ABSTRACT
        This report contains the rationale for and results of
a study investigating computer integration in the primary grades. The
study encompassed functions and purposes of computer use, the
subjects and programs currently in classroom use, and the extent of
microcomputer use by student and teacher. Sources of investigation
included published literature, personal observations, and teacher
interviews. Results of the study indicate that teachers integrate
computers into their existing curriculum with methods suggested in
the literature, such as computer-assisted instruction. While methods
were similar, computer management aspects, especially environment and
schedules, varied among the observed classes. It is concluded that
computer integration depends on educational environment and available
resources. Appendices include a list of software (14 items), a
researcher classroom observation form, a teacher interview form, and
a list of specific programs observed in use. (15 references)
(Author/DB)

Computer Integration in the Primary Grades

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Running Head: COMPUTERS IN PRIMARY GRADES

Abstract
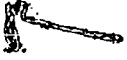
Computer integration in the primary grades was investigated. The study encompassed: functions and purposes of computer use, the subjects and programs included, and the extent of use by student and teacher. Other aspects included implementation, mangagement, problems, and teacher opinions. Sources of investigation included published literature, personal observations, and teacher interviews. Results of the study indicate that teachers integrate computers into their existing curriculum with methods suggested in the literature, such as computer-assisted instruction. While methods were similar, management aspects, especially environment and schedules, varied among the observed classes. The gathered information would be useful to implement or alter computer integration in the primary grades.

Computer Integration in the Primary Grades

Computers have become an everyday part of our lives. Whether or not we touch a computer, we cannot escape the daily influence on our lives, from speedy information transmittal, printouts, and receipts to control of light and temperature of our workplaces. As computers are an integral part of adult life, young students need to have exposure to computers. But how can computers be used in primary grades?

Teachers continually search for new methods and enhancements of instruction. The computer can serve as a tool for the teacher in the classroom. As with any tool, teachers vary in integration and use of computers. In order to investigate the integration of computers in the primary grades, several areas needed to be addressed:

1. the function of the computer in the curriculum,

2. the purpose of student computer use,

3. the subjects included in the integration,

4. the programs utilized, their purpose, and

5. the extent of computer use by student and teacher.

4

Implementation and management were considered in different environments, such as a computer lab, a single computer classroom, and a classroom with on-line computers. Within those environments, several areas needed to be addressed. First, the accessibility of the computers was determined. Accessibility factors included the environment, the computer:student ratio, and the schedule (including frenquency and length) for computer usage. The next area addressed was the orientation for the students. How did the teacher orient the students to the computers and to the various programs? Yet another area was teacher follow-up. Did the teacher follow-up on student use of the computer, and if so, how? The final area, implementation and management, addressed the results teachers reported for students' computer usage.

The last aspects of the study, problems and teacher opinions, added perspective to the rest of the study and served as useful information for a future plan for the integration of computers. The inclusion of problems in the study could help others avoid or cope with the problems. The teacher opinions could likewise guide others in areas such as the

determination of frequency and length of student use of computers. All the information gathered in the study, combined with information from a review of the literature on computer integration, would be useful to implement computer integration in primary grades for the first time or in a new environment or grade level.

Literature Review

Much of the literature on the integration of computers in the primary grades dealt with justification of technology in the school and acquisition of the technology. As most of the primary schools in this area already have computers, the part of the literature useful to this study dealt with the following areas: why teachers would choose to use the computers with their students, how the computers could be used (with a separate treatment of programs and software), and how this usage could be implemented and managed within the curriculum.

Reasons for Computer Use

One point made in the literature as a reason for students to use computers was the results of that usage. Becker (1985) surveyed teachers who reported that their students had increased enthusiasm for

schooling, did more independent work, and helped each other (at the computer) because of computer use. Thus positive attitudes and independence stood out as reasons to continue computer use.

