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ABSTRACT

A project was developed in the Columbia, Missouri, public schools to use computer technology as a catalyst and support for systemic school reform to implement multiage grouping of students. Classrooms were grouped as grades K-1 and 2-3. This report includes all the formative evaluation data collected throughout the implementation of this project, Fall 1994 to Spring 1997, as well as summative data collected at the end of the project. The purpose of this evaluation was to document the extent to which the project accomplished its primary goals: to create a local learning community based on technology in order to acquire and apply knowledge about multiage grouping, and to moderate the electronic exchange of information about multiage grouping locally, nationally, and internationally. Data from multiple sources were collected and analyzed, including classroom observations, teacher interviews, teacher surveys, and teacher reflection journals. It was determined that multiage grouping was successfully established with the assistance of technology, but that practical assistance and continuous support were needed to maintain multiage grouping patterns. While developmental appropriateness improved after the first year, the emphasis was found to be more on technology than curriculum, and a need for integrating technology into constructivist teaching practices was found. There was a continued need for implementing technology to help it facilitate teaching, learning, and professional development. (JPB)

CONSTRUCTING AND NETWORKING FOR MULTIAGE LEARNING

Results of Final Year Evaluation

By
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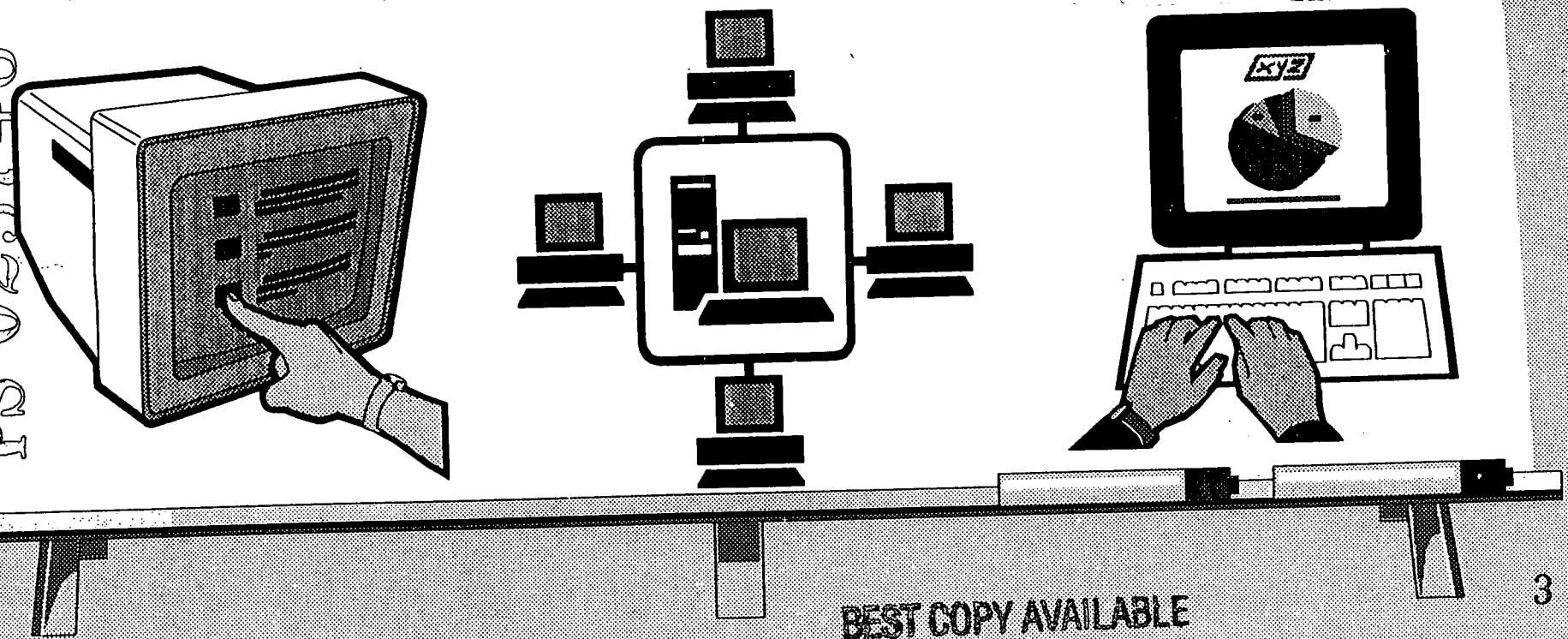
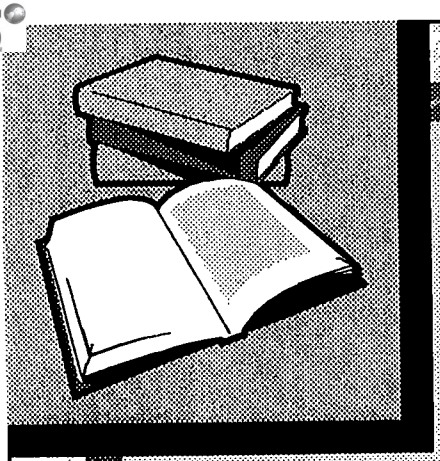
University of Missouri-Columbia
June, 1997





