on vocational and special education students. A master file of every student in the high school, usable for lists such as mailing lists, is kept on one disk and includes information on special educational status, vocational education programs, and minimum-competency-test scores. Equipment inventories and budgets are kept on other disks.

The attendance microcomputer is in a room off of the main office in the high school. It was bought in May 1982, the only microcomputer in the high school to be purchased with school funds. The counselor/coordinator worked with a computer consultant to set up an attendance program and it is now used daily by two secretaries in the office to enter all absent and tardy reports. The microcomputer can produce a variety of records on individual students or groups of students, and can show attendance by day or by class period.

The ESEA microcomputer was purchased under an ESEA grant for administrative purposes. It is used to prepare a file of

all special education students, and the district is considering using it to develop IEPs. The counselor/coordinator set up the file using the Profile software program.

Instructional Microcomputers. The instructional microcomputers are divided into those in a "lab" and those in individual classrooms. The computer lab in the library area has three Apple IIe units and three TRS-80 Model III units, equipped with single disk drives and two dot matrix printers. The microcomputers are used by vocational and special education students for learning basic skills, and by the career center counselor/coordinator's advanced computer students, who serve as student aides and develop software for use by the teachers. Four of the six microcomputers were recently purchased; two had been in the career center since February 1982.

All but one of the five microcomputers in the individual classrooms are new, and applications are still being developed. The TRS-80 Model III located in a corner of the high school reading lab was purchased in February 1982, and has been used for reading and language instruction. The remaining four are used in computer-assisted-instruction in the following areas:

- a home economics classroom, used to teach weights and measures and give tests;

- a drafting room used for computer assisted drafting;

- an elementary special education classroom for teaching basic skills and programming; and

- an elementary gifted/talented classroom used for computer literacy.

Management of the Microcomputers

The microcomputers in Pittsburg have been purchased with vocational education or special education funds, and the funding source is the primary determinant of how they are allocated. There are no formal procedures for purchase, allocation, or use of microcomputers set up in the district; management of the system falls into the hands of four key people. The assistant superintendent for curriculum and the director of pupil personnel authorize purchases for the microcomputers. In addition, the assistant superintendent for curriculum assists in developing new microcomputer applications in the district. The principal of the high school also participates in approving purchases. The career counselor/work experience coordinator operates as an informal technical support person for all microcomputer

applications and makes most of the day-to-day decisions re-
garding their use. Although he has no time allocated specifi-
cally to microcomputer administration, he provides training to
teachers, assists in identifying, acquiring, and developing
software for the various applications. There are no formal
procedures for software accession, use, or coordination in the
district.

Illustrative Applications

To provide an idea of how the microcomputers are being used
in the Pittsburg schools, three illustrative applications are
described below.

CAI in High School Microcomputer Lab. The microcomputer
lab is one of several rooms adjoining the high school library.
It is as large as a classroom but is irregular in shape and
shares the high, cathedral ceilings of the main library room. A
folding wall is more than half open, but serves to divide the
room lengthwise into two long, narrow areas. The door from the
library opens into an area that is used to store a number of
pieces of AV equipment and other items.

To the right, beyond the half-open sliding wall, six micro-
computers and two printers are arranged on tables placed against
the longest wall. Three of the microcomputers are Apple IIe
units and the other three are TRS-80 Model III units.

Two groups of special education students (12 in all) are
working at the microcomputers. A teacher and a student aide
(from the high school "special projects" computer class) are
working with each group. An adult aide is also working with one
of the groups.

The learning disabilities group is working with the Apple
microcomputers, learning to use LOGO to draw geometric figures
on the screen. They have just begun to learn to use LOGO, and
most can only copy sample programs from the manual. The student
aides help them with problems and demonstrate how to do other
things with the LOGO turtle. The second group is working with
the TRS-80 microcomputer, using instructional programs for
developing reading, language, and math skills.

CAI and CMI in a High School Reading Lab. The reading lab
provides a regular elective course for any students who are
having trouble passing the state-mandated competency tests, who
want to brush up for the military ASVAB test, or who just feel
that they need to improve their reading skills. Some special
education students take the course, but many of the students are
not in any special program. The course is offered five periods

per day, with 15 students each period.

The lab is housed in a regular classroom, but it is distinguished by a collection of carrels and small tables that replace the normal classroom desks. A number of bookshelves filled with reading materials divide the room into two main sections.

The microcomputer, is on a table in an attractively decorated front corner of the room. Each student is required to work at the microcomputer for a set period every week. The computer work counts toward their grade, and students must log in to show that they have met their obligation. The teacher says that, actually, the microcomputer is a real incentive for the students, and the student at the microcomputer agrees. Students who complete their regular work can get extra time on the microcomputer and are encouraged to do so.

In addition to the instructional programs, the teacher also makes use of a program for determining the reading level of text books. Not only does she use it for her own classes, she also provides a service to other teachers, computing reading level ratings for texts and other materials that they submit to her.

Individualized Instruction in Administrative Applications. The administrative microcomputer is used mainly by the high school's career counselor/work experience coordinator, who is in charge of the career center. He is also responsible for a "special projects" computer class (an individualized class for advanced computer students), and some of his students use this microcomputer to develop new administrative applications. Some have also learned word processing and are using the microcomputer to prepare scholarship applications.

The microcomputer was originally purchased in February 1982 to keep records for the vocational education and career counseling programs in the high school. The counselor/coordinator's previous background in special education (he was a special education teacher) ensures that the needs of handicapped students are met in the vocational programs. The vocational education files include over half of the 1,500 students in the high school and store several dozen items of information on each student--from courses taken, to ethnicity and vaccination records. Other files are maintained for budgets and equipment and inventories. A master file of all students in the school is maintained on a single disk, and includes names, grade levels, and state competency test records.

The benefits of this program are two-fold. Administrative functions in the high school--especially vocational education, special education, and counseling records, reports, and planning--are improved through this automation. Second, the advanced students learn to use the microcomputers in real-life situations. The applications depend on their knowledge and expertise with the software.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The degree of centralization/decentralization of the micro-computers is based on several characteristics: the initial decision to adopt, the decision to assign and locate the micro-computers, the degree of coordination in using the microcompu-ters, and the organization of the software resources. The use of microcomputers in Pittsburg has both centralized and decen-tralized features which vary depending on the application being addressed.

The initial impetus for use of microcomputers came from the assistant superintendent of curriculum, who was responsible for introducing the first microcomputer into a junior high school special education classroom. The first attempt did not prove successful and the microcomputer was withdrawn. He then redi-rected his efforts to supporting the career counselor/coordina-tor, who was simultaneously attempting to use computer applica-tions to improve instructional and career guidance programs at the high school. Although the initial decision to adopt may be said to have been decentralized, district support for purchasing and development of applications was provided.

Initiative for the other applications came from a Parent Teachers Organization and individual teachers: for purchasing microcomputers and implementing applications in the elementary gifted/talented program and in the high school reading lab.

At the district office, the assistant superintendent for curriculum and the director of pupil personnel services (special education) approve funds for microcomputer purchases. The counselor/coordinator reports directly to the high school prin-cipal, who has also provided funds for purchases.

Allocation decisions are based largely on the source of funding used in microcomputer purchases -- voc-ed funds for voc-ed computers, special education for special education microcom-puters; etc. Within this general constraint, allocation is also determined by the specific need and interests of the administra-tors and users. This process is assisted by informal planning and "propagandizing" by the assistant superintendent, the high school principal, and the career center counselor/coordinator. They jointly reach decisions about which program areas would benefit from microcomputer use. The counselor/coordinator then identifies teachers that would be interested in using the equip-ment and provides them with preliminary training and orienta-tion, before the microcomputer is acquired. Then the unit is

placed where the teacher who is most committed, or has the best plans, can use it.

Although no formal coordination procedures are in place, the counselor/coordinator assists a variety of users in the high school, in both administrative and instructional applications. He meets regularly with the district assistant superintendent to plan future microcomputer approaches, as well as other innovative programs for the district. He also assists the district special education director in developing administrative applications on the microcomputer placed in the district offices. The high school principal has full authority over the allocation and use of microcomputers in the high school. He often discusses and plans allocation and use of microcomputers in the high school with the counselor/coordinator. Ultimately, however, the actual day-to-day use of the microcomputers, especially in instructional applications, is determined by the teachers.

There are no formal procedures for software acquisition, use, or coordination. The counselor/coordinator is most knowledgeable about software (all district-received mail relating to software is automatically routed to his mailbox) and he advises users on selection of software. He also shares his software with others and modifies or produces custom software for users. Based on his recommendations, individual users may purchase software with local building funds, district funds, special education funds, or any other money (e.g., high school BINGO and booster club money) that is immediately available. There is no centralized "library" of software, but the counselor/coordinator knows where most software is held, and borrows or shares software (including his own) among users.

Special and Regular Education Interaction

From the beginning of the high school microcomputer applications, collaboration between special and regular educators was intended. A serendipitous factor in this collaboration is the fact that the counselor/coordinator was a former special education teacher. Even before the introduction of microcomputers, the career center services had a strong focus on the needs of handicapped students. The collaboration, however, is limited to shared use of the equipment and to some teachers (e.g., home economics, reading lab) using the microcomputer with both special and regular education students.