An important point made throughout the literature was that computer usage should be considered within the context of the existing goals and objectives for the education of the students. Dockterman (1990) made the point with a comparison of teachers' choice of chalkboard usage to the choice of computer usage. Teachers do not start with the tool, such as the chalkboard or computer, and decide how to use it that day. Teachers start with instructional goals and plans, then they decide what tools will best accompany those plans. Likewise, others (Adams & Fuchs, 1986, Collis, 1988, Olson, 1988, and Vockell & Luncsford, 1986) recommended the computer as a tool to enhance the existing curriculum.

Riedesel & Clements (1985) pointed out that computers are unavoidable in society and education. They challenged educators to find ways to improve education with the inclusion of the computer. They also pointed out that this challenge requires decisions

about appropriate types and levels of computer use for the individual students.

Dockterman (1990) stressed that the teacher can use the computer as an tool to improve instruction and as a time-saving device to give the teacher more teaching time. He suggested the following uses of the computer to bring about these results:

1) Management of paperwork and administrative tasks: word process tests and communications; use an electronic gradebook program;

2) Whole class presentations: connect computer to large monitor for electronic blackboard;

3) Whole class discussions: use software to conduct instructional review or discuss values/social issues;

4) Management of cooperative learning activities: use software to serve as a step in cooperative learning activities; and

5) Opportunities for self-discovery: students discover new concepts as well as practice known concepts.

Collis (1988) identified seven problem areas in which computers offer assistance: the writing process, comparison through simulation, organizational skills, skills to cope with information, interpretation and critique of graphs of information, problem solving and use of strategies, and attitudes toward curriculum areas. Riedesel & Clements (1985) offered a similar list of suggested uses with a few exceptions. They also suggested that students and teachers use the computer as a teacher aid, to learn to use the computer, to aid the handicapped, and to aid the gifted. Hentrel & Harper (1985) made yet another case for the computer in the classroom. They proposed that the computer could function as a tool to help educators do what they have always wanted to do but found difficult, like develop thinking skills.

The purpose of education is to learn. The computer can serve as a tool for various learning outcomes: intellectual skills, classification type discriminations, concepts, rules, problem solving, verbal information, motor skills, and attitudes (Merrill et al., 1986). If the teacher can promote learning through any method, computer or otherwise,

those methods become useful tools for education.

Methods of Computer Use

Within the literature several methods were suggested to accomplish the various purposes already discussed. Riedesel & Clements (1985) included computer-assisted instruction, computer-managed instruction, and specific subject uses in their methods. Within computer-assisted instruction, they included drill and practice, tutorials, games, simulations, problem solving, and information retrieval. Computer-managed instruction included tasks like attendance, grades, interactive tests, scoring/analyzing tests, and managing instruction. These computer-managed instruction programs referred to programs similar to on-line programs, as they keep track of performance on the various tasks and allow the teacher to manipulate variables such as difficulty. The specific subjects included reading/language arts, math, music, art, science, social studies, and computer programming. In the language arts information, Riedesel & Clements pointed out that computer programs could be used to develop letter recognition skills, critical reading skills, vocabulary, grammar, phonics,

writing skills, and spelling. For the word processor in language arts, they suggested several positive outcomes, such as more willingness to write, more risk-taking with spelling and vocabulary, faster writing, and legible work. In the math section, they discussed drill and practice and discovery learning benefits. In science and social studies, they referred to simulation programs.