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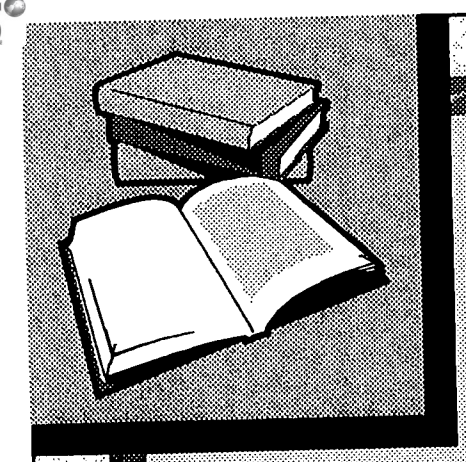
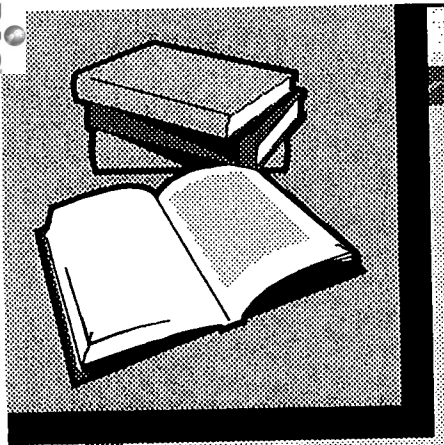




Introduction

This report includes the formative evaluation data collected throughout the education of this project, Fall, 1994 to Spring 1997, as well as the summative data collected at the end of the project. The purpose of this evaluation was to document the extent to which the project accomplished its primary goals, 1) to create a local learning community based on technology to acquire and apply knowledge about multiage grouping, and 2) to moderate the electronic exchange of information about multiage grouping locally, nationally, and internationally. Project evaluations have been conducted bi-annually and presented to the Advisory Board in Winter, 1995; Summer, 1995, Winter, 1996; Summer 1996; Winter, 1997; and Summer, 1997.

Multiple sources of quantitative and qualitative data have been collected and analyzed for this evaluation. Classroom observations, teacher interviews, teacher surveys, and teacher reflection journals were included as part of the data collection. We hope this report provides useful information to the administration and faculty of the Columbia Public Schools as they reflect on the successes and challenges of this project. It has been our pleasure to be a part of the Construction and Networking team.

Linda M. Espinosa
Weigh-Jen Chen

Objective #1: Create a local learning community based on technology to acquire and apply knowledge about multiage grouping.

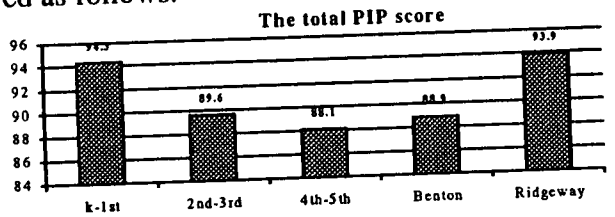
The following methodologies were employed to evaluate this objective:

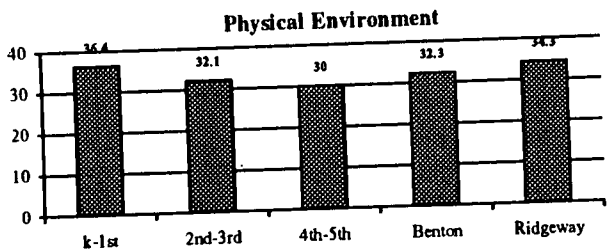
1) **Classroom Observations:**

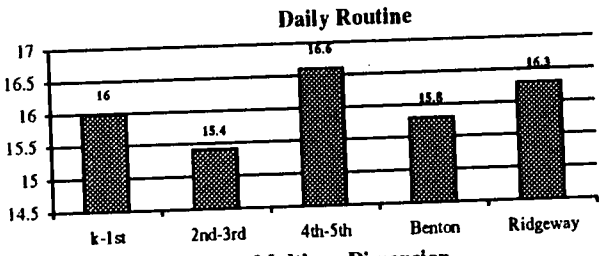
A. Classroom observations were conducted twice during each school year, 1994-1997, once in the fall and once in the spring. A classroom observation scale measuring the degree to which the classroom implements a constructivist or developmentally appropriate philosophy, the Primary Implementation Profile (PIP) Form was adapted. The original PIP form consists of 30 items. They are rated on a 5-point scale with detailed descriptions for scoring 1, 3, and 5. A higher score on any dimension reflects a classroom that contains more developmentally appropriate practices according to the criteria developed by NAEYC. The 30 items of the PIP are divided into four scales: physical environment, daily routine, adult-child interaction, and adult-adult interaction. In the first year evaluation, to accommodate this grant, a total of 9 items, including the whole scale of adult-adult interaction (6 items) and 3 items, one from each of the other scales, were eliminated because they were considered to be more appropriate for preschool than primary classrooms. An additional scale with 5 items to measure multiage grouping dimensions was developed for this grant. The 5 items assess how the classroom is organized, how the curriculum is organized, whether adults are able to meet children's individual needs, how strategies are used for different ages of children, and whether the curriculum is integrated into meaningful and authentic learning experiences. Therefore, the adapted PIP used in the first year evaluation included 26 items. However, two items were eliminated for the second year evaluation due to their low rate of occurrence during an hour's observation. The remaining 24 items of the PIP are divided into four scales: physical environment, daily routine, adult-child interaction, and multiage dimensions. The data collected during the 1994-1995 school year were compared with the data collected during the school year of 1995-1996 and 1996-1997 to measure the extent to which the classrooms became more constructivist or developmentallyappropriate, during the course of this project. See Appendix 1 for a copy of the PIP instrument used in the final evaluation.