The major benefit of shared usage of the equipment (especially in the learning lab) is the availability of more hardware/software for both groups of users. Special education students in the high school are highly mainstreamed. The regular education programs that use microcomputers are open to both regular and special education students. In such cases, the dif-

ferences in applications between students is transparent.

Administrative and Instructional Applications

The initial adoption of the one IEC microcomputer was intended solely for instructional use in a junior high school special education class. This adoption was not successful and the subsequent adoption and growth of microcomputers in the high school was implemented with an intended mix of both administrative and instructional applications. Thus, the first four microcomputers purchased by the district were acquired, at the outset, for both administrative and instructional uses. Three of the four microcomputers were smaller TRS-80 Model III units, selected for instructional applications. The fourth was a larger TRS-80 Model II selected for administrative applications.

In later purchases, some microcomputers were pre-planned to be allocated to classrooms or the learning lab; others were scheduled for placement in the career center or in offices. For administrative applications, only TRS-80 Model II units have been purchased, so software that runs on one will run on all. All other available funds to purchase software (estimated to be $1,500 - 2,000) have been spent on instructional software.

There are no formal district policies or procedures for coordinating instructional and administrative applications. However, with one exception, the microcomputers are all specifically designated for either instructional or adminitrative use; not both. The exception is a TRS-80 Model II in the career center office. This unit is used for administrative applications and for instructional use. The instructional applications on it consist of computer literacy and computer programming for advanced students in the high school. The counselor/coordinator manages this shared usage and it has been very effective. In fact, both applications benefit from the interaction:

- The students learn computer operations in a realistic environment; their "lessons" include data entry and report preparation of real data and reports that are used by high school and district administrators. Based on this experience, the counselor/coordinator has been able to place some students in computer-related jobs.

- The administrative functions benefit from the student "labor;" more reports can be generated with better turn-around time. (Students do receive some payment for their participation, through a vocational education grant program.)

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Training

Very little formal or group training on microcomputers has been provided by the district. During the initial IEC microcomputer implementation, an outside consultant provided a workshop for junior high school special education teachers. Shortly thereafter, the junior high school special education teacher who received the IEC microcomputer also presented some training to other teachers. Both of these initial efforts, however, concentrated on computer programming and were not well received by the teachers.

In the last two years, the high school counselor/coordinator has provided individualized training and technical assistance to new users. The counselor/coordinator, himself, is essentially self-taught regarding microcomputers, although he did take some college courses in the summer of 1981 on computer programming.

In February 1983, the first district-wide inservice training session was offered. The counselor/coordinator presented a four-hour introductory workshop to 20 teachers. These included teachers who were just receiving their microcomputers. The district is planning similar inservice training for fall 1983, when 20 new microcomputers will be acquired and placed in a new computer lab in the high school.

Emerging Roles

No new staff positions related to microcomputers have been established in the Pittsburg school district. One person, the high school career counselor/work experience coordinator, is, however, the de facto coordinator for microcomputer applications. He has assumed this role on the basis of his recognized expertise and enthusiasm for microcomputer implementation in education.

In addition to his official roles as career counselor/coordinator and his unoffical role as microcomputer specialist, he also provides other services in the district. He works closely with the assistant superintendent for instruction and the high school principal to plan and develop special projects. One of these, for example, is MESA--Mathematics, Engineering, and Science Achievement. This is a state-supported, opportunity program for talented students from disadvantaged backgrounds. He also coordinates vocational education programs in the high school and, when time allows, works individually with students.

As a counselor/coordinator, he is able to schedule his own time in the high school. He uses some of his time to provide

training and technical assistance to microcomputer users, to
offer individualized instruction in computer literacy and pro-
gramming, to counsel students, and to fulfill many other voca-
tional education and counseling responsibilities. Both the
assistant superintendent and the high school principal rely
heavily on his assistance in these areas.

PRESCOTT UNIFIED SCHOOL DISTRICT NUMBER ONE
Prescott, Arizona

Case Study Report

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The School District

The Prescott Unified School District encompasses the s
rural, western community of Prescott in the central part of
Arizona. Known as the "Retirement City of the North," Pres
has a residential population of approximately 20,000. Ther
no industry within the area, so the major sources of employ
are the Veteran's Hospital and the school system. Prescott
history as a gold mining town makes summer tourism another
economic resource for its residents.

The school district has eight school sites: five eleme
schools (K-6), two junior high schools (7-9), and one high
school (8-12). The central administration building is situ
in the center of town, while the schools are scattered alon
outskirts. Approximately 4,470 students attend the Prescot
schools. The ethnic composition is 80 percent White, 12 pe
Hispanic, and 2 percent Black and Asian.

The special education program in the district serves a
450 students which includes those with sight and hearing im
ments, learning disabilities, and emotional and physical ha
caps. Presently, there are 27 special education teachers i
Prescott schools. This represents a dramatic increase from
teachers ten years ago. In addition to the special educati
teachers, there are 3 psychologists, 2 speech therapists, a
physical therapist. One of the psychologists also acts as
coordinator of special education for the district on a part
basis. He is responsible for special education program
activities and provides overall supervision for the special
education teachers (building principals are their immediate
supervisors). The coordinator reports to the assistant
superintendent of educational services who is responsible f
all the instructional programs and personnel in the distric
As one of two assistant superintendents, he is directly
responsible to the Superintendent.

Special education students, as well as all other stude
in the district have access to approximately 300 Commodore
microcomputers at all grade levels for computer literacy
courses, computer-assisted instruction, and programming. 1
Special Education/Vocational Education program has an Apple
microcomputer for a vocational diagnostic project with the
junior and high school special education students. The dis
administration uses an IBM System 34 minicomputer system fc
accounting, budgets, payroll, student records, and other
business functions.

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Overview of Microcomputers Studied

The approximately 300 Commodore PET microcomputers in Prescott are used for a variety of instructional and administrative applications. Examples of microcomputer use are:

- Special education students in resource rooms receive computer-assisted instruction in academic areas, such as math and spelling; microcomputer software is also used to foster eye-hand coordination.

- At the high school, computer science courses include introduction to computer operations and BASIC programming. The skills taught include flowcharting, documentation, problem-solving, and writing "readable" programs.

- The gifted/talented students in the 4th-12th grades use microcomputers to learn programming in BASIC language. Students have written programs to calculate the perimeter of a triangle and the area of a square.

- In the junior high school, science students are using a microcomputer to control the environment to stimulate the growth of a tree as part of a research project.

- At the elementary level, all 4th, 5th, and 6th grade students receive two weeks of computer literacy instruction on the microcomputers. In addition to "hands-on" experience, students discuss the history of computer development and the computer's impact on society.

- The Chapter 1 Reading Labs are equipped with microcomputers for computer-assisted instruction in reading, grammar, and spelling skills.

- All of the elementary and junior high schools use microcomputers equipped with small, mark-sense card readers to score and process the district developed Continuous Uniform Evaluation System (CUES) tests.

- Administrative uses of a microcomputer in one of the junior high schools includes attendance, grade reports, class scheduling, equipment inventories, and mailing labels.

Chronology

In the fall of 1978, a committee composed of the director of several federal projects, two secondary computer science teachers, and a fourth grade teacher, decided to write a proposal for an elementary/junior high computer literacy project. Prior to that time, the district offered limited instruction in computer programming for secondary gifted/- talented, students with terminals connected to the local college's mainframe computer system. Microcomputer use was limited to one TRS-80 unit bought by the fourth grade teacher for instructional applications in his classroom.

With funding from the ESEA Title IV-C grant, the first 40 Commodore PET microcomputers were purchased in July 1979. Project funds also supported the development of a computer literacy curriculum to be piloted in the fourth grade. The curriculum encompassed four areas of computer literacy--the history of computers, career exploration, the social impact of computers, and basic programming. The computer literacy curriculum also served as the basis for the first teacher training course offered at the local community college later in the summer. The course was aimed at preparing the elementary school teachers to teach computer literacy.

In the fall of 1979, a computer lab for computer literacy classes and some programming was established at the junior high school. At the elementary level, two groups of ten micro- computers were rotated to each of the schools for six weeks for computer literacy classes with the fourth grade students. In January 1980, the computer literacy curriculum was expanded to include the fifth grade students.

In the summer of 1980, the district allocated funds for the purchase of ten Commodore PET microcomputers. This purchase signaled the beginning of the district's financial support of the microcomputer program. The Superintendent stated that the district had a history of taking innovative programs that had received external funding, and then continuing to support them as viable and on-going parts of the district's curriculum. The district also began to fund a part-time microcomputer position when funding for the federal project director's role was ending.

Beginning in the fall of 1980, an advanced inservice course was offered for teachers to learn more advanced programming techniques. The focus of the course was on developing computer- assisted instruction programs for use in the elementary and junior high schools. About a third of the teachers who took the

introductory course went on to take the advanced course. Over
200 of the 270 teachers in the district have taken the
introductory inservice that runs 16 weeks, with two hours of
lecture and two hours of lab per week.

In addition, a computer literacy course based on the
elementary school curriculum was offered to community members in
September 1980. The course has been given four times and a
total of 240 participants have attended the sessions.

During the 1981-1982 academic year, the district purchased
40 Commodore PET microcomputers with local and special education
funds. The computer literacy curriculum was revised to include
courses for the sixth and seventh grade students. Microcomputer
units were rotated less among schools, with units being
allocated to individual classrooms or computer labs within
sites. The Commodore PETs purchased with special education
funds were assigned to resource rooms in the elementary schools.
Use of the microcomputers began to expand to include computer-
assisted instruction at the elementary level and more program-
ming in the secondary schools.