Coburn et al. (1985) noted similar methods for computer usage. They included computer-assisted instruction, instructional/learning tools, computer-managed instruction, programming, and computer literacy. As computer-assisted instruction, they referred to drill and practice, tutorials, demonstrations, simulations, and instructional games. Instructional and learning tools referred to the word processor, numerical analysis (word problems or test scores), database programs, instrument monitoring devices (like thermometers in science), graphics, and sound. Computer-managed instruction referred to interactive tests and record keeping. Programming and computer literacy, self-explanatory terms, were also discussed. As a benefit of computer use, it is

interesting to note that Coburn et al. (1985) also
pointed to the word processor as positive encouragement
for students to write longer and use more details.
Other authors (Adams & Fuchs, 1986, Hentrel & Harper,
1985, Keyser, 1981, Merrill et al., 1986, Miller, 1988,
and Tolman & Allred, 1984) also suggested similar
educational applications for the computer in the
classroom: tutorials, drill and practice, simulations,
games, tools (piano, calculator), computer-managed and
computer-assisted instruction, demonstrations, and
problem solving activities.

Implementation and Management of Computer Use

The literature dealt with the topic of
implementation and management from the perspective of
the management of instructional use by the teacher and
the introduction of computers to the students.
Dockterman (1990) suggested that teachers use computers
where they actually do their work. He recognized that
many teachers do much of their instructional planning
at home. He recommended that teachers take school
computers home on the weekends or in the summer in
order to make them truly accessible. Dockterman
offered many suggestions for the computer as a time

management tool for the teacher. He pointed out that
tests and worksheets are more quickly processed and
changed on the computer. For grades and student
records, he recommended an electronic gradebook
program. Also, he offered a parent communication
suggestion. Word processed parent letters could be
personalized on the computer. Some materials can be
produced more quickly and neatly on the computer. He
suggested time lines for social studies, banners, and
other graphics. A time line program can also produce
graphs of measured elements such as distance or
sequence. These methods were all suggested by
Dockterman as ways for the teacher to improve time
management and have more time for instruction. He also
offered a management suggestion for computer usage as
whole class instruction. So that the teacher does not
need to turn his/her back on the class, the computer
can be hooked up to its usual monitor for the teacher
and to a large monitor (television) for the class. (An
RCA splitter cable does the trick.)

Other authors offered suggestions for introduction
of the computer to students before they use it. Adams
& Fuchs (1986) suggested that teachers create in their

students an awareness of computers in our world. Their

suggestions for classroom activities included other

aspects of the curriculum, such as reading and social

studies (current events). In one of those activities,

students read newspapers to search for evidence of

computers in our world. Riedesel & Clements (1985)

suggested films, books, and other resources to help

students first understand what the computer is and how

it works. Pantiel & Petersen (1984) also suggested the

introduction of computers by film, discussion,

presentation of the history, and information roundup of

related information. Pantiel & Petersen included an

especially useful appendix which is an historical time

line of computer education.

Programs and Software

One important aspect of computer integration in

the primary curriculum was software. This study did

not attempt to include a comprehensive evaluation of

software. However, Adams & Hamm (1989), Riedesel &

Clements (1985), Collis (1988), and Dockterman (1990),

offered some suggestions for software and its uses (see

Appendix A).

Literature Summary

In summary, the literature suggested that teachers would choose to use computers to improve education and enhance their current curriculum. Various methods to include the computer in the curriculum were suggested. These methods included: as an administrative management tool, as a tool for whole class instruction, as a tool for special use (word processor, graphics, etc.), for computer-assisted instruction, for computer-managed instruction, for specific subject work, to teach programming and computer literacy and to aid exceptional students. In the area of implementation and management, the literature offered suggestions for the introduction of computers as a concept, the integration of computer use in specific subjects, the time-management of the teacher's use, and the management of computers for whole class instruction and group activities. The literature also offered interesting suggestions for software and possible uses.

Methods

In order to collect information on the integration of computers in primary grades, observations were made in primary classes. Also, interviews of the primary

teachers of those classes were conducted. Nine classes were observed in various computer environments. Eight classroom teachers were interviewed; one was not available for interview. The primary classes were found in the Charlottesville area in three public school systems and one private school. The grades ranged from kindergarten to third grade. The study was conducted in regular classrooms with mainstreamed s .dents, but no special education classes were included in the study.