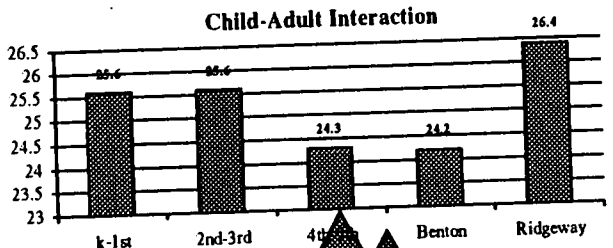
B. Grade level and school comparisons: Spring of 1997 (n=23)

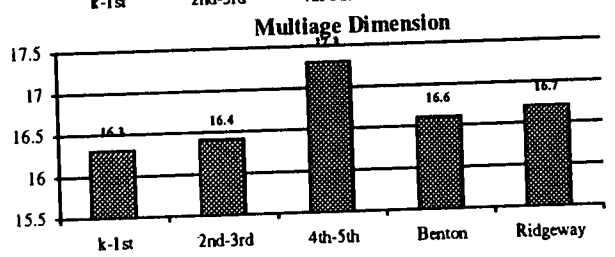
- The adapted PIP (Primary Implementation Profile) Form for the second year (1995-1996) evaluation was also used during 1996-97 to measure the extent to which the classrooms became more constructivist or developmentally appropriate.
- The average total PIP score was **91** with a range of **70-107**.
- The grade levels were not significantly different from each other in the total PIP scores, child-adult interaction subscale, and multiage dimension. However, the grade levels differed significantly in the physical environment. The K-1 classroom had a significantly higher score in meeting criteria of physical environment of PIP. The differences between grade levels and the two schools decreased during the 1996-97 school year.
- Between the two schools, there was no significant difference in the total PIP score, the physical environment, the child-adult interaction, and the multiage dimension.
- The mean scores are displayed as follows:











C. Computer usage in the classroom:

- During the Spring of 1997, each classroom of the participating teachers was observed. There were 24 teachers who participated during the 1994-1995 school year. Because one of the teachers took a leave during 1996-1997, only 23 classrooms were observed. The observations were conducted during a 2 week period in late spring 1997. They were one hour in length and occurred between 9am and 3:30pm - 10 in the am, 9 in the pm, and 4 were scheduled between 11:30-12:30. During the observation, the evaluator recorded information on computer usage. The following is a summary of the 23 observations.
- Number of children at the computer: during the one hour observation, the computers were in use in 11 of the 23 classrooms; a total of 43 children, 26 boys, 17 girls were using the computers.
- Setting: Choice/Center time (n=3), Math time (n=3), Writing/Reading (n=3) , Computer Lab time (n=1), Social Science (n=1).
- Software: the software programs included Math - Trudy's Time and Place House, James Discovers Math, Peter Rabbits' Math Garden, Math programs for basic facts, Jump Start Kindergarten, Troggle Trouble; Language Arts - Microsoft Works, CD-ROM Living Books; and Social Science - The Magic School Bus.
- Two teachers, grades K-1 and 2-3, used the computer to look for information in a whole class grouping. The students were gathered at the front of the computer to view the screen. One of the teachers used Encarta to search for information about frogs; the other teacher had a student (girl) use a networked program, Worldbook (Gallery) to find information on seeds. Both teachers were demonstrating how to use the computer for personal information. Moreover, one teacher used the computer to take pictures of the students. Each student took a turn to take their photo on the computer so they can put it in their research report.