In the summer of 1982, the computer coordinator organized a
paid working group of teachers and high school students to do a
systematic review of software programs. The ultimate product
was a catalog of recommended programs with brief descriptions
and outlined instructional objectives. The distribution of the
printed software catalog, in January 1983, coincided with the
establishment of software libraries in each elementary school.

The district continued to make additional purchases of
microcomputers--70 Commodore PET units in September 1982 and 16
Commodore PETs in February 1983. In January 1983, a pilot basic
skills computer lab with 31 of the microcomputers was esta-
blished in an elementary school.

The major events in the implementation of microcomputers in
the Prescott school district are presented in Table 1.

Table 1: Chronology of Implementation   Prescott School
                                                District

Date Month-Year	Event
1978-1979 Academic Year	
Sept. 1978	Feasibility study conducted of computer use in district.
Sept. 1978	Elementary teacher brings own TSR-80 microcomputer into classroom.
Jan. 1979	Steering committee formed for Computer Literacy.
Jan. 1979	Proposal submitted for Title IV-C Computer Literacy Project.
April 1979	Title IV-C Computer Literacy Project funded.
July 1979	Purchased first 40 Commodores (30-Title IV-C funds, 10 Voc Ed funds.)
Summer 1979	Developed curriculum for 4th grade computer literacy course, teacher training, and jr. high school class.
Aug. 1979	First 16 week teacher training course offered at local community college.
1979-1980 Academic Year	
Fall 1979	Inservice workshops on computers held for district's teachers.
Oct. 1979	First taught 4th grade computer literacy and gifted/-talented jr. high and high school programming course.

Jan. 1980	Taught computer literacy in 4th and 5th grades.
Summer 1980	Further developed 4th grade computer literacy curriculum and added 5th grade section.
July 1980	Purchased 10 Commodores with district funds.
Summer 1980	Offered summer school for 7th, 8th, & 9th grade students in computers with Career Education Grant.

1980-1981 Academic Year

Sept. 1980	Federal project director became computer literacy project director.
Sept. 1980	First advanced teacher training and district patron computer course offered at local community college.
Oct. 1980	Held statewide mini-conference on the Microcomputer Literacy Project.
June 1981	Purchased 40 Commodores with district and local special education funds.
June 1981	District funded part-time microcomputer coordinator position.
Summer 1981	Revised computer literacy curricula and developed 6th grade computer literacy course.

1981-1982 Academic Year

Sept. 1981	Microcomputers placed into special education resource rooms.
March 1982	Developed five-year plan for

	computer projects in dis- trict.
June 1982	Purchased 31 Commodores with Title IV-C funds.
Summer 1982	Software evaluation com- mittee formed to review programs.

1982-1983 Academic Year

Sept. 1982	Purchased 70 Commodores with district funds.
Sept. 1982	Articulation meeting held with local community college.
Jan. 1983	Set up pilot basic skills computer lab in elementary school with 31 Commodores.
Jan. 1983	Printed software catalogue and organized software libraries in each school.
Feb. 1983	Purchased 16 Commodores with district funds.
March 1983	Microcomputers allocated to six Chapter 1 Reading Labs.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Presently, there are approximately 300 Commodore PET microcomputers in the Prescott school district. The majority of these units are equipped with cassette players. However, there are some microcomputers with disk drives and printers in the schools and in the district office. Four of the five elementary schools have approximately 20-30 microcomputers with 2 or 3 units assigned to individual classrooms. The other elementary school has a basic skills computer room with 31 Commodore PET units networked together.

When computer literacy classes are being taught in the elementary schools (about half the school year), all the microcomputers in a school are moved together to create a computer literacy lab. The remainder of the school year, the principal and teachers at each school decide where to locate the units. Allocation decisions receive final approval from the coordinator of computer education. He is often involved in moving the microcomputers and seeing that they are set up properly after a move.

In the past, sets of 10 or 12 microcomputers were transported from one elementary school to another for the computer literacy classes. Now that is not necessary, since every elementary school has enough units for its computer literacy needs.

The two junior high schools have computer science labs with 15-20 microcomputers in each one. In addition to the labs, microcomputers are located in various classrooms or departments for use by individual teachers with students. In one of the junior high schools, the office has a microcomputer for administrative functions. The total number of microcomputers is approximately 35 in each junior high school.

The high school has a similar distribution pattern for microcomputers. There are two computer science labs with 15 microcomputers in each and approximately 12 units distributed in classrooms and departments throughout the school.

The special education resource rooms and the Chapter I reading labs in all the schools have been allocated microcomputers on a permanent basis. The coordinator of computer education has two Commodore PET units in his office for reviewing and cataloging software and for some other minor administrative tasks.

Within the individual classrooms, microcomputers are usually placed in a corner or to the side of a room to be separated from other classroom activities. It is entirely up to the teachers to arrange and use the microcomputers as they wish. The coordinator of computer education, along with other teachers, is available for assistance and support in the utilization of the microcomputers.

The microcomputers allocated to the elementary schools are used primarily for computer literacy courses and computer-assisted instruction in individual classrooms. The two-week computer literacy courses for all the 4th, 5th, 6th, and 7th grade students utilize the "lab" microcomputers full-time for approximately half of each school year. The microcomputers located in classrooms, including resource rooms and reading labs, are in use by students about 70 percent of each school day. The junior high schools and high school computer labs are scheduled for use all during the day for either computer literacy or programming classes. Microcomputers located in the secondary classrooms or departments also are used on a constant basis by individual students for drill and practice and skill reinforcement.

Management of the Microcomputers

The microcomputers were originally coordinated and managed by the Title IV-C project director with the assistance of the other three members of the proposal-writing committee. After two years, the project director left the district and one of the committee members was appointed half-time computer director while continuing to teach computer literacy half-time. The computer director serves as the major curriculum and technical support person for the entire computer program and a major driving force in its growth and expansion in the district.

Basically, all the microcomputers are considered to belong to the district rather than to individual teachers or schools, except those allocated to Chapter I reading labs or special education resource rooms. The computer director is responsible for all purchasing. This is currently accomplished with district funds for bulk orders of Commodore PET microcomputers. The computer director also decides on the allocation of the equipment to buildings. Principals and teachers may, however, decide on their actual locations withing the schools.

Requests for new microcomputers are initiated by teachers and coordinated by the computer director. Because of budget constraints, not all requests can be met, and the computer director decides on which request will have highest priority.

The computer director is also responsible for all training and maintenance in the system.

The computer director coordinates all software orders and distribution. Requests may come from teachers or the computer director may order items himself. Usually he screens new programs briefly and then asks others to review the programs more in depth. One copy of each program is kept in a master collection in the computer director's office. Additional copies are distributed to the schools as appropriate.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Prescott schools, two illustrative applications are described below.

Seventh Grade Computer Literacy. An 18-week computer literacy course for seventh graders is designed to familiarize the student with the operation of the microcomputer. It also entails the study of the computer's impact on society and the careers available in the area of computers.

All seventh graders are required to take the semester course in computer literacy with the option then of taking an elective computer science course in the eighth and ninth grades. Students use computer labs in both junior high schools, equipped with 14-15 Commodore PET microcomputers, for the "hands-on" portion of the course.

Prior to using the microcomputers, students discuss the various applications and uses of computers including information managment, graphics, telecommunications, word processing, and instruction. One week is spent on the study of the historical development of computers. A "current events" approach is used to discuss the social ramifications of computer uses on society. The text for the course is Are You a Computer Literate? by Karen Billings. This is supplemented with additional articles and readings.

The second half of the course focuses on computer programming in BASIC and skills such as flowcharting and problem-solving. Besides learning programming skills, students are taught the use of tables, arrays, and sorting; the use of peripheral devices (printer, disk drives); and the use of machine memory (PEEK/POKE). Each student is expected to use these skills for an independent project in developing a computer game or graphic demonstration. Part of the project assignment includes exploring potential markets for the programs.

Computer-Assisted Instruction in Special Education Resource
Room. Microcomputers are being used in the elementary school
resource rooms to provide special education students with
computer-assisted instruction. Each resource room is equipped
with one Commodore PET unit with cassette drive and an
assortment of 20 program tapes. The programs are used to
reinforce basic skills, such as mathematics and spelling, and to
develop visual motor and eye-hand coordination skills.
According to one special education teacher, the microcomputer is
like-having an extra aide in the classroom. "The computer can
keep several students busy and that allows us time to
concentrate on working with one or two students."

A sample program that elementary students use on the
microcomputer is one called "drag racing." Students are
presented with multiplication problems that vary in terms of
difficulty. Correctly answering the problem moves an animated
car along a race track. Incorrect answers prevent the car from
reaching the finish line.

Usually students work individually at the microcomputer
with the assistance of a teacher's aide. The aides are
responsible for teaching each student basic computer operations
and selecting programs that correspond with student's learning
objectives. With 20 students scheduled into a resource room
during the day, each student has approximately one hour of
microcomputer time each week.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

In Prescott, the administration and support of the microcomputers is highly centralized, although much of the actual use in the classrooms is left to the individual classroom teachers.