In each case, the observation was conducted first, then the interview. Forms were used for the observations and interviews; but the interviews were audio-recorded then transcribed to the fcrm. After the observation and the interview were completed for each case, a synopsis was written to record general impressions. Observation information included demographics, equipment and environment details, and usage details (see appendix B).

In the teacher interviews, questions covered information about computer integration, programs, implementation and management, schedule, purposes and results of computer integration, problems, and teacher

opinions (see Appendix C). After the interviews had
all been conducted, the questions and responses were
mapped on a chart. On the chart, similarities and
differences were noted and combined for the data report
in this paper.

Data

Observation Information

Nine primary classes were observed: two
kindergarten, two first grade, two second grade and
three third grade classes. Observations were conducted
in different environments: two single computer
classrooms, three labs, three classrooms with on-line
computers (two of which had another computer not on-
line) and one multiple computer classroom (not on-line,
but reportedly will be on-line soon).

The observed computer:student ratios ranged from
1:1 to 1:19. In lab settings, the ratio was 1:1 or
1:2. In on-line settings, the ratio was an average of
1:6 and included all the computers in the room. In the
single computer classrooms, the ratio was 1:18 or 1:19.
In the multiple computer classroom, the ratio was 1:5.

Accessory equipment varied greatly in the
different environments. For this study, accessory

equipment was considered to be extra external drives, printers, mouse attachments, speech synthesizers, and headphones.

The single computer classroom teachers had ac.. to a printer in the library. The library computer also had a double external drive. The single computer classrooms did not have any accessories in the room.

For the on-line computers, each computer had a mouse and speech synthesizer. Each classroom with on-line computers had at least one printer. One classroom also had a printer for the computer that was not on-line. That same classroom had headphones for each of the on-line computers.

One of the labs had all fifteen computers connected to four printers. This lab also had one computer with a double external drive. The other lab had two printers connected to two individual computers. No other accessories were observed in the lab settings.

The multiple computer classroom had three of the four computers connected to three printers. One computer in this room had a mouse, a double external drive, and a speech synthesizer. This same computer was connected to one of the printers.

See Table 1, Observations of Student Computer Use, for information about the average length of computer use by students as observed, as well as the grade, the setting, the number of computers, and the number of students who used the computers during observation. It is interesting to note that the actual observations of student computer use ranged from two minutes by a first grader to sixty minutes by a third grader. The averages for computer use ranged from nine minutes in a first grade room to thirty-eight minutes in a first grade lab. The overall average for computer use was twenty-eight minutes. A list of the specific programs the students used can be found in Appendix D, Observations of Specific Programs.

Interviews

The interviews were conducted with the eight available classroom teachers after the observations. Tables 2-12 show the data collected from the interviews on the topics. Table 2, Schedules of Student Computer Use, shows the schedules for their students that teachers reported by grade and is matched with the appropriate number of computers. Table 3, Reported Descriptions of Student Computer Use, shows the

descriptions by grade that the teachers gave of how students use the computers. Table 4, Reported Purposes for Computer Use, lists the purposes teachers reported for student computer use and how many teachers reported each purpose. Table 5, Reported Purposes for Program Use, is similar to Table 4, except that it lists the purposes for the programs. Table 6, Reported Results of Computer Use, lists the results of computer use as teachers viewed them, and the number of teachers who reported these results. Table 7, Reported Problems With Integration, describes the problems that teachers had with computer integration and gives the number of teachers who reported the problems. Table 8, Reported Teacher Use of School Computers, lists the various methods of personal use that teachers reported. Table 9, Use of Computers as Policy or Choice, describes the policies on c uter use that teachers reported for their schools, and shows that all of the teachers reported use of computers as personal choice as well as adherence to school policies. Table 10, Reported Ideal Length of Student Computer Use, lists by grade the length of time that teachers thought was ideal for their students to spend on the computer. Table 11,

Teacher Choice of One Method or Software, describes the choices that teachers reported they would make if they had to choose only one method or software, and shows how many teachers made similar choices. Table 12, Choice for Change of Computer Integration, reflects the areas of computer integration in which teachers would most like to effect change. Two other topics from the interviews, follow-up procedures and orientation and implementation, are escribed in the following paragraphs.

