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ABSTRACT

The experience of Central Pennsylvania's Keystone Central School District (KCSD) illustrated how microcomputers can help solve some of the characteristic problems of rural schools. KCSD's Renovo Elementary School has 3 stand-alone microcomputers and the district's Buckeye High School has 12 networked microcomputers. One major benefit of the microcomputers has been to improve communication in the district; like many rural school districts, it encompasses a wide geographic area, has many widely-separated small school sites, and is isolated from major colleges, universities, and other sources of information. KCSD has found that word processing allows the fast preparation of reports and instructional materials which can be distributed via modem throughout the district. Also, electronic mail allows faster, closer communication among schools and between the administration and the various schools. Finally, on-line discussion with educational consultants is both faster and more economical than site visits. Another major benefit of microcomputers has been to address successfully the educational problems of keeping individualized records (especially as required for handicapped students by PL 94-192), improving testing and learning, increasing the quality of basic mathematics instruction, developing computer awareness among faculty and students, and increasing teacher interest in classroom research and curriculum development. (SB)

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THE ROLE OF MICROCOMPUTERS IN RURAL SCHOOLS

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THE ROLE OF MICROCOMPUTERS IN RURAL SCHOOLS

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INTRODUCTION

Naisbitt (1982) in his book Megatrends points out that the United States is in the process of moving from an industrial-based to an information-based society. He specifically focuses upon how computer technology is playing a major role in stimulating these changes. Rural school districts share in this national transformation and have some unique characteristics that are the genesis of a variety of problems which can be solved or coped with by making creative use of microcomputers and related technology. What are these characteristics?

Most rural school districts:

1) Encompass a large geographic area

2) Have their central administrative offices located a long distance from most of their school sites

3) Have a variety of small school sites that are widely separated from one another

4) Are isolated from major colleges and universities, mass media centers, state departments of education and organized retraining programs

5) Have local news coverage that tends to ignore other than local educational trends and issues

6) Have more limited budgets and other educational resources and facilities than do urban and suburban schools

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A paper presented at the National REA Convention, Manhattan, Kansas, October 1983.

7) Have small high school faculties and departments with low turn-over rates. Hence, their science and vocational curricula tend to be limited in scope and quality.

8) Have teachers who graduated from the local high school and attended only local colleges for both their undergraduate and graduate teacher training. They also tend to have a low percentage of teachers who complete masters degrees.

The purpose of this paper is to describe how one rural school district in Central Pennsylvania has begun to use micro-computer technology to cope with some of the problems associated with the characteristics enumerated above. Two microcomputer uses are described. These include--how the microcomputer is being used to improve communication and how it is being used as an educational problem solving tool.

Background Information and Microcomputer Configuration

The Pennsylvania State University and the Keystone Central School District (KCSD) have been involved in a collaborative effort over the past five years. These collaborative models and related processes are described in detail by Trueblood and Flanagan (1983) as "a relationship of mutual trust between educational groups who have decided to work toward common goals" (p.26). The general results are described in The Forum for Liberal Education (1983). One specific goal of the Teacher Corps Project was to determine through experience and formative research how microcomputers and related technology can be profitably used by rural schools to improve a school district's basic skills curriculum in mathematics and the students' and faculty's computer literacy.

A question frequently asked is do rural communities have the expertise required to learn how to use microcomputers? We found that at the Renovo school site in KCSD there were two faculty members who had on their own developed expertise with microcomputers. One of these teachers in fact owns and operates the computer store in the community. These two individuals provided the school

district with the initial in-house interest and expertise and when properly motivated and supported were able to share their expertise within and outside of the school district (Short & Woodring, 1981).

What effect did using this faculty expertise have in Renovo? The microcomputer configuration now in use in the Bucktail High School consists of twelve networked TRS-80's with dual disc drives, a printer, phone modem and an optical scanner. In the Renovo Elementary school there are three stand-alone TRS-80's with one disc drive. The high school terminials are scheduled by one teacher and are used by the special education teachers, the physics teacher, the mathematics teacher and the high school principal. The terminals in the elementary school are scheduled by the head teacher and are available to the faculty on request.