The initial microcomputers were part of a single Title IV-C project, to teach computer literacy in elementary and junior high schools. From that beginning, both the number and applications of the microcomputers expanded rapidly, under the guidance of the Superintendent's office and the original IV-C project staff. The directorship of that project (which changed hands after two years) has evolved into a formal, district-level position as coordinator of computer education. The centralized functions, directed by this coordinator, include:

- Hardware purchasing: All orders are initiated by teachers, but the coordinator sets priorities on orders and makes the purchases. This has enabled the district to limit itself to one standard brand of microcomputer.

- Allocation of hardware: The coordinator's policy is that all microcomputers belong to the district rather than to individual teachers or buildings. The microcomputers are rotated a great deal, both within buildings and between buildings to meet the needs of all the different users. However, some microcomputers are, in effect, permanently assigned to specific teachers, because the teachers make constant use of them. Then too, as the district acquires more microcomputers, less rotation is required.

- Software ordering, screening, reviewing, and distribution: Virtually all software purchases are coordinated by the coordinator of computer education. He personally screens many of the new programs when they arrive in the district, and requests reviews from others. In the summer of 1982, he organized a paid task force to review software, and he hopes to repeat this regularly. He also coordinates the distribution of new software to the different teachers and libraries in the district.

● Teacher training: Formal inservice training for teach-
  ers is an important part of the Prescott program, and
  this training is conducted or organized by the coordi-
  nator.

● Curriculum planning and development for computer liter-
  acy and computer science: The curriculum for the ori-
  ginal computer literacy project has evolved in the past
  four years to include grades four through seven. This
  evolution is expected to continue under the supervision
  of the coordinator and other personnel, and eventually
  it should cover all grades (K-12).

● Test scoring and data processing: Prescott has testing
  procedures to measure achievement and attainment of dis-
  trict instructional objectives. In the past, scoring
  has been done by an outside service, and data processing
  has been done on the district's minicomputer system.
  The coordinator has developed an operational prototype
  system for the microcomputers that will score tests and
  process data. This new system will probably be used
  throughout the district.

The decentralized functions include all instructional uses
of microcomputers outside of the district's computer literacy
courses. All teachers are trained to select and operate
software packages, and, to a large extent, they choose what they
want from among the packages available in the district.
Specifically, each special education teacher decides what uses
will be made of the microcomputers.

Hardware, software, and curriculum support for the teachers
is provided by the coordinator of computer education to the
extent that he can find time. However, much of the current
support comes from informal networks or individual teachers
within the different schools. Teachers with the most experience
and interest help those who are just beginning to use the
microcomputers, so that much of the day-to-day support is
decentralized.

Because of the widespread availability of the
microcomputers, the teachers, school building administrators,
and district administrators are beginning to realize the
potential administrative uses of the microcomputers. At this
point, the development of these administrative applications is
largely decentralized.

The administration (and specifically the coordinator of
computer education) is well aware of the trade-offs between

centralization and decentralization. The policy is to provi‹ centralized support for the teachers, and the support system being developed as rapidly as time and resources will permit At the same time, the philosophy is to give the teachers a g deal of independence in actually using the microcomputers in their classroom.

The goal of the coordinator is to increase support substantially in four areas: (a) providing additional train programs for teachers and administrators, (b) creating works and seminars for microcomputer users to share experiences an ideas, (c) reviewing new software on a regular, formal basis and (d) developing newsletters and other methods for communicating with users on a regular basis.

The role of the district's minicomputer system should a be considered in relation to the centralization-decentraliza issue. In Prescott, the minicomputer system was purchased a about the same time as the first microcomputers were introdu into the district. The division of roles between the two ty of computers had been established by a needs assessment committee headed by the assistant superintendent for busines who is in charge of the minicomputer system. This committee decided that all instructional applications should employ microcomputers, and that the minicomputer should be reserved business uses. The assistant superintendent for business continues to hold this position, and supports the decentralization of the test scoring and processing as well. However, he points out the need for careful planning and coordination to prevent the inefficiencies that can occur wh highly similar data bases are maintained separately in each school.

Special and Regular Education Interaction

Collaboration between special and regular education is extremely informal, and depends almost entirely on the relationships between the specific teachers involved. With exception, the special education teachers have become invol‹ in the microcomputer system relatively late (at the start o: third year, fall 1981), and they use the microcomputers for computer-assisted instruction, a relatively low priority in Prescott.

There was no specific plan for collaboration between t! special and regular education users of the microcomputers. of the special education teachers took the early inservice training, and they have added microcomputers to the variety other resources in their resource rooms. Purchasing, set u and maintenance were handled by the coordinator of computer

education, along will all other microcomputer applications in
Prescott (except for the new Special Education/Vocational
Education diagnostic system that will use Apple microcomputers
rather than the district-standard Commodore units.)

In practice, many of the special education teachers work
closely with the regular classroom teachers in scheduling
microcomputer lessons, just as they have always done when using
other teaching methods. The special education teachers discuss
the needs of their mainstreamed students with the regular
classroom teachers and try to give the students practice in the
skills they need for their course work. Specifically, they try
to give the special education students drills on classroom
spelling words and arithmetic skills.

Administrative and Instructional Applications

The original needs-assessment committee recommended that
microcomputers be used for instructional purposes, while the
minicomputer was to be used for the district administrative
needs. Initially, this division was strictly maintained and all
microcomputer uses originally instructional. As teachers and
administrators gained familiarity with the capabilities of
microcomputers, they have become interested in computerizing a
number of tasks that have been done manually in the past. One
of the major examples is in the Special Education/Vocational
Education program. This program provides vocational training
for special education students. It operates at one of the
junior high schools, with junior high and high school students.
The program has a Commodore PET microcomputer that is used for
computer-assisted instruction in vocational training, but it is
also being used now to create local norms for special education
students.

In addition, Special Education/Vocational Education is
currently developing a system of diagnostic programs for the
special education students,using an Apple microcomputer. The
diagnostic programs are part of a pilot project being conducted
with the University of Arizona. This application is unique and
is separate from other microcomputer uses in the district.

Other tasks are now being transferred to the microcompu-
ters. A major example is the scoring and processing of the CUES
tests. These are tests of the local instructional objectives,
given twice a year. Arizona requires such a system, but the
systems are locally developed. In the past, scoring was done in
Phoenix, and data analysis was done on the district's
minicomputer. Recently, the coordinator of computer education
purchased several small mark-sense card readers and has
developed programs to score the tests. The programs are being

pilot tested now and are planned for implementation in the fall of 1983.

There is also considerable interest in transfering atten-dance and scheduling functions to the microcomputers. The interest is in improving turnaround time and control over the tasks, but it is not clear how soon, if at all, the software can be obtained (or developed).

Finally, virtually all teachers who have made extensive instructional uses of the microcomputers are also interested in using the microcomputers for classroom management functions. Again, the problem is finding time for the coordinator or other interested personnel to locate or develop appropriate software, and to provide the training that the teachers will require.

In the meantime, the instructional uses of the microcomputers are continuing to expand. Microcomputer uses are also well established in special education programs, with computer science for gifted/talented students and computer-assisted instruction for special education and disadvantaged students. The computer literacy curriculum is now available for fourth through seventh grades, and computer science classes are being implemented for eighth and ninth grade students. The high school computer science course is well established, and there are long range plans to produce an integrated curriculum for all grades (K-12).

Training

The training program is a key feature of Prescott's approach to microcomputers. The major training course has been the introductory inservice course given twice a year since the beginning of the microcomputer project. The course is aimed at computer literacy and at preparing the elementary school teachers to teach the computer literacy course. The course is voluntary, but salary increment credits are given, and the local college gives course credit to the teachers. Over 200 of the 270 teachers in the district have taken the course, and more are signed up for future sessions.

Beginning in the second year of implementation (fall 1980) an advanced inservice course has been offered once or twice a year for teachers who want to learn more advanced programming. The focus is on developing computer-assisted instruction programs. About four or five teachers out of each introductory course have proceeded to the advanced course, and it has been given three times.

Also beginning in the second year, a literacy course based

on the elementary school curriculum has been offered to parents and others in the community. This course has been offered four times so far and has been fully and immediately subscribed each time.

Emerging Roles

The major new role that has been created in Prescott is the role of coordinator of computer education. This position evolved from the position of project director of the original Title IV-C microcomputer project. The original project director held the position for two years before leaving the district. At that time, the current coordinator was given a half-time position, while continuing to teach computer literacy half-time. Next year (1983-84), the position will be made full-time if the board approves the new budget. District commitment to the position is indicated by the fact that the coordinator already has an office (two rooms with a secretary) in the district office building.

Other new positions that have been created include computer science teachers at the two junior high schools. In addition, some pre-existing roles have been altered. The elementary school librarian has been very much involved in the microcomputer project from the beginning, and she has had responsibility for software in the five elementary schools. (There is one librarian with an office in the district building, plus an aide in each school library.) The software can only be checked out by teachers. In addition, each library has a microcomputer for use by the students.

Most elementary school teachers have added the teaching of computer literacy to their previous duties. Many teachers have added programming to their standard teaching tasks, but the major role changes have involved the consulting and support functions that several teachers have added. These teachers are the informal computer leaders in the various schools, and other teachers come to them for help on all aspects of computer use.

Other new functions that have been added include the review of software conducted by an ad hoc group of about a dozen teachers and students in June 1982. Similar review groups are planned for the future. In addition, several teachers have been involved in the development of the computer literacy curriculum.