Teachers reported various follow-up procedures for student use of computers. One method was to access on-line information about each student's computer use, such as specific program use, length of each use and relevant scores on various programs. Two other methods of follow-up included observations and print-outs.

For orientation of students and implementation of computer use, all of the teachers reported that they reviewed or explained rules. Some programs were introduced to small groups of students, who then taught other students. Teachers introduced other programs in small groups for the whole class. Some new programs were self-taught by the students after orientation.

Table 1

Observations of Student Use

Grade	Setting and Number of Computers	Number of Students on Computers	Average Length of Use
K	Single	3	33 minutes
K	One on-line & one other	4	16 minutes
1	Single	11	9 minutes
1	Lab (15)	15	38 minutes
2	Lab (15)	17	32 minutes
2	Three on-line & one other	6	20 minutes
3	Lab (12)	25	30 minutes
3	Three on-line	2	30 minutes
3	Multiple (4)	11	30 minutes

Table 2

Schedules of Student Computer Use

Grade	Computers	Schedule
K	1	Choice time, 90 minutes in morning & 30-45 minutes in afternoon
K	2	Center time, aide helps, each child uses each program weekly
1	1	When finish work & free time
2	15	Lab: 40 minutes weekly Class: lessons & free time
2	4	Writing workshop-choice, math 20 minute schedule, free time
3	12	Keyboarding 15 minutes/week, choose language program 15 minutes/week, math 20 minutes & 45 minutes/week
3	3	Scheduled 30 minutes daily
3	4	Flexible, available most of the day, except during whole class instruction

Table 3

Reported Descriptions of Student Computer Use

Grade	Description of Use
K	Beginning letters, sounds, spelling, phonics, readiness, numbers
K	Drill & practice abc's, aide helps
1	Drill & practice math & language arts
2	Programming, graphics, word processor, math drill & practice
2	Mostly free-write on word processor (in all subjects), math drill & practice, games
3	Language arts lab hour: 15 minutes keyboarding, 15 minutes choice of language arts program (silent sust ined reading for other 30 minutes), math drill & practice
3	Choice from menu: word processor or drill & practice in math, spelling, or language
3	Drill & practice in math, language arts, explore science & social studies, writing in all subjects

Table 4

Reported Purposes for Computer Use

Purpose	Teachers Reported
Gain comfort and/or skill in computer use	8
Keyboarding skills	4
Programming skills	1
Motivation, independence, to write stories, enhancement of classroom instruction	1 each

Table 5

Reported Purposes for Program Use

Purpose	Teachers Reported
Reinforcement of instruction	8
Math drill and practice	6
Keyboarding skills	4
Coordination/manipulation skills	4
Motivation of learning	4
Development of computer skills	3
Writing across curriculum	3
Problem solving and thinking skills, expression, creativity, discovery	1 each

Table 6

Reported Results of Computer Use

Results	Teachers Reported
Improvement of skills practiced on computer[a]	6
Motivation and enthusiasm for learning	4
Comfort/familiarity with computers	3
Improved self-confidence, more risk taking and problem solving, more writing, reading for a purpose	1 each

[a]One teacher cautioned that the improvement may not be directly or solely the result of computer use.

Table 7

Reported Problems With Integration

Problems	Teachers Reported
Time for teacher to explore software	4
Schedule conflicts[a]	3
Lack of time for computer use	3
Interruptions from students on computer	3
Lack of availability of new software, "down" network, screen distractions for other students, no problems	1 each

[a]Two of these teachers had one computer in the classroom. One teacher had two computers in the room.