D. *Classroom Observation Comparisons over the three years*

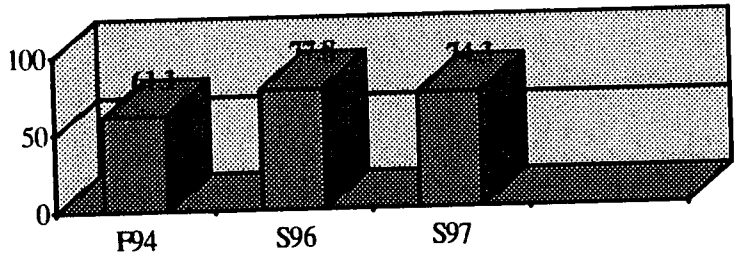
	F94	S96	S97	S96-S97
Environment	25.7	33***	33.2***	
Daily Routine	13.8	17.9***	16**	**
Interaction	21.7	27***	25.1***	*
Total (the above 3 subscales)	61.1	77.8***	74.3***	
	F95	S96	S97	S96-S97
Multiage	18.6	19.7	16.7	**
Total PIP scores	93.7	97.5	91	*

* p< .05 ; ** p< .01; *** p< .001

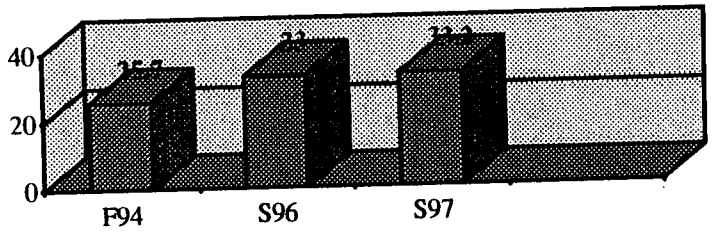
- **Classroom Ratings.** At the beginning of the project, Fall 1994, the average score for the PIP was 61.1 points out of a possible 130 points. The subscale scores for Environment, Daily Routine, and Interaction for three points in time, Fall 1994, Spring 1996 and Spring 1997 are presented in Table 1. Clearly the classrooms become more developmentally appropriate throughout the project; all subscales and overall ratings increased significantly from Fall 1994 to Spring 1997. The final observation, Spring 1997 revealed a small, but statistically significant decline from Spring 1996 in two subsections of the PIP, Daily Routine and Interaction, and the overall score. Therefore at the conclusion of the project, the classrooms showed improvements when compared to the initial, Fall 1994 PIP scores. However, they also evidenced a decline from Spring 1996 to Spring 1997 with respect to developmental appropriateness.
- **Multiage Grouping Scores.** In the Fall of 1994, 17 classes out of 24 classes had multiage grouping. Therefore the PIP subscale measuring the extent to which the classes were organized to meet a wide developmental/age span was not included until Fall 1995. At that time, the teachers had completed the first year of training and all had reorganized to prepare for multiage grouping. As Table 1 reveals, the teachers' multiage grouping occurs increased slightly between Fall 1995 and Spring 1996, but declined significantly by Spring 1997. This finding is not surprising given the timing of the training on multiage grouping, the effects of the enthusiasm following the first year of training, and the lack of school-wide training focusing on multiage grouping during Year 3.

Table 1

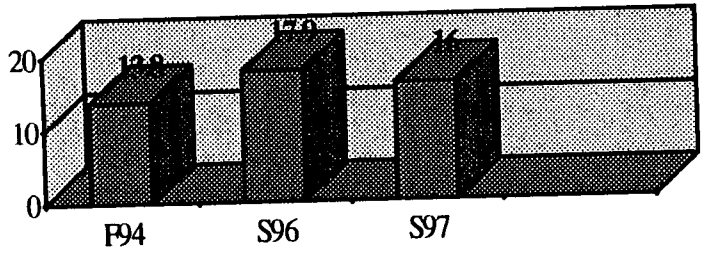
A. The total PIP Scores without Multiage Subscale



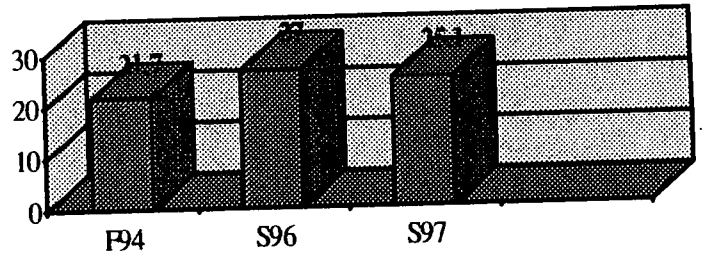
B. Physical Environment Subscale Scores



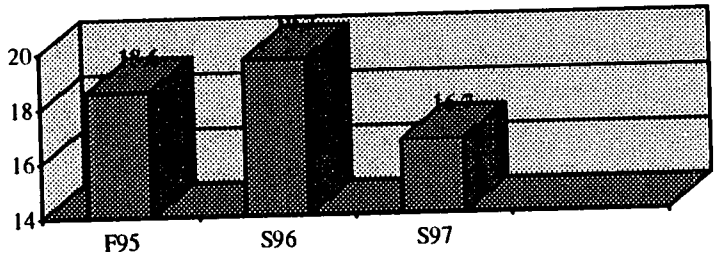
C. Daily Routines Subscale Scores



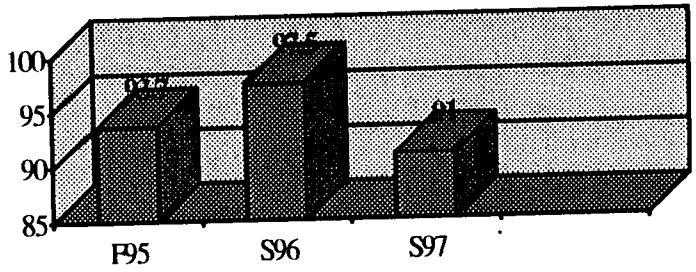
D. Child-Adult Interaction Subscale Scores