The head of one junior high school math department has joined the coordinator in giving workshops around the state for other educators. The Special Education/Vocational Education coordinator has become involved in vocational education assessment in collaboration with the University of Arizona. Several

teachers are now getting involved in the new test scoring
project using the microcomputers and card readers.

SHELBY CITY SCHOOL DISTRICT
Shelby, Ohio

Case Study Report

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I.   SUMMARY NARRATIVE AND CHRONOLOGY

The School District

        Shelby City School District encompasses roughly 58 square
miles of Richland County, which has been described as the
"industrial heart" of North Central Ohio. Most of the residents
are employed in one of three large industries: Ohio Steel Tube
Company, Shelby Business Forms, and Shelby Mutual Insurance
Company. The Shelby community has a residential population of
approximately 10,000, which has remained stable over the years
although industrial unemployment is currently a problem. In
general, community members describe Shelby as providing "small
town life" with access to the larger cities of Columbus and
Cleveland.

        Shelby City School District is an autonomous district
that currently serves 2,800 students in grades K-12. Almost all
the students are white, with less than one percent minority.
There are six schools: four elementary schools (one K-6 and
three 1-6), one junior high school (7-8), and one senior high
school (9-12). Also located within the district is a regional
vocational school, which offers programs to 200 juniors and
seniors from Shelby, as well as students from 14 neighboring
districts.

        Of the total student population, 210 students receive spe-
cial education services. At the elementary school level, two of
the schools house all the self-contained special education
classrooms. The junior high school has two special education
classrooms and the senior high school has a learning
disabilities resource center and two special education classes
for students identified as developmentally handicapped.

        However, there are not enough special education students to
warrant a full-time position for directing special education
services. At one time, the assistant superintendent was respon-
sible for special education services, but that position was
eliminated in 1982. Presently, the administration of special
education is shared among three people. First, the high school
guidance counselor is responsible for some special education
services--e.g., mailing referrals and IEPs for the entire dis-
trict, attending regional meetings, and generating reports.
Second, the coordinator of special programs handles the funding
and accounting for the special education programs and all mate-
rial and equipment requests. (Both of these people report
directly to the Superintendent.) Third, the district psycholo-
gist is responsible for most of the testing, screening, and
placement of special education students, and he reports to the

guidance counselor. In none of these cases is the special
education responsibility a full-time position.

In addition, the district contracts with the county for
special education supervisor to work directly with the specia
education teachers on curriculum development and to serve on
student placement committees. The position is a resource to
teachers but carries no line authority. The district's ten s
cial education teachers (seven elementary, three secondary) a
supervised by their principals, who in turn report to the Sup
intendent.

The students in the Shelby schools have access to a tota
of 18 microcomputers. The units are located in all six schoo
In addition to these microcomputers, the district has access
a Burroughs mainframe computer at the regional vocational sch
through two terminals in the district office. The mainframe
used by the district administration to schedule secondary sch
programs and to support the district's budgeting and accounti
systems.

Overview of Microcomputers Studied

Microcomputer applications in Shelby vary across schools
and among individual classrooms, reflecting the interests and
objectives of the users. Of the 18 microcomputers in the dis
trict, 13 (8 TRS-80, 4 Commodore, and 1 Apple) are located in
the elementary schools. These are used with gifted/talented,
special education, and fifth and sixth grade students. There
are three microcomputers (two Apple II-Plus, and one TRS-80)
the junior high school, used only with the special education
gifted/talented students. The senior high school has two mic
computers (two Apple II-Plus), one for the senior computer c
and the other in a special education classroom.

The microcomputer applications are primarily instructio
with only very limited administrative uses by a principal an
senior high school science teacher. Examples of microcomput
use are:

- A sixth grade class uses a self-directed program-
  ming course, "Meet the Computer," which is a set
  of card files that teaches programming through a
  sequence of computer activities.

- A special education classroom in the senior high
  school has a microcomputer that is used by the
  students for drill-and-practice games. The
  microcomputer is seen primarily by teachers as

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an instructional tool for remedial work in basic skills.

● Two sixth grade classrooms each have a microcomputer which is scheduled for use by all of the students every week. Students use it for computer-assisted instruction (drill-and-practice) in math and reading with some opportunity to play games such as backgammon and micro-chess.

● At the junior high school, the gifted/talented students are given six weeks of programming instruction using high-resolution graphics on a TSR-80 Color Computer.

● One elementary school principal uses a microcomputer in his office for staff information and evaluation files. During the teacher review conferences, the information is displayed on the computer monitor to facilitate discussion between the principal and the staff member.

● Another elementary school principal has a micro-computer in his office which is used by the gifted/talented students for their before-school program. Students, in pairs, are rotated through his office during the week to learn the writing of basic programs or to play popular microcomputer games such as backgammon and blackjack.

● A Senior Computer Class is offered to twenty students each semester, to learn computer awareness and basic programming. One microcomputer is used for demonstration purposes, with students scheduling individual time for programming assignments.

Chronology

The district's first microcomputers, five TRS-80 (Model I's), were purchased in the summer of 1980 with funds from an ESEA Title IV-C grant. The grant proposal was written by the principals and several teachers from two elementary schools. The aim of the grant was to provide the gifted/talented students with computational drill-and-practice and with experience in microcomputer operation and programming. The project funds also supported the purchase of software.

As use of the microcomputers became more visible in the

district during the 1980-81 academic year, the other two elementary schools decided to purchase microcomputers with gifted/-talented supply funds and Title IV-B monies. At the same time, staff at the junior high school realized that the sixth graders who were learning from the elementary classes would have nothing to expand their skills upon when they reached the seventh grade. Consequently, Title IV-B funds were used to acquire a TRS-80 color microcomputer. The funding was arranged by the coordinator of special programs who had taken an interest in expanding microcomputer use in the district.

A year later, staff at the senior high felt that a micro-computer was needed, to enable the incoming students to continue their programming work. Also by this time, computer use had expanded in some schools beyond the small numbers of gifted/-talented students, as individual teachers began to acquire more software and see the advantages of using the microcomputers for instructing all of their students.

The first microcomputer for special education was purchased at the request of a special education teacher in one of the elementary schools in the winter of 1981-82. The coordinator of special programs began at this point to use more of the Title VI-B federal funds to acquire microcomputers for the other special education classrooms. As funding became available during the 1982-83 academic year, microcomputers were provided to one special education classroom in each of the junior and senior high schools, as well as to another elementary school special education classroom.

The growth and expansion of microcomputer use and applications in the district has been primiarily at the initiative of individual, interested teachers and principals. During the early implementation, no district-wide inservice training was available. However, one school used a consultant, under the original funding proposal, to provide several brief inservice demonstrations. Most of the teachers were either self-taught or only knew the rudiments of operating microcomputers. It was the previous Superintendent's strategy, according to the coordinator of special programs, to provide a "facilitative, not directive, atmosphere" by providing microcomputers, but allowing those interested to seek their own training. However, the absence of training, combined with a lack of software, resulted in underuse of microcomputers in some schools. Currently, units at two elementary schools are underused, either because they are new and have not been allocated to teachers, or because there is no strong interest or direction for utilizing them.

It is the responsibility of individual principals to provide direction and coordination regarding the use of micro-computers in their schools. The principals, in turn, may dele-

gate the development of specific applications to the discretion
of individual teachers. Apart from the coordination of funding
by the special programs director, the scheduling, training,
maintenance and software purchases are channeled through the
principals, whose interest and involvement vary at each site.

The lack of district-wide coordination and direction has
not gone unnoticed. A Computer Committee was organized in
January 1983, with representatives from each school. The com-
mittee has begun to address the need for a K-12 computer course
of study and a system-wide agreement on the future purchase of
hardware and software.

Major events in the history of microcomputer implementation
in the Shelby City School District are presented in Table 1.

Table 1: Chronology of Implementation   Shelby City
                                                      School District

Date
Month   Event
_____

1979-1980 Academic Year

Feb. 1980   Resubmission of ESEA Title IV-C
                                   proposal (Project INPUT) requesting
                                   five microcomputers and software.

April 1980   Awarded ESEA Title IV-C grant for
                                   computer project.

July 1980   Purchased five TSR-80 Model 1 (4K &
                                   16K) and starter software packages.

1980-1981 Academic Year

Nov. 1980   Teacher inservice with consultant
                                   at two elementary schools (10
                                   weeks - 30 hours).

Dec. 1980   Purchased one TRS-80 Color Extended
                                   Basic unit.

March 1981   Purchased two TRS-80 Model I micro-
                                   computers.

June 1981   Summer course offered in BASIC pro-
                                   gramming for grades 4-9 (1 week -
                                   15 hours).

1981-1982 Academic Year

Sept. 1981   Purchased one Apple II-Plus.

Sept. 1981   Shelby Super Satuday courses offer-
                                   ed in computer literacy and basic
                                   programming for grades 3-9 (6
                                   weeks - 12 hours).

Dec. 1981   Purchased one TRS-80 Model III and
                                   one Apple II-Plus.

Feb. 1982	Upgraded original TRS-80 Models to 48K capacity and purchased one 16K TRS-80 Model III.