Table 8

Reported Teacher Use of School Computers

Teacher Use	Teachers Reported
Word process letters and other correspondence to parents	7
Software review	5
Student records and grades	3
Graphics	1
Teach other teachers about computers	1

Table 9

Use of Computers as Policy or Choice

Policy	Teachers Reported
Keyboarding	1
Scheduled lab use for programming skills	1
Policy of encouraged computer use	8
Choice	
Integrate computers into curriculum	8

Table 10

Reported Ideal Length of Student Computer Use

Grade	Ideal Length of Time
K	10 minutes daily, or depends on interest
K	10-15 minutes daily
1	15-20 minutes daily
2	Lab: 40 minutes weekly
	Classroom: 15-30 minutes weekly
	practice computer skills
2	Stories: 30 minutes daily
	math: 20 minutes, twice weekly
3	60 minutes daily
3	30 minutes daily
3	Exploratory programs: 90 minutes
	otherwise: 30 minutes daily

Table 11

Teacher Choice of One Method or Software

Choice	Teachers Reported
Programs with multiple options and creativity, like keyboarding and word processing programs	5
Math drill and practice	2
ABC program that requires various responses like tactile, recognition, auditory, verbal, reading	1

Table 12

Choice for Change of Computer Integration

Choice	Teachers Reported
More computers	6[a]
More time for student use	2
Expert to run a lab and act as consultant	1
Teacher to run a lab with a reading/writing workshop	1
More assistants with more computers	1
Better or improved equipment	1
Better physical space	1

[a]Five of these six teachers also reported a second choice.

Conclusions

This investigation allowed me to see many different possibilities for computer integration. While the data seemed similar for most of the situations, the differences were worthy of examination. The main differences noticed in the investigation were especially in management, but also in grade level and environment.

While students used the computers similarly in the various situations, the management of those situations reflected different teaching styles. Specifically, schedules were very different. In the lab environments, either the whole class was involved the whole time or half the class spent half of the time on computers and half reading for SSR (silent sustained reading). In the classroom environments, the student schedules could have different effects on the overall management of students and instruction. For example, one class used the computer on a schedule throughout the day. This type of schedule meant that students must make up any instructional work they miss as a result. The effect of this system may depend on the teacher's management and the students' responsibility.

A teacher may also need to decide whether to accept the visual distraction in this situation. In another class, the computers were used as an option during writing workshop, which required the teacher to monitor (for fairness in opportunity) at least by observation. These different scenarios point to the many different decisions that computer management might involve. The teacher needs to consider first the current objectives of instruction, then how computer integration can address those objectives. The management of the environment and the management of the integration need to be considered as well.

Specific computer integration in the primary grades obviously varied with different teachers, grades, environments, and objectives. However, some general tendencies were noted within the observations. As the grade/age of the students was higher, the type of computer use included more tasks than drill and practice. Students in observed second and third grade classes reportedly used the computer for free-writing. However, most of the observed use of computers was for drill and practice. The variants in observation were free-writing in a second grade class, drawing programs

in a first grade lab and a third grade class, practice

of keyboarding skills in a third grade lab, and

practice of programming skills in a second grade lab.

This note on use of drill and practice programs is an

observation, not a judgement. In each of the

observations, the students were enthusiastic during

their computer time. If drill and practice of the same

material is more enthusiastically approached by the

student on the computer than by another method, it

makes sense to use the compu... when possible.

The literature suggested that the computer should

be used to fulfill current objectives in order to

encourage teachers to integrate its use into their

curriculum (Adams & Fuchs, 1986, Collis, 1938,

Dockterman, 1990, Olson, 1988, Riedesel & Clements,

1985, and Vockell & Luncsford, 1986). The many uses

that the teachers reported, from drill and practice to

free-writing across the curriculum, indicated this type

of integration into the existing curriculum. However,

it is interesting to note that none of the teachers

reported use of the computer as a tool for whole class

instruction (except for lab instruction of programming

skills). One teacher reported past use of this

technique with a previous class of fourth graders.