E. Multiage Subscale Scores



F. The Total Scores Including Multiage Subscale



2) Teacher Interviews: The teachers were interviewed twice each year from Fall 1994 to Spring 1997 to assess their feelings toward multiage grouping, using computers in the classroom, using computers for their own professional development, and their concerns or suggestions for this project. This was an open-ended interview conducted over the phone, via email, or through written response.

A. About Mulitage Grouping: Fall 1994 - Spring 1997

i) Regarding feelings about multage grouping, 82.6 (19/23) teachers had positive feelings about it in the Spring of 1997. Five of the 16 teachers felt that participation in the project confirmed their positive feeling. One of them felt that the use of computers helped the multiage grouping. However, 33.3% (8/24) teachers had mixed feelings or were unsure about it in the Fall of 1994. In the Fall of 1995 when a full implementation of multiage grouping has begun, 91.7% (22/24) of the teachers had positive feelings; only 8.3% (2/24) teachers did not feel comfortable about it or were not able to see the advantage of having it at that point.

	Fall 94	Fall 95	Spring 96	Fall 96	Spring 97
Positive	66.7%	91.7%	100%	91.3%	82.6%
Negative	0%	0%	0%	8.7%	4.3%
Unsure	33.3%	8.3%	0%	0%	13%

Fall 1995:

"It is hard and I really can't see the advantage at this point. (Why?) People think multage grouping is good for younger kids, like k-1-2-3, but not for 4th and 5th grade students."

"I am not sure about the results yet. Because it's just a beginning of implementing the 2 grades together, and I don't know whether it's good."

And then by the Spring of 1996, 100% (24/24) teachers had positive feeling and felt multiage grouping is beneficial to students. However, in the Fall of 1996, teacher's positive feelings about multiage grouping were back to 91.3% (21/23). 8.7% (2/23) teachers expressed negative feelings. In the Spring of 1997, 82.6% (19/23) teachers expressed positive feelings, the following are some of their comments:

"It is very good for both the younger and older students to have the benefit of being together. On the one hand, the bright younger students can have an older learner to "bounce ideas off of" and to see what things and gains are made in just the space of one classroom year. The less equipped and younger student can get help from someone in his/her grade level or beyond. It also gives the younger learner someone to look up to."

"Knowing I have my students for two years allows me to give them time and added support (as opposed to a one-year setting)."

"I think the continuity that multiaging provides is beneficial for our population."

"It allows the teacher to use a wider span of materials, benchmarks and allows the students a wider span of comfort."

"The children are very good about using peers for help when I am busy and they do not have any stigma about being "dumb"."

"I still enjoy teaching a multiage classroom, and see many benefits such as the whole group learning, the across the age role modeling, the cooperation from the children, the ability to meet the needs of the children, and to have a classroom that is centered around the early child."

"I think multiage grouping is very good for all students. Having the students more than one year is a real strength, also. I feel parents also see the strengths of the program - they always are excited with their child's growth."

Three of the teachers stated that the participation in this project confirmed their positive feelings. One of the teachers felt that the use of the computer provided by this project helped her manage multiage teaching better.

Three out of the 23 teachers (13%) had mixed feeling about it because of the new class configuration or the curriculum for mixed age grouping. One teacher (4.3%) expressed strong negative feeling about it .

"I like the concept of multiaging as I have developed it. However, I feel that I was supposed to conform to a certain way and I didn't feel like I was accomplishing that goal. Therefore, I was very unhappy with the program this year. I have, however, come to the conclusion that I can't fit into the mold that someone else has designed. So, I will design my own mold and fit into that!"

ii) Regarding the new configuration of K-1, 2-3, and 4-5, in the Fall of 1995, 45.8% teachers stated the new class configuration is a better combination of age levels than before. 12.5% teachers had the same feelings and 16.7 teachers were unsure or were not able to decided unless positive results can be shown. 25% of the teachers had negative feelings. In Spring of 1996, all the teachers had positive feelings or comments about the k-1, 2-3, 4-5 class configuration. However, in the Fall of 1996 and the Spring of 1997, 21.7% (5/23) teachers expressed difficulty with the new class configuration. Their comments expressed during the interviews in Spring 1997 are as followed:

	Fall 95	Spring 96	Fall 96	Spring 97
Positive	58.3%	100%	78.3%	78.3%
Negative	25%	0%	21.7%	21.7%
Unsure	16.7%	0%	0%	0%

"We had been multiage for so long I don't think anyone had a difficult time adjusting when we were still k-6. I had great difficulty moving down from 6th to 4\5th. I didn't realize the maturity difference would be so great between 4 and 5th graders."