Educational computing may be considered institutionalized when commitment reaches a classroom of terminals which has been in operation for at least two years. At the level of personal commitment, several instructors share or control at least three stand-alone terminals. These persons develop or purchase educational programs to assist a small number of repeated courses and personally supervise student use.

Currently the Bucktail High School and the Renovo Elementary School are best described as being at the level of personal commitment. An attractive feature of this approach is that several faculty members remain committed to computer based instruction without losing personal contact with students. This configuration is successful when: (1) the number of students is small and the teachers are willing to maintain the system's hardware and software, (2) the students are carefully supervised, (3) the principal has a supportive attitude toward the faculty members involvement in computer activities and maintenance, and (4) the faculty are willing to share their expertise and facilities with other faculty as new needs are

discovered. Given the network system which was put in operation during the Fall of 1983 in the Bucktail High School, educational computing will probably move to the level of institutional commitment in the near future.

THE MICROCOMPUTER AS A COMMUNICATION TOOL

As indicated previously, rural schools are characterized by their location in a large geographic area and their isolation from one another and from outside educational resources. These characteristics tend to inhibit change and communication within the school district and with outside resources. In addition it prevents faculty and students from having access to data bases that are available for problem solving within and outside of the district. Microcomputers provide a new and exciting way to improve communications among areas such as those found in isolated school sites in rural school districts.

Described below are some of the communication applications and related benefits now available to the Keystone Central School District because they have invested in microcomputer technology.

Word Processing

Microcomputers are very valuable as word-processing devices for teachers and administrators. Because the school district purchased a good editor program and a printer, the teachers and the principal can now prepare and quickly revise reports, tests, worksheets, and other instructional materials in less time and with less effort. They have found that making use of this capability does mean that someone must maintain a carefully documented floppy disc library. With the addition of a phone modem, these types of materials can be sent electronically from one school site to another. This points to another capability made available by having a microcomputer, electronic mail.

Electronic Mail and Centralized Reporting

With the installation of compatable microcomputers and phone modems in several of the high schools and the KCSD central office it is possible for the central office administrators to send and receive information from these school sites when required. At sites where there are printers available, a printed copy of this information can be retained. Messages concerning changes in agenda and dates for administrative meetings, daily attendance data, instructional material and textbook inventories and arrangements for inservice sessions and other educational programs can be transmitted and discussed and immediate confirmation received. This use can replace or supplement a more costly and slower inter-office mail service that is usually limited to once a day truck or car delivery. The cost for such electronic mail service is about $1 for transmitting 3 to 5 pages. Where this capability has been used extensively it has created a new kind of closeness between administrators. In KCSD this service could be extended to teachers if the current systems were organized into a network of microcomputers.

Access to Outside Data Bases

This potential is best described by the expression now heard in Renovo. "Reach out and access someone." This expression came about when the spring flood of 1981 disrupted normal transportation and communication channels and the microcomputer was used to obtain national state and local weather forecasts to keep track of the flood stages and rainfall predictions.

Two major public data bases are CompuServe, Columbus, Ohio (1-800-848-8199) and The Source, McLean, VA (1-800-336-3330). The number of individuals and organizations who are plugged into one or more networks now approaches a million. The projection in two years is close to 10 million. Thousands of topics are currently available. They include computer shopping, stock market, poetry and electronic art,

all of which have educational implications. In addition to national types of data bases there are state-wide networks. In Pennsylvania EDNET(PA) distributes daily AM and PM educational briefs on important news items and topics. Several examples of these are attached for your references. These are now distributed to the College of Education faculty at Penn State and are available to school districts who have microcomputer facilities and wish to purchase such a service.

There are now about 1,500 data bases to choose from. They charge an initial membership fee of from $35 to $200 and then an hourly use fee. The Source and CompuServe charge about $7 an hour. Some communities have an electronic bulletin board. These are maintained free by students who love doing it. Such a service could improve communication among rural consolidated schools and the small isolated communities who support these schools with their taxes.

What you need to plug into such data bases includes a microcomputer and a phone modem which ranges in price from $70 to $700. It is also helpful to have a communication package or program. There are commercial programs that make communications a lot easier. They range in price from $20 to $200.