Another teacher reported that she would soon have

access to the necessary equipment to use the computer

with a large monitor.

Again, these comments are simply observations.

However, the idea of the electronic blackboard is

appealing, especially with the capabilities of programs

like word processors, databases, and spreadsheets. And

as Dockterman (1990) suggested, with the use of a large

monitor and the computer monitor, the teacher has the

ability to see the students as well as the information.

Whole class instruction can be conducted with the

computer without the large monitor. Appendix A refers

to some programs that can be used as part of whole

class instruction without the need for a large monitor.

When this investigation began, many of the

purposes and uses of computers were anticipated. There

was uncertainty as to whether primary teachers used

computers for whole class instruction, and the teachers

did not report this type of computer use. While I

anticipated such purposes/uses as drill and practice,

exploration, and word processing, there were

unanticipated purposes/uses. One such use was

programming (Logo) with second graders. Also, all of
the teachers reported that one of their purposes for
student computer use was to gain comfort and/or skill
in the use of the computers. Previously I had thought
of these computer skills as coincidental for primary
students and as goals for upper elementary students.
However, it makes sense for primary students to learn
proper keyboarding skills instead of learning poor
habits. It also makes sense for primary students to
become comfortable/skilled with various types of
programs, to have opportunities to troubleshoot and
problem solve, and to learn about the potential of
computers.

As a result of this investigation, I feel more
prepared to make decisions about computer integration.
The observations offered many useful ideas for programs
and possible schedules. It is obvious that any
decisions about computer integration in my future
classes will depend in part on the environment and the
resources available. However, with any grade or
computer environment, I see potential for drill and
practice in math and language arts. Most of the
teachers believed that the practice was beneficial to

the students.

Also with any grade, there is potential for the computer as a word processor. The teachers who had their students use the word processor for writing believed that students were more willing to write. They also believed that the students wrote more on the computer. The benefits of motivation, as well as editing capabilities, make the word processor very useful in the integration of the computer.

Since computers are a part of many aspects of life, it is important to include them in the education of our students. Computers can enhance instruction and improve time management. Students may experience greater motivation for learning or for a specific task. With consideration given to the aspects of this investigation, computer integration can occur as a positive influence on education.

Appendix A

Software

From Adams & Hamm, (1989)

LogoWriter, Logo Systems, Inc.: Logo is a computer language, children can learn programming, math, graphics, and with LogoWriter, can word process as well.

LEGO TC Logo, Logo Systems, Inc.: This version of logo combines the logo language with LEGO toys for students to explore, construct, and discover. The students make a LEGO construction and program the computer to "run" it (make it spin, roll, etc.).

Other Suggestions

Stickybear Reading Comprehension, Stickybear Shapes, Stickybear Alphabet, Optimum Resources

Odell Lake, MECC (Minnesota Educational Computing Consortium)

Challenge Math, Muppet Learning Keys, Sunburst

Talking Text Writer, Scholastic

More suggestions were found on pages 165-169. They also listed a directory of publishers on pages 170-171.

From Riedesel & Clements, (1985)

Odell Lake, MECC: The program allows the students to choose to be one of several kinds of fish. The program then has the fish swim through Odell lake and encounter other fish. The student then has to decide what action to take: hide, eat, run, or ignore. The computer responds by letting the student know the consequences. Riedesel & Clements listed the program as a sixth grade program, but I have seen third graders successfully use the program.

Oregon Trail, MECC: The program is a simulation of westward emigration around 1800. The students use various skills of decision making, planning, analyzing, etc. The results of their actions are based on diary accounts from the time period. The program was listed for third through sixth grades.

More suggestions were given in the book. Also included in the book was a comparison of MECC simulation programs on pages 134-139.