"There is a huge difference in the emotional and social sides of fourth and fifth graders. There is also a big difference in background of experience and in ability to put forth initiative and in focusing on the tasks at hand. We are looping our students in language arts and in math and that may be beneficial in that the fourth graders this year know the ropes so to speak and will be in the same classroom with the same teacher so there will be a minimal adjustment period in the fall of next year."

"I have learned that all multiage classrooms do not have to be set up and run the same way. You need different models for different levels and ages of the students ..."

"It is difficult when the numbers are uneven. Too many kindergartens not enough lst graders."

"This year has been taxing in that the classroom has been 2/3 five year olds and only 1/3 six year olds. The proportions don't have to be exactly 1/2 and 1/2 ..."

iii) The following is a summary of the changes in the types of concerns teachers expressed regarding multiage grouping.

	F94	F95	S97
	%		
No concern.	3.8	44	56.5
Unsure about/difficulty in the new pattern of classroom organization.	0	3.8	13
Not enough support from the district (i.e., to do truly thematic units for higher grade levels; enough help for students with an IEP; a high students' turnover rate)	0	11.5	8.7
Unbalanced student number in each age level.	7.7	3.8	8.7
Curriculum knowledge to meet various levels.	23.1	7.7	4.3
Small room with big class size	0	0	4.3
Meeting individual needs/the needs of a wide age span/teaching new age levels/the needs of gifted students.	38.5	11.5	0
Not enough time.	11.5	0	0
How to implement multiage grouping.	11.5	0	0
Being able to assess everyone/Assessment.	7.7	3.8	0
Covering a lot of objectives for two grade levels.	7.7	0	0
Managing materials.	7.7	0	0
Not losing the kids in the outer edge.	3.8	0	0
Having another teacher to help in the classroom/Expect to have a smaller size class/The increased number of children in 1995-1996.	3.8	11.5	0
Organization.	3.8	0	0
Having parents understand multiage grouping, curriculum, and assessment.	3.8	0	0
Difficult for new teachers/All new.	0	0	0
Making less capable students feel successful.	0	3.8	0

Two teachers (8.7%) had concerns about the support from the district (8.7% - 2/23). They said:

"My only concern about multiage grouping at this time is the continued lack of district support. Some classes have had to teach parts of their curriculum as graded because the teachers felt they had so little support from district people. We continue to have difficulty with transiency at Benton and that problem disrupts the community we are trying to build as a multiage school."

""My only concern is the lack of materials, and the district not setting a "cap" on our enrollment. All literature states that the ideal multiage room is no higher than 18, and that is with an aide!"

Two K/1 teachers were not happy about the uneven student number in each grade level.

"It is difficult when the numbers are uneven. Too many kindergartens not enough lst graders."

"This year has been taxing in that the classroom has been 2/3 five year olds and only 1/3 six year olds."

One teacher was concerned about the curriuclum for multiage grouping. Another one teacher felt that the classroom is too small and the class size is too big.

B. The Use of Computers in the Classroom:

i) A summary of teachers' concerns about using computers in their classrooms is as follows.

	F94	S95	S96	F96	S97
	%				
Having enough/more computers.	62.5	25	20.8	4.3	39.1
No concern.	4.2	4.2	50	34.7	30.4
Having time for students to use/Finding the right time to use.	37.5	37.5	12.5	52.2	26.1
Having enough/good/appropriate/more software.	37.5	12.5	8.3	4.3	13
Having support from the media specialist.	0	0	0	4.3	8.7
Having enough space for many computers/a big room.	12.5	12.5	0	0	4.3
Being integrated into the existing curriculum/Knowing how to work it and what to use for.	12.5	20.8	0	21.7	4.3
Having a computer lab.	0	0	0	4.3	4.3
Expanding teachers' own knowledge base of computers/Knowing the software well	25	20.8	0	0	0
Students' keyboarding skills.	8.3	4.2	0	0	0
Internet and E-mail are too abstract for young children to understand.	4.2	0	0	0	0
Taking responsibility of organization away from students (Preventing students from doing hands-on thinking and producing).	4.2	0	0	0	0
Assessing how well the students are doing.	4.2	0	0	0	0
Equal opportunity for each student/Availability of technology for everyone.	0	12.5	0	0	0
Availability next year about what we are doing now/Number of software and computers going to get.	0	12.5	0	0	0
Monitor students' using in Internet.	0	8.3	0	4.3	0
Having competent parents or students to help/Having people to help.	0	8.3	8.3	0	0
Afraid of something going wrong in the computer/tech support.	0	0	12.5	4.3	0
Need more guidance/know more about how to use Netscape.	0	0	8.3	0	0
Keep the computer in the classroom instead of in a lab or the library.	0	0	4.2	0	0
All the students benefit at an appropriate level.	0	0	4.2	0	0

The major concerns that the teachers expressed at the end of the project were, in order of frequency, more computers, time management, software programs, and support from the media specialist.