On-line Discussion with Educational Consultants

For rural schools the major cost of on-site educational consultants comes from providing the consultants with travel, room and board and other expenses. It is now possible for KCSD to get consultant help at a much reduced cost through on-line discussions about important topics or issues.

It is also possible for university or local consultants to look at computer programs to locate errors or provide design advice instantly through inter-terminal talk. Instructional materials can be viewed and reviewed by key users and detailed critiques may be transmitted to the developer. This sharing will motivate more teachers to author simple programs for use in their classes.

EDUCATIONAL PROBLEM SOLVING AND THE MICROCOMPUTER

There are a variety of important educational problems that rural schools can address when microcomputer technology is available. These include increasing: (1) the use of individualized record keeping, (2) the quality of basic mathematics instruction, (3) computer awareness among the students and faculty, and (4) teacher interest in classroom research and curriculum development.

Individualized Record Keeping

Once teachers begin to individualize eductional programs for a relatively large group of students (N>15) it becomes desirable to use some form of computer managed record keeping to keep track of student performance and to manage the sequencing of instruction. Individual education programs (IEP's) which are required by P.L. 94-142 for each handicapped child may be 25 pages long. These include several pages of short-term instructional objectives and related learning activities which must be updated at least annually. This document requires that a teacher spend on the average three hours per student per year. Potential lawsuits by public interest groups and parents also require that the process for developing the IEP be recorded and carefully documented. In rural schools where the number of special education teachers are limited, it is important to make maximum use of these specialist's time and energy.

Therefore, it is not surprising that the special education teachers and the principal of the Bucktail High School saw the microcomputer as a record keeping tool that would allow them to make more efficient use of their time. The principal encouraged his teachers to use their inservice time to develop a software program that could be used to record and print-out the IEP's required by P.L. 94-192. Penn State collaborated by providing the programming expertise needed to produce the program.

These professionals were also motivated by two other factors. They knew that the results of their efforts would be used by other special educators and administrators in the school district and they found out by experience that they could produce their IEP's in 1/2 the normal time required to handwrite or type these documents. This means the computer and related software now allow the two special education teachers to devote 45 hours a year to other professional tasks such as conferring with parents or working with individual students. A sample of the IEP that is now being produced at the Bucktail High School is attached for your reference.

This particular use of microcomputers is also an example of how standardizing and centralizing record keeping in general would allow a small faculty to make more efficient use of their time and, hopefully become more effective. Some of the other Bucktail High School faculty are currently considering how they can modify the software used to generate IEP's to help them improve their record keeping and reporting process.

Testing and Learning

One other attractive feature of the microcomputer is the role it can play in testing and learning. Some teachers at the Bucktail High School have used the microcomputer in conjunction with an optical scan device to administer and score tests. The results are used to provide students with immediate knowledge of their test results. The microcomputer is also being used to maintain individual and class performance records. Some teachers have begun to use the time that machine scoring saves to revise their course material based upon their students' test results. The microcomputer can also be used to provide teachers with item analysis data. This data allows the teacher to evaluate and revise individual test items and to see which content or concepts needs to be retaught. Finally, some teachers are using

the computer to furnish input to their grading system by showing which objectives have been mastered and/or by providing information needed to implement a norm-based grading system.

Increasing the Quality of Basic Mathematics Instruction

One of the more high priority tasks of a junior high mathematics teacher is to identify those students who have not mastered the basic computation skills taught in the elementary school and to provide appropriate corrective instruction. The Bucktail Junior High School mathematics teacher was no exception. He developed a criterion referenced test and identified those students who needed corrective instruction. This instruction was provided via a TRS-80 and the software program titled Radio Shack K-8 Math Program with Student Management, Volume I.

The results of his efforts are reported in his masters paper (Gordon, 1983). Briefly he found that:

1) Drill and practice provided via a microcomputer corrected the computation skill deficiencies of his student and produced a record of their performance. See the attachments for a sample student record.

2) The use of Computer Assisted Instruction (CAI) freed him to work on other important educational tasks i.e., providing enrichment activities for more gifted students.