1982-1983 Academic Year

Sept. 1982	Upgraded 16K TRS-80 to 48K capacity and equipped with dual disk drive and printer.
Nov. 1982	Purchased one Apple II-Plus with dual disk drives and printer.
Nov. 1982	Teacher inservice at one elementary school on computer literacy (6 weeks - 12 hours).
Jan. 1983	Computer Committee formed to establish district directions for computer program.
Jan. 1983	Complied district-wide listing of software.
Jan. 1983	District teacher inservice with computer workshop (1 hour).
Jan. 1983	Purchased one Apple IIe microcomputer.
Feb. 1983	Purchased one disk drive for each elementary school.

II. FEATURES OF THE MICROCOMPUTERS

Introduction

There are 18 microcomputers of differing hardware types in the district's six schools. The four elementary schools have 13 of these microcomputers. One elementary school has three TRS-80 models, equipped with cassette players, located in the fifth and sixth grade classrooms. A second elementary school has two TRS-80 models, allocated to a special education classroom and to the gifted/talented resource room. A third elementary school, in addition to two TRS-80's, has recently acquired four Commodore 64's with tape recorders. These microcomputers are located in the fifth and sixth grade classrooms, with the exception of one unit in the principal's office. The fourth elementary school has one TRS-80 Model I unit and one TRS-80 Model III unit, located respectively in the principal's office (for use by the gifted/talented students) and in a special education classroom.

At the junior high school, there are three microcomputers: one Apple II-Plus with disk drive and printer, one Apple IIe with disk drive, and one TRS-80 Color Extended Basic unit. One of the computers is located in the principal's office. The senior high has two Apple II-Plus microcomputers, both with disk drives and printers. One computer is used for a senior computer class and is in a storage room of the science department, the other microcomputer is located in a special education classroom.

Management of the Microcomputers

Most of the microcomputer purchases, including those for special education, have been managed by the coordinator of special programs, who is responsible for all federal and special funds. The purchases were all approved by the Superintendent and school board. In some cases, the initial decision to adopt microcomputers for special education classes was made by the coordinator, and not by the special education teachers. Several special education teachers indicated that they were directed to use microcomputers in their classrooms. One microcomputer purchase occurred against the expressed wishes of two special education teachers.

The purchase of microcomputers for regular education and gifted/talented students has also been handled by the coordinator of special programs when the use of federal or special funds has been involved. However, when independent funding was used--such as proceeds from school fund-raising events or P.T.O money--principals have independently purchased

microcomputers and made independent decisions regarding the use of the equipment.

Apart from purchase and allocation, the district has no single person responsible for coordinating the implementation or use of the microcomputers. Once microcomputers are allocated to a school or an individual teacher, decisions regarding software, training, and scheduling are left to the teachers and principals. In general, software requests and hardware maintenance are the responsibility of the principals. Thus, the extent of use reflects the leadership, support, and direction of principals or teachers.

A newly-formed computer committee is beginning to question the lack of district-wide coordination and the isolated adoption of different hardware. With representatives from each school, the committee plans to develop district guidelines for hardware and software purchases and to develop a computer program encompassing all grade levels. The committee has the authority to make recommendations directly to the Superintendent.

Illustrative Applications

To provide an idea of how the microcomputers are being used in the Shelby schools, two illustrative applications are described below.

CAI/CMI in High School Special Education Classroom. A special education teacher was excited about the possibility of using computer programs to develop the eye/hand coordination skills of her 17 special education students. Given the choice between an aide and a microcomputer, she chose the microcomputer.

The microcomputer, a TRS-80 Model III with dual disk drive and line printer, is located at the back of her classroom in a "Computer Center" along with other audio-visual equipment. As students complete their "seat work," they take turns using the computer for at least 30 minutes daily. Students are allowed to work independently at the microcomputer after receiving operating instructions and program demonstrations from the teacher. However, only certain students are allowed to load the disks and use the printer because of some earlier abuse and damage. According to the teacher, students respect this arrangement, as they do not want to be denied access to the microcomputer.

The most frequently used program package is the Radio Shack series of computer-assisted instruction (CAI) software in mathematics for grades K-12. It has a student management capability (computer-managed-instruction) that allows automatic

progression (and return) from one lesson to the next, and records each student's progress in a skill area. Students also use the microcomputer for a variety of educational game programs that focus on motor coordination or specific skills such as vocabulary and grammar. In addition, the microcomputer is used for the class's "alfalfa sprout business." All the business accounts and records are kept on the microcomputer. Shares of stock are sold in the company. The microcomputer was used to type and print letters to the stockholders who received an annual dividend check of four cents per share.

Individualized Instruction/Tutoring in an Elementary School. At one elementary school, fifth grade students are involved in a tutoring program. Two mornings per week, the school's three TRS-80 microcomputers are moved to a location in the hallway. Half of the students in the class report to the reading teacher who tutors them in reading, and the remaining fifth graders are involved in the microcomputer tutoring program.

Each fifth grade student is teamed with one first grader. Each team works together for 15 minutes, using a math program written by the fifth grade teacher after his review of the first grade math text. Teams share the microcomputers, and three teams can be working at any given time. Each fifth grader works with the same first grader for a five-week session. The fifth grade students are proud to show the first grade teacher how their "students" are doing. The fifth grade teacher keeps the print-outs of student progress. Students are presently participating in the first five-week series. During the next series the teacher will give his fifth graders additional instructions in order for them to further direct their "charges" on how to use the microcomputer.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The first microcomputers in the district were purchased
through ESEA Title IV-C funds. Their use was shared and coor-
dinated by staff at two elementary schools, to provide gifted/-
talented students with math computation drills and experience in
microcomputer operation and programming. Since this initial
coordination between two schools during the Title IV-C project,
the subsequent expansion of microcomputer use in the district
has been very decentralized. In successive years, additional
microcomputers were purchased for the remaining two elementary
schools, followed by purchases for the junior and senior high
schools. Most purchase requests were initiated by interested
teachers and their principals. Purchasing decisions have been
made at the building principal level, unless federal funds were
used for the purchase.

When purchases involved federal funds, requests were
directed to the coordinator of special programs. His decisions
are approved by the Superintendent. His early involvement with
administration of the first federally sponsored project involv-
ing microcomputers (Title IV-C), coupled with his responsibility
for administering federal funds, led to individuals seeking him
out with their microcomputer requests. Nevertheless, this
responsibility has not been added to his formal job description.
He has also been very instrumental in providing microcomputers
for special education. Several units were purchased for special
education classrooms with available federal funds. All proce-
dures, however, regarding scheduling of use, maintenance, secur-
ity, and software purchases, have been determined by individual
principals and teachers.

There have been two district-wide, one-hour inservice
training sessions on microcomputers, and one county-wide, two-
hour inservice on computer use. However, most training is left
primarily to the individual teachers, whose interest and initia-
tive determines whether they teach themselves, take an outside
course, or get some training from other, more experienced teach-
ers. The teachers using microcomputers to teach programming at
the junior and senior high schools have taught themselves and
developed their courses independent of each other. Different
types of microcomputers were purchased separately by the
schools. As microcomputer use has expanded to include CAI as
well as programming, software purchases have become necessary.
Staff at the schools have now become aware of significant
software incompatibility problems, as they attempt to share
software and information between buildings.

Teachers are also concerned with a question of efficiency--
how much of a student's time is spent becoming acquainted with
several different kinds of microcomputers, as the student pro-
gresses from elementary, to junior, to senior high schools.
Because of this evolution, the Shelby staff and the Superin-
tendent felt that additional coordination would be valuable. In
January 1983, a Computer Committee was established. The esta-
blishment of a committee is characteristic of administrative
practices in the district. There are at least seven committees
that report to the Superintendent on issues ranging from dis-
trict philosophy to inservice training. The structure and pro-
cess of the Computer Committee is similar to the others. The
committee chairperson is a principal who was appointed by the
Superintendent. Committee members include the coordinator of
special programs, as well as principals and teachers. Interest-
ed principals and teachers from all the schools were encouraged
to become members. There is presently at least one person
representing each of the Shelby City schools.

Members of the committee feel that they are at a crossroad
and may need to decide on one type of hardware for all future
purchases. No procedures for hardware/software acquisition have
been determined yet, and all purchases are essentially on hold.
It is expected, however, that software/hardware purchase recom-
mendations will be made before the end of the school year, in
order not to lose available federal funds.

The introduction of the microcomputer has not affected
mainframe applications in the district. These include budget-
ing, secondary scheduling, payroll, and secondary attendance.
(The district presently uses the Pioneer Computer Consortium at
the regional vocational school for these services.)

Special and Regular Education Interaction

No particular collaboration between regular and special
education teachers occurred during the initial implementation of
microcomputers in the district. This is the first full school
year that both regular and special education teachers have had
microcomputers, and they are still working in relative isolation
from one another. All microcomputers presently being used by
the special education teachers were purchased with special edu-
cation funds. This has obviated the need for shared usage dis-
cussions between regular and special education teachers. One
special education teacher who is particularly enthusiastic about
computer-assisted instruction has been working on her own ini-
tiative to get other sixth grade teachers in her building inter-
ested in microcomputers. She has loaned out her microcomputer
to one interested teacher and has set up demonstrations for the

other teacher's students.

At the present time, gifted/talented and special education students have more opportunity for microcomputer use than other students. There were no indications that regular education teachers without microcomputers feel that they have been left out. The teachers who are presently most interested in using microcomputers already have them. This is reflected in the number of microcomputers (more than three) that are available in some schools and are not regularly checked out by teachers for classroom use.