Comments regarding the desire of having more computers include:

"I have no major concerns about using the computer in my classroom, other than not having enough of them."

"Wish I had one for each one."

Some of the teachers felt that the number of computers and the time management are connected.

"The only major concern I have about computer use is the need for more machines. With only two machines, time management is difficult."

"I only have one computer in the classroom so it does make it difficult to manage time . . ."

"I have 2 in my room and it is difficult to get 26 kids on for equal time . . ."

"We do not have enough computers for the whole class to have access to computer time each day—or even each week."

"My biggest concern about using computers in the classroom is that there is simply not enough time in a school day to allow each child enough time on the computer. (Only one computer in the room.)"

Some other comments regarding time management:

"I have no concerns except managing time for the children to use the computers."

"Time. I still have trouble getting the children onto the computer and teaching them how to use it."

Three teachers were concerned about the software programs.

"My major concern centers around . . . the lack of efficient/appropriate software."

"I try to find programs that children can do without teacher assistance."

"Just looking for programs that meet the K-1 needs."

Two teachers had concerns about the support from the media specialist.

"I think the media specialist should be directly involved in the instruction on the computers."

"No concerns about computer in my room. Just . . . trying to get our media specialist to unlock the computers so that teachers may get to areas of the computer that we need to get too, and create a children's page so that our students do not click onto items they are not supposed to."

ii) Teachers were further asked the method that they use to manage time for their students' use of the computers. The following is the summary.

	N	%
Sign-up/Check-off sheet/Rotation system.	5	21.7
Help from using a computer lab.	3	13
Scheduling groups to use.	3	13
Using the computer on a regular basis/during station time.	3	13
Help from parents/volunteers.	2	8.7
Preventing aggressive students from using too much.	2	8.7
Using the computer as a needed basis.	2	8.7
Using overhead.	1	4.3

iii) The extent that the teachers integrated the computer into their curriculum included using it for research/information resource (43.5%), word processing or weekly class newspaper (13%), enrichment in math (8.7%), typing skills (4.3%). Ten of the teachers (43.5%) said that they integrated the computer in their curriculum whenever possible. However, three teachers (13%) said that there was not much integration between the computer and their curriculum.

iv) Nineteen of the teachers (82.6%) used the computer in language arts; 18 teachers (78.35) used it in math; and two teachers (8.7%) did not use it in these two areas.

Language arts software most used in the class included 500 Nations, Explorers, Encarta, Printshop, Dangerous Creatures and Dinosaurs, Book Shelf, Trip Maker, Microsoft works, Student Writing Center, Worldbook Encyclopedia, Living Books, Netscape, Magic School Bus Aviation, ABC Programs, Jump Start Kindergarten, and Jump Start First Grade.

Math programs used most often included Math Keys, Speedway Math, Clockworks, My Clock, Planet Math, Aclock, Dinomath Shareware, Flashmath, Unlocking the Whole Numbers, James Discovers Math, Trudy's Time & Place, How Many Bugs in a Box, Sticky Bear Month, Peter Rabbit Math Garden, Math Blaster, Mighty Math Carnival Countdown, Magic School Bus Under the Ocean, The magic school bus - Lost in Space, Jump Start Kindergarten, Jump Start First Grade, and Fisher Price 1,2,3's.

v) In the spring of 1997, the teachers were asked how they used the computer networking functions in their classrooms. Eleven teachers (47.8%) used Netscape, seven teachers (30.4%) used the available networked programs (i.e., Encarta, Student Writing Center), and seven teachers (39.4%) used e-mail for reading, writing, research, and social studies in their classrooms. The following illustration is one of the examples:

"Last year my class was learning about illustrators and we started talking about animation which led to Disney movies. We got on the Internet and found out some cool stuff about The Lion King movie. We then found one of the animator's e-mail addresses and wrote to him. That turned into a two week dialog with a real person who does both animation for film and illustrations for books. The children were able to write questions to him about his work and he would give them the answers. It was great!"

One of the teachers also used the networking functions for entertainment:

"I use them mostly for research, however I have used them to have fun too. We downloaded James and the Giant Peach and listened to a clip from the movie and saw a piece of the movie too."

Four teachers (17.4%) said that they did not use the networking functions in their classrooms. The following is one of the expressions:

"I have not been very successful at networking. It would be great if I had a parent who was skillful in this area. My biggest problem is not being able to be in two places at once. I am uncomfortable with my being at the one computer with all the children behind me and not being supervised well enough when my attention is on the computer."