3) The microcomputer allowed a small high school mathematics department to provide the same high quality of remedial instruction found in the more affluent high schools who can afford to hire teacher aides and who have more faculty to supervise their work.

Developing Computer Awareness Among Faculty and Students

Increasingly, competency with computers is necessary for many vocations and some leisure-time activities. Naisbitt (1982) points out that some level of proficiency with computers will soon be essential for the routine tasks of living and teaching. For rural communities with the high unemployment rate evidenced in Renovo, PA (>70% at the height of the recent recession), competence with and interest in computers and other high technology is essential to attracting industry to

their area as well as improving their children's ability to obtain employment outside the community. These factors make teaching about computers to all inservice teachers and their students a necessary goal which can be met in rural schools by introducing low-cost microcomputers.

The developmental history of microcomputers in Renovo reveals what happens when a change such as educational computing is appropriately introduced. In Renovo, The Penn State/KCSD Teachers Corps Project held inservice computer awareness workshops for the community council, administrative and elementary and high school faculty. One year later, (1981), the high school introduced its first computer literacy course and the school district purchased a microcomputer for use in the elemenary school. In 1982 the school district purchased two more microcompu.ers for the high school and provided inservice time for interested teachers to develop and purchase software. By Fall 1983 ten more microcomputers have been purchased and the business education teacher, special education teachers, physics teacher and the mathematics teachers have begun to use microcomputers to teach significant parts of their courses. We believe this developmental history shows how collaboration between a university and a school district and its constituency can be used to address educational problems such as computer literacy in rural schools and communities.

Teacher Interest in Classroom Research and Curriculum Development

Two other outcomes that were achieved as a result of introducing microcomputers into the Renovo Elementary school and the ucktail High School are the participation of the teachers in curriculum development and in action classroom research. Table I shows the subjects and topics that have been addressed because of the availability of microcomputers and an external masters degree

program which made it possible for teachers to become involved in these kinds of activities.

You will note that most of the activity is in the high school where the resource teachers we mentioned previously are located. The types of teacher participation shown in Table I were stimulated by the fact that what the teacher produced received recognition by central office administrators and by Penn State faculty who helped the teachers turn their projects into Masters papers.

INSERT TABLE I HERE

The attitude research we have done to date indicates that teachers' attitudes toward the use of microcomputers tends to be negative at the elementary school level. This attitude factor may help explain why more activity has not taken place in the elementary school where three microcomputers are available. We believe more intensive inservice is required for elementary teachers who have expressed the need to see first hand what pupil outcomes can be achieved by using microcomputers with their students. Our plans are to increase the amount of inservice in this area in the near future.

SUMMARY

This paper presents some of the unique characteristics that rural school districts have in common. It then discusses how microcomputers were used in a rural school district to cope with some of the communication and instructional problems related to these characteristics.

TABLE I. SUBJECTS, TOPICS AND GRADE LEVELS WHERE MICROCOMPUTER USES HAVE STIMULATED ACTION CLASSROOM RESEARCH AND CURRICULUM DEVELOPMENT

SUBJECTS/TOPICS	GRADE LEVELS	MICROCOMPUTER USES	TYPES OF TEACHER PARTICIPATION
Mathematics	5-6 / 7-9	Drill and Practice	Curriculum Development/ Classroom Action Research
Individualization	High School Special Education	Record Keeping	Curriculum Development & Classroom Action Research
Improved Testing	10-12	Test Development	Curriculum Development
Business Education	10-12	Word Processing	Curriculum Development
Computer Literacy	9-12	Basic Programming and Consumer uses	Curriculum Development

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Cooperative activities between high schools and colleges. The Forum for Liberal Education, April, 1983, 5(5), p. 14.

Gordon, B. P. The Computer as A Tool for Diagnostic/Prescriptive Instruction in Mathematics At the Junior High School. An Unpublished Masters Paper, The Pennsylvonia Stote University, 1983.

Naisbitt, J. Megatrends: Ten New Directions Transforming Our Lives. Warner Books, New York, 1982.

Short, W. and Woodring, K. Computerized Individualized Education Plans. 32nd Annual PSCD Conference, Harrisburg, PA, November 1981.