The special and two regular education teachers using microcomputers at the high school have begun an informal relationship for sharing information, software, and microcomputers. The special education teachers at this school cannot accommodate requests by the regular education teachers to use the special education computer for periods during the day. Microcomputers bought with special education funds must be located in special education classrooms. Students assigned to those classrooms have first priority for use of the microcomputers. If no special education students need the microcomputer, a regular education student can use a special education microcomputer on a casual basis.

Administrative and Instructional Applications

The present applications of the microcomputers are primarily instructional. The first microcomputers in the district were purchased through a grant which designated their use for instructional purposes. Subsequent purchases have been a result of teachers' requests for instructional use, or of the coordinator of special program's interest in using EHA Title VI-B funds to establish computer-assisted-instruction in special education programs.

One principal shares a microcomputer with his teachers and uses it for an administrative application: storing personnel information and displaying staff evaluation summaries during individual teacher conferences. He is the only administrator presently using a microcomputer in this way.

Several principals have expressed an interest in future administrative applications. One principal feels this is at least five years away, and the Computer Committee is only giving attention to instructional issues. One principal uses a microcomputer rather extensively but only for instructional applications. He conducted a six-week course in computer literacy for 12 interested teachers. The course was held twice each week before school. He is presently going into classrooms (grades

two through six) for five-week demonstrations that are arranged with individual teachers.

One principal has a computer in his office while he is learning to use it so he can teach other teachers. Another principal has one in his office for use by gifted/talented students because there is no other space available. All of these additional uses by principals reflect instructional rather than administrative applications.

The existence of the mainframe (time-sharing) services for budgeting and scheduling does not preclude administrative applications with microcomputers. Rather, the growth of such usage is limited by the availability of microcomputers, and by the time and training required to determine how to implement effective administrative applications. The Superintendent related that, although he personally would not have the time to use a microcomputer, at least one person at the district office is interested. Alternatively, he felt that purchase of a micro-computer for the district office would not be well received at this time. Rather, any microcomputers purchased should be made available to the students. The Superintendent also related that teacher representatives with access to a microcomputer appeared to have an advantage during budget/salary negotiations with the school board. This was due to their quick ability to produce spread-sheet data on personnel and expenses.

Training

During the Title IV-C Project, the school board paid for a ten-week training course taken by the first five persons in the district to use microcomputers. Since that time, there has been very little district-sponsored training, and most users are self-taught. It was the Superintendent's strategy, according to the coordinator of special programs, to only provide microcompu-ters to interested teachers and, thereby, to encourage them to generate their own pressure to learn. There have been two dis-trict-wide inservice meetings attended by approximately 12 teachers but lasting only one hour each. In addition, there was one county-wide inservice on microcomputer use. All four of the users at the high school are self-taught. One of the junior high users is self-taught. The other user has taken an "Apple II and YOU" course at the local technical college.

One elementary principal has taken courses at Radio Shack. He conducts before-school training sessions for interested teachers at his school. He simultaneously encourages his teachers to use the one microcomputer that is available for general use at his school. Another principal is hoping to offer more training through a free program sponsored by Radio Shack.

Several teachers at one school have taken a course at the local technical college and several teachers at another school are presently taking a course at the regional vocational high school. Some teachers are not aware of any training available to them.

There is no formal mechanism that would allow those who learn about outside training at one school to share that information with interested staff at other schools. Some teachers who have not received formal training have been interested enough in the microcomputer to teach themselves programming. They then go on to introduce programming to their students. For others, however, the implementation experience has not been as satisfactory and, according to some teachers, has been marred by the lack of training and software.

In some instances, microcomputers were assigned to teachers who were not highly motivated to use them. Several of these teachers do not know how to load diskettes. They have little or no software and don't know what to order or whether there is money for software. Several teachers said that they were able to use commercial software and had taught their students how to load the microcomputer. However, they felt that they were probably misusing the microcomputer because they didn't know how to program it as other teachers did.

Emerging Roles

No new roles have been formally created to coordinate the implementation of microcomputers in the district. The coordinator of special programs has been instrumental in securing microcomputers through various federal funding sources. His activities were, however, limited to his financial role in securing microcomputers and related materials. He continues to be sought out for information about federal funding possibilities for microcomputers. Most administrators and teachers felt that his responsibilities did not include coordination of the microcomputer applications. Building principals have assumed primary responsibility for microcomputer use and maintenance.

The recently formed Computer Committee, chaired by a principal, will draft recommendations regarding coordination functions as part of their recommendations to be submitted to the Superintendent for approval. It is not anticipated that coordination responsibilities will be delegated to any one person in the district.

There have been no additional salaries to any school personnel for microcomputer related activities during the school

year. There are no indications that this will change. Some of
the teachers have served as instructors at the two district-wide
inservices. Also, several teachers instruct students in micro-
computer classes on "Shelby Super Saturdays."

MADISON PARISH SCHOOL SYSTEM
Tallulah, Louisiana

Case Study Report

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I. SUMMARY NARRATIVE AND CHRONOLOGY

The School District

The Madison Parish School System is located in extreme
northeast Louisiana, on the bank of the Mississippi River. The
school district's administrative offices are located in the town
of Tallulah, which is the parish seat and largest town. The
residential population served by the school system is approxi-
mately 13,000. The economy of the district is agriculturally
based and, until the mechanization of farming in recent years,
was dependent on manual labor. With the decline of needed labor
and the absence of alternative employment opportunities, the
rate of unemployment is 18-19 percent in this area. Presently,
the school district is the largest employer in Madison Parish.

The student population of the school system is 3,800,
slightly less than previous years. Ninety percent of the stu-
dents are Black, and 95 percent of all the students qualify for
compensatory education funds. The Madison Parish School System
consists of ten buildings: three administrative offices and
seven school sites. One of the administration buildings is for
central district functions, one is for Title I functions, and
one building contains the special education services. Five of
the schools--two elementary, one junior high, and one senior
high-are located in Tallulah. The other two schools are a K-12
school located in Thomastown and an elementary school in Waver-
ly.

The special education program in the district has expanded
during the last five years from 3 to 16 resource and
self-contained classrooms, now serving approximately 380
students. In addition to the 16 special education teachers in
the schools, there are three preschool teachers, who conduct
home visits and early evaluation activities, and four speech
therapists. The special education program also employs a school
psychologist, a social worker, and an assessment teacher, who
are responsible for pupil evaluation and placement
recommendations. The supervisor of special education
coordinates and manages the entire special education program in
the district. He reports directly to the Superintendent.

All of the microcomputers in the school system are used for
either administrative or instructional special education activi-
ties. In the special education administrative offices, there
are two Intertec Compustar microcomputers used by the super-
visor. Ten microcomputers (one TRS-80 and nine Commodore PETs)
are distributed in special education classrooms throughout the
district. In addition, two Franklin 1200 and six Franklin 1000

microcomputers have been purchased for a basic skills lab at t
junior high school.

Overview of Microcomputers Studied

The microcomputers chosen for the focus of this study are
the two Intertec Compustars located in the special education
administrative office. The units are used exclusively by the
supervisor of special education for administrative applicatio₁
The microcomputers are used for data base management, word
processing, and other administrative software packages.
Examples of administrative use include:

- The monitoring of students' Individualized Educa-
  tional Plans (IEP);

- Notification letters to parents for IEP conferences;

- Student data records for forms and reports;

- Inventory of special education materials and equip-
  ment;

- Word processing for the Special Education Policies
  and Procedures manual;

- Listing of microcomputer equipment in district with
  locations and acquisition dates;.

- Special education accounting with budgeted items
  and list of expenditures;

- Annual special education and speech reports.

Chronology

Microcomputer technology was introduced into the Madisor
Parish School System by the supervisor of special education i
1977. The supervisor had become interested in the possibilit
of microcomputer technology from an article in a Popular
Mechanics magazine. After purchasing a DMS microcomputer foi
his personal use at home, he soon realized the applicability
the microcomputer for special education functions. He starte
by using his home computer for storing demographic data on sp
cial education students with a data base management program i
for developing report formats with word processing. At appro
mately the same time, a special education supervisor in a ne:
boring district was exploring microcomputer use, so the two

supervisors began to exchange ideas informally.

The Madison Parish supervisor decided to approach the
school board about the possibility of the parish purchasing a
microcomputer for special education services. Convinced of the
feasibility and cost effectiveness of using a microcomputer in
their small, rural parish, the school board approved the acqui-
sition of one unit. Based on the supervisor's evaluation of
available hardware and bid results, one Intertec Compustar and
printer was purchased in the fall of 1979, using federal special
education funds.

A second Intertec Compustar was added to the special educa-
tion office in the fall of 1982, using additional federal spe-
cial education funds. Both microcomputers are used extensively
by the supervisor of special education for a variety of adminis-
trative tasks.

In addition, the supervisor developed a comprehensive track-
ing system for the special education students in the district.
The local company that assisted in the design of the software
has sold the program to 14 other districts in the state. The
supervisor of special education was involved in the implementa-
tion of the system in the other school systems. He often makes
presentations and holds inservice training in the neighboring
districts. The microcomputers in Madison Parish are connected
by modem to another district's microcomputer so the special edu-
cation supervisors can exchange information and resources. In
the fall of 1983, the Madison Parish School System will be par-
ticipating in a pilot project to implement a statewide computer-
ized student tracking system similar to the existing microcompu-
ter program.

Apart from his involvement in the implementation of admin-
istrative microcomputers in the special education office, the
supervisor was instrumental in acquiring microcomputers for in-
structional use in special education classrooms. The supervisor
coordinated the purchase of ten microcomputers (nine Commodore
PETs and one TRS-80) and software, using special education cur-
riculum funds. He is responsible for managing the use of the
microcomputers, including maintenance, training, and technical
assistance. It must be noted, however, that the microcomputers
for instruction are entirely separate in their management and
use from the units for administration.

The major events in the implementation of administrative
microcomputers in the Madison Parish School System are presented
in Table 1.

Table 1: Chronology of Implementation   Madison F
                                                         School Sy

Date Month-Year	Event
1977-1978 Academic Year	
Fall 1979	Supervisor of special educatiou chases microcomputer for home ι and develops reports and forms special education.
1978-1979 Academic Year	
March 1979	Approval granted by school boa purchase one microcomputer for special education services.
1979-1980 Academic Year	
Sept. 1979	Purchase of one Intertec Compu and printer with federal speci education funds.
1980-1981 Academic Year	
Sept. 1980	Presentation on administrative applications of microcomputers two state conferences by super of special education.
Fall 1980	Course offered to administrato and teachers on microcomputer cations through the Profession provement Program Points.
Spring 1981	Supervisor of special educatic provides inservice to other sc districts.
1981-1982 Academic Year	
1982-1983 Academic Year	
Sept. 1982	Purchase of one Intertec Compu and printer for special educat

II. FEATURES OF THE MICROCOMPUTERS

Introduction

Presently, the special education administrative offices have two Intertec Compustar microcomputers. Both units are equipped with disk drives and printers (one dot matrix and one NEC 7710 letter-quality printer). One of the microcomputers is located behind the clerical aide's desk for data entry purposes. The other unit is placed behind a room divider in the rear of the office, creating a separate workstation for the special education supervisor's use.

The microcomputers are used on a daily basis by the special education supervisor and the clerical aide. The supervisor estimates his use to be approximately three hours daily and the aide's use (of the other unit) four hours daily.

Management of the Microcomputers

As the primary user of the microcomputers for special education administration, the supervisor of special education is responsible for all aspects of their use. He handles the funding and purchasing decisions, installation, maintenance, and software acquisitions. The supervisor is responsible for keeping the Superintendent and school board informed of his microcomputer activities.

In addition, the supervisor has been instrumental in assisting the other microcomputer adopters in the district. He was responsible for purchasing the microcomputers for instructional use in special education classrooms. As a result, he provides coordination and technical assistance for these units. The supervisor has the only computer expertise in the district, so he informally serves as the "microcomputer specialist" for the entire district. In the absence of planning groups or committees, the supervisor has acted alone in guiding the adoption and expansion of microcomputer use in the Madison Parish School System.

Illustrative Application

To provide an idea of how the microcomputers are being used for special education administration in Madison Parish, one illustrative application is described below.

Student Tracking System. The administrative tracking system for special education students represents the most unique application in the district. The program was custom-designed by a programmer with MicroTechnology, in conjunction with the supervisor of special education. It is a Modular Software System, set up to handle general business and fund accounting in addition to the special education student tracking. (The program allows a user to purchase only the needed modules, with the option of adding other modules later.)

The Special Education module is used to create and maintain files about students in special education programs. Optional routines include capabilities for adding, examining, listing, and deleting the student records. The supervisor uses the computer files to enter data on the progress of students. He is then able to print a variety of reports such as IEP revisions, dates, pupil appraisal summary reports, evaluation process reports, and principals' Special Education Reports. Also, detailed reports can be printed showing the status of each student and the students needing updates of their records.

Since the implementaion of the program in the Madison Parish School System, approximately 14 other districts have purchased the software package along with an Intertec Compustar microcomputer. The supervisor is recognized as the initiator of this program and often travels to other districts to provide consulting and training.

III. ORGANIZATIONAL ISSUES

Centralization and Decentralization

The microcomputers used for special education services in the Madison Parish School System are highly centralized with regard to their adoption, implementation, and use. The decision to adopt was made by the supervisor of special education, who was interested in the microcomputer's capablities for administrative tasks. On his home computer, the supervisor began using a data base management program for student records and a word processing program for office forms and reports. It was based on his experience and knowledge that the school board approved the purchase of Intertec Compustar microcomputers with federal special education funds.

As the primary user, the supervisor of special education has complete control over the location, scheduling, and use of the two microcomputers. The units are designated exclusively for administrative use in special education. The supervisor has been responsible for obtaining all the software programs as well as having new programs designed for specific administrative functions. He alone decides on which applications to use in the delivery of special education services. The supervisor is continually expanding the microcomputer activities with recent additions including accounting, a student tracking system, forms, manuals, and equipment inventories.

In the adoption of microcomputers for instructional use, the supervisor of special education purchased a separate system, operated independently of the microcomputers for administrative purposes. The instructional microcomputers are a different type of hardware and only use instructional software. Even though the instructional microcomputers represent a separate system, they are also centralized in terms of purchasing decisions, software acquisition, location, and applications. The supervisor handled both the acquisition of the microcomputers with special education funds and the allocation of the units to special education resource rooms. Use of the microcomputers is identical in each resource room because teachers have the same software programs for computer-assisted instruction in basic skills.

Special and Regular Education Interaction

The use of microcomputers in the Madison Parish School System has not affected the pattern of collaboration between regular and special education. The two Intertec Compustars are

used exclusively for administrative purposes in the special
education services office. In part, their use is restricted to
special education because they were purchased with federal spe-
cial education funds.

In planning for implementation, the supervisor of special
education acted alone except for final approval given by the
school board. The supervisor is responsible for all aspects of
the microcomputers, including acquiring software, developing ne
applications, self-training, and maintenance. In addition, by
being the only user, except for his clerical aide, the need for
collaboration is not even an issue.

The supervisor of special education also is responsible fo
the microcomputers used for instructional purposes. These unit
were purchased with special education funds and allocated only
to special education resource rooms. As a result, regular edu-
cation is not involved in any microcomputer use in the district

Administrative and Instructional Applications .

In adopting microcomputers, the supervisor of special edu-
cation planned only for administrative applications in special
education services. No consideration was given to regular
education administrative applications or instructional uses.
The supervisor's priority was to computerize the recordkeeping
and other administrative tasks needed for tracking, evaluating,
and reporting on special education students. The supervisor
adapted existing software such as data base management and word
processing programs for some administrative functions specific-
ally for special education. One software program was custom-
designed by a local programmer for a comprehensive tracking
system for special education students.

The original administrative uses of the two microcomputers
are continually developed and expanded as more programs become
available and more capabilities of the microcomputers for spe-
cial education services are recognized. The data base manage-
ment program first used by the supervisor now includes student
demographic information, IEP planning and placement committee
dates, student evaluation time-lines, federal special education
counts, and reporting requirements. The word processing progra
is used for annual reports as well as over 60 forms and manuals
for special education, such as parent notifications, annual con
ferences, IEP reviews, and reimbursement reports. The custom-
designed, comprehensive student tracking system has been adopte
by 14 other districts in the last two years.

A separate set of microcomputers (nine Commodore PETs and
one TRS-80) exists for computer-assisted instruction in the

special education resource rooms. There is no overlap in terms of use, software, scheduling, or location between the instructional microcomputers and the units in the special education office. The microcomputers and software for instructional use were purchased with state special education funds that are designated only for classroom purposes. Consequently, there was no conflict in allocating resources to two different sets of microcomputers.

Training

No training was necessary for the implementation of the two microcomputers for special education services. The supervisor of special education is the primary user of the equipment and using a computer at home, taught himself both computer operations and programming. He has developed all the administrative applications for special education by either adapting commercial programs or collaborating on the design of new software. The supervisor has informally trained his clerical aide in computer operations for entering data into programs.

The supervisor's microcomputer expertise has been important to other districts adopting similiar microcomputer systems for administrative applications. Often, the supervisor provides inservice training and workshops to neighboring districts on a need basis. In addition, he made several presentations at state conferences on the use of microcomputers in special education administration.

Training for the use of microcomputers in special education instruction has been provided by the supervisor of special education. An inservice session on computer operations was offered for the special education teachers when the equipment was first placed in the resource rooms. The only additional training has been provided through the Professional Improvement Program Points in the district. Teachers can participate in five-hour workshops taught by the supervisor and receive credit for salary increases. The training focuses on computer applications in instruction and on BASIC programming. The supervisor admits that the training for teachers has been minimal because it is an additional demand on his time.

Emerging Roles

No new organizational roles have been created due to the implementation of microcomputers in the district. The supervisor of special education was the only person involved in the planning and adoption of microcomputers in special education services. He describes his involvement in implementing micro-

computers as a personal interest that has enabled him to organize and administer special education services more efficiently.

Since the supervisor has the only computer expertise in th district, he has informally assumed the role of computer specialist but it is not an official part of his position. For th central administrative office's microcomputer, the supervisor was instrumental in the purchasing, installation, training, and continues to provide technical assistance to its users. The supervisor was responsible for the purchase of the microcomputers and software for instruction, and continues to manage the system in terms of maintenance and technical assistance.