C. The use of the computer for the teachers' own professional development:

The teachers' concerns about using computers for their own professional development over time are summarized as follows:

	F94	F95	S96	F96	S97
	%				
No concern.	41.7	37.5	70.8	82.6	65.2
Not having enough time/The time of learning more about the computer and about the implementation of curriculum to be a part of school day.	25	29.2	20.8	13	17.4
Keeping up with educating oneself/learning new programs.	20.8	0	0	0	8.7
Lack of confidence/knowledge/skills in using the computer.	0	4.2	0	0	8.7
Immediate help not available.	0	0	0	0	4.3
Hard to get in the COIN.	16.7	0	0	0	0
Accessing technology from classroom directly (for the trailer classroom).	4.2	0	0	0	0
Knowing which is the best way to enhance their own professional development and what is the appropriate way to use the computer in the classroom.	4.2	0	0	0	0
The technology training (having doubts about the training style; the answer not always informed; not meeting the needs)/Need someone to assist at the level of a beginner/Training on how to install programs.	0	20.8	0	0	0
Need more training and practice/Weekly training instead of monthly training.	0	8.3	0	0	0
Wasting time to learn COIN if not using this approach to access Internet later.	0	0	0	0	0
Having someone know the computers very well when help needed.	0	0	0	0	0
Need more software.	0	8.3	0	0	0
Do not know how to use e-mail to send journal entries.	0	4.2	0	0	0
Do not know how to use Network with k-1 students.	0	4.2	0	0	0
What learned last year can't be practiced immediately after back to school due to the lack of equipment.	0	4.2	0	0	0
Buy a computer at home to use.	0	0	4.2	0	0
Own willingness to use/improve the skill.	0	0	4.2	4.3	0

D. Classroom grouping and assessment procedures:

The following is a summary of the changes that teachers made in their classroom grouping and assessment procedures over time.

	Fall 95	Spring 96	Fall 96	Spring 97
	%			
No change.	33.3	45.8	17.4	52.2
Use the computer to help assessment.	16.7	16.7	4.3	21.7
More effort for young students.	0	0	0	8.7
More collaborative work for students.	0	0	0	8.7
Different expectations for different grade levels.	0	0	0	8.7
Computer license used for children at the computer.	0	0	0	4.3
Students mixed with different level.	0	0	0	4.3
More flexible grouping (according to interests/abilities/computer use).	0	0	65.2	4.3
More peer tutoring.	0	0	8.6	4.3
More large groups.	0	0	4.3	0
Alternative assessment (anecdotal records, checklists, portfolios)	33.3	4.2	52.2	0
Use more rubrics.	16.7	8.3	0	0
More (paper) work/more intense.	12.5	0	4.3	0
More hands on/observations/informal approach.	16.6	12.5	0	0
Less pencil-paper work/tests.	8.3	4.2	0	0
More working examples.	0	4.2	0	0
More flexible to accept students' answers.	0	4.2	0	0
More individualized than a whole group.	0	4.2	0	0
Looking at process rather than a product.	0	4.2	0	0

E. The training of the project:

i) Most helpful part of the training:

	S96	F96	S97
	%		
Technology.	33.3	21.7	69.6
Technology & Collaboration.	29.2	26	21.7
Collaboration.	33.3	21.7	8.7
All aspects.	0	0	8.7
Technology & Observation of other schools.	0	0	4.3
Observation of other schools.	0	0	4.3
Self-explore w/computer.	4.2	34.7	0

Most of the teachers (69.6% - 16/23) saw the technology part was the most helpful part of the training provided by the project. The following are some of their comments:

"The most valuable for me were the computer and technology workshops."

"The most valuable aspect of the training has been the opportunity to learn more about the computer, how it works, and how I can best use this technology in my classroom."

"The technology training has been the most valuable."

"Time spent on the new computers was very valuable."

"Learning to be computer literate on the Gateway has helped me the most."

"Learning many things about how to use computer and about how other use them."

"The computer training was very valuable."

"The most valuable aspect for me has been the technology training."

"My ability to operate a computer! My knowledge has increased so much! 3 years ago, I would have thought it impossible to work a computer, let alone use one in the classroom. Now, I could not live without a computer."

Two teachers valued the collaboration time:

"The most valuable aspect of the training was time spent discussing/planning with my immediate building team."

"Time to collaborate with other teachers."

21.7% (5/23) of the teachers viewed both the technology and team collaboration time most valuable. They said:

"The times when we have gotten together to discuss various aspects of multiage or using the computers have been good."

"Meeting with teachers, hands-on time on computer."

"The increased teacher interaction time, planning time, and computer assistance provisions have enhanced my classroom's programs."

"I believe the focus on team collaboration has been the most valuable activity. Yet without a doubt the computers (I know they are a thing, not a training activity!) have impacted my students in such an important way. I'm amazed at how well they can work on the computers and they are always very motivated to do so."

"Being able to learn about computers and receive the computer in the classroom has been the most helpful part of the project. The time spent collaborating with fellow teachers at Benton and also with the Ridgeway teachers was extremely beneficial as well."

Two teachers were very positive about and valued all the training provided by this project.

"The most valuable part of the training has been our time to interact with other teachers from