From Collis,(1988)

Cereals, MECC: The student selects a brand of cereal. The computer then shows the student how much sugar would be in a bowl by representing the sugar as cubes

in the bowl. Collis also included lesson suggestions
and worksheet information to accompany the lesson. The
lesson was presented as a second grade lesson, and an
adaptation for older students was suggested.

Kindercomp, Spinnaker: The program has various programs
and suggested for kindergarten through third grades.
The tasks teach keyboarding as well as things like
letter and punctuation recognition.

Collis suggested and described many programs and
lessons for all grades and all subjects. She also
included an Apple II disk of several teacher-made
programs that she described in the book.

From Dockterman, (1990)

All are from Tom Snyder Productions, Inc.

TimeLiner: The program can be used to make time lines
in history, to make a calendar of classroom
events/deadlines, to sequence in reading or
storywriting, or to graph size, distance, etc. for
comparisons.

All Star Drill: The program can be used to set up a
review of material as a baseball game for whole class
instruction.

<u>Choices, Choices</u>: This program offers young elementary students social situations to discuss as a group with an emphasis on identification of goals and predicting consequences.

Appendix B

Observation Form

SCHOOL_____   GRADE_____

TEACHER_____   DATE_____

TIME   FROM_____TO_____

1. How many computers are in the room?

2. What kind of computers are in the room?

3. Are there printers, modems, voice boxes, etc?
Describe the equipment.

4. Describe the location/arrangement of the equipment
in the room.

5. List other descriptive factors (schedule posted,
how-to's, instructions, etc.).

6. How many students used the computer/s?

7. What was the length of time of use per student or
group?

8. Does the teacher use the equipment during the
observation? If so, describe the use (demonstration of
program, instructional aid, etc.).

9. How is the equipment used? Note specific programs.
Also describe the usage.

Appendix C

Teacher Interview Form

1. What types of programs do you use? What is the
purpose of these programs? How is the computer time
spent (software, subjects, word processing, etc.)?

2. Are there television connections available to use
the computer as a display for the whole class? Are
there laser discs or other special equipment available?
Do you use the computer as an instructional aid in your
lessons, as an electronic blackboard or audio/visual
enhancement, etc.? If so, how? Where are the
computers, software, and other materials kept?

3. Describe your student schedule for computer time
(when they use it, how often, how long, scheduled or
free time).

4. What are your goals for the students on the
computers?

5. What results do you see from students' use of
computers?

6. Do you follow-up on or know what students have done
or accomplished on the computer? If so, how?

7. How did you implement computer use at the beginning
of the school year, or whenever computer use began in

the classroom? How did you orient the students?

8. What problems have you encountered in the integration of computers (schedules, selection of programs, availability of software or equipment, time to plan and follow-up)?

9. Do you use the classroom computer for teacher things like grades, letters to parents, word process tests, etc.? If so, how?

10. Is your student computer use your choice, school policy, or a combination? Explain.

11. How long do students need to spend on the computer for each use? What do you think is the ideal length of time? And how often should students have access to the computer?

12. If you had to pick ONE method or ONE piece of software for your students to use on the computer, what would it be, and why?

13. If you could change one thing about computer use in your class, what would it be, and why?

Appendix D

Observations of Specific Programs

Kindergarten

Easy as ABC, Springboard Software, Inc.

Bouncy Bee Learns Letters, IBM Corporation

Typing is a Ball, Charlie Brown, Random House, Inc.

Grade One

Stickybear Word and Sentence Fun, Optimum Resources

Road Race, Delta Draw, Spelling Bee, Gertrude's
Puzzles, Sunburst

Grade Two

LogoWriter, Logo Systems, Inc.

Primary Editor Plus, IBM Corporation

Grade Three

The Friendly Computer, Odell Lake, Circus Math, Word
Munchers, Multiplication Puzzles, Subtraction Puzzles,
Space Subtraction, Clockworks, MECC

Primary Editor Plus, IBM Corporation

Also various Troll programs

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