Trueblood, C. and Flanagan, K. University/School District Staff Development: A Collaborative Effort. Wingspan: The Pedamorphosis Communique, Volume I, Number 2, January, 1983.

ATTACHMENTS

CHECK YOUR DIVISION OFFICE OR BULLETIN BOARD FOR DETAILS ON THE STORIES BELOW

PM IN BRIEF: OCT. 4

OAKLAND TEACHERS' STRIKE--More than 2,000 teachers in Oakland, Calif., walked off their jobs today, joining counterparts in Chicago, Michigan and Illinois on strike.

USING SCHOOL ATTORNEYS--School boards often waste their resources by not using their legal counsel effectively, school legal experts told business officials yesterday.

EFFECT OF EXCELLENCE PUSH ON AVERAGE PUPILS--Principals of several public college-preparatory high schools are concerned not only with the effects of mandates for educational excellence on their schools but also the impact on other schools and "average" students.

AM IN BRIEF: OCT. 5

PHILADELPHIA DESEGREGATION PLAN--The Philadelphia school board yesterday presented a desegregation plan to commonwealth court that emphasizes expanding present magnet programs.

CONNECTICUT TEACHER CERTIFICATION--A state advisory committee study on teacher quality has recommended a four-level system for recertifying Connecticut teachers.

CONSTRUCTION PLANNING BY SCHOOL OFFICIALS--Specific construction plans by school officials, especially board members and business officers, can alleviate many problems with school construction projects, the Assn. of School Business Officials convention was told yesterday.

SENATE APPROPRIATIONS FOR ED--The Senate late yesterday approved a spending package for the Depts. of Labor, Health and Human Services and Education that would allocate $13.4 billion for funding school programs.

'STUDNTID'(18) DATA:

STUDENT FILE NUMBER:	12345
NAME (LAST/FIRST):	SMITH,JOHN
INITIAL ENTRY (Y/N):	N
CHANGE/UPDATE (Y/N):	Y
DUE PROCESSED (Y/N):	N
TRANSFERRED (Y/N):	N
DISTRICT:	KEYSTONE CEN
LOCATION:	BUCKTAIL
COUNTY:	CLINTON
SEX (M/F):	M
ADDRESS LINE #1:	445 APPLE DRIVE
ADDRESS LINE #2:	RENOVO,PA 17764
BIRTH DATE:	01/31/62
TELEPHONE NUMBER:	(717)923-6542
PARENT/GUARDIAN:	SMITH,SAMUEL
P/G ADDRESS LINE #1:	445 APPLE DRIVE
P/G ADDRESS LINE #2:	RENOVO,PA 17764
PROGRAM:	MIXED CAT
CLASS TIME (F/P):	P
GRADE LEVEL (P/S):	S

'YEARLYID'(18) DATA:

STUDENT FILE NUMBER:	12345
YEAR #:	6
NAME (LAST/FIRST):	SMITH,JOHN
SCHOOL YEAR:	1980/81
GRADE (00-12):	12
TEACHER'S NAME:	BIZUB
ADMINISTRATOR:	ALLEN
PREPARED BY:	WOODRING
IND. PSCYH. EXAM:	BINET
ED. ASSESMENT #1:	WRAT
ED. ASSESMENT #2:	WOODCOCK
ED. ASSESMENT #3:	KEYMATH
TRANSPORT (Y/N):	N
PROVIDER (IU/RC):	RC

NAME: SMITH, JOHN FILE #: 12345

LANGUAGE ARTS

COMPLETED OBJECTIVES:

23. IDENTIFIES RHYMING WORDS

62. RECPGNIZES AND UNDERSTANDS THE USE OF PRONOUNS

51. RECOGNIZES SIMPLE ENDINGS

2. RECOGNIZES NAME ORALLY

52. RECOGNIZES ING WORDS AND IDENTIFIESROOT WORDS

67. RECOGNIZES THE DIFFERENT TYPES OF SENTENCES AND THEIR PUNCTIATION

63. RECOGNIZES AND UNDERSTANDS THE USE OF ADJECTIVES

54. RECOGNIZES PREFIXES

PRESCRIBED OBJECTIVES:

71. RECOGNIZES THE INDIRECT OBJECT OF A SENTENCE

72. RECOGNIZES THE OBJECT OF A PREPOSITION

72. RECOGNIZES THE OBJECT OF A PREPOSITION

84. USE BASIC LIBRARY REFERENCE SKILLS

85. USE BASIC GENERAL REFERENCE SKILLS

86. FILL OUT GENERAL INFORMATION FORMS

87. USES NEWSPAPERS, ETC. EFFECTIVELY

88. FILLS OUT JOB APPLICATIONS

5. RECOGNIZES SIMILAR OBJECTS IN PICTURES

3. RECOGNIZES BASIC OBJECTS

NAME: SMITH, JOHN FILE #: 12345

MATHEMATICS

COMPLETED OBJECTIVES:

22. DIVIDE 2 DIGIT DIVISOR INTO 2+ DIVIDEND WITH OR WITHOUT REMAINDERS
32. CHANGE IMPROPER FRACTIONS TO WHOLE OR MIXED NUMBERS
42. SOLVES WORD PROBLEMS
[illegible]. SUBTRACT 2 DIGIT NUMBERS WITH OR WOTHOUT REGROUPING
12. SUBTRACT 2 DIGIT NUMBERS WITH OR WOTHOUT REGROUPING
23. COMPUTE AVERAGES
33. ADD UNLIKE DENOMINATORS
43. REVIEW ADDITION AND SUBTRACTION FACTS
5. RECOGNIZES +, -, = SIGNS

PRESCRIBED OBJECTIVES:

16. MULTIPLY 2 DIGIT NUMBERS WITH OR WITHOUT REGROUPING
26. DRAW THE FRACTIONAL PARTS OF A WHOLE
36. ADD MIXED NUMBERS
17. MULTIPLY 3 DIGIT NUMBERS WITH OR WITHOUT REGROUPING
27. LABEL THE FRACTIONAL PARTS OF A WHOLE
37. MULTIPLIES FRACTIONS
38. DIVIDES FRACTIONS
28. ADD FRACTIONS WITH LIKE DENOMINATORS

NAME: SMITH, JOHN FILE #: 12345

BEHAVIORIAL

COMPLETED OBJECTIVES:

3. COMPLETES ASSIGNED WORK
5. FOLLOWS A GIVEN SET OF INSTRUCTIONS
7. WORKS INDEPENDENTLY
9. WORKS WELL IN GROUPS
11. DISPLAYS ACCEPTABLE SOCIAL BEHAVIOR
13. ACCEPTS BASIC RESPONSIBILITY

PRESCRIBED OBJECTIVES:

3. COMPLETES ASSIGNED WORK
5. FOLLOWS A GIVEN SET OF INSTRUCTIONS
6. DOES NOT FOLLOW A GIVEN SET OF INSTRUCTIONS
7. WORKS INDEPENDENTLY
9. WORKS WELL IN GROUPS
1. FOCUSES ATTENTION ON SPECIFIC TASK

EVALUATION PROCEDURES

TEACHER OBSERVATIONS

TEACHER EVALUATIONS

TEACHER PREPARED TESTS

PUBLISHER PREPARED TESTS

DAILY CLASSWORK

STUDENT PROJECTS (REPORTS, DISPLAYS, ETC.)

EVALUATION SCHEDULE

DAILY CLASSWORK

WEEKLY TESTS

BIWEEKLY TESTS

MONTHLY TESTS

CHAPTER TESTS

UNIT TESTS

QUIZZES

ANNUAL GOALS

THE STUDENT WILL HAVE A BETTER UNDERSTANDING OF LANGUAGE ARTS SKILLS.

THE STUDENT WILL HAVE A BETTER UNDERSTANDING OF MATHEMATICAL SKILLS.

MULTIPLICATION

DATE	NAME	MODE	LESSON	# WORKED	# RIGHT
10/7/83	Barry	S.B.	12	5	100
10/7/83	Frank	S.B.	27	3	33
10/7/83	Cecil	Plac.	11	NA	NA
10/7/83	Barry	S.B.	12	10	100
10/7/83	Barry	Test	12	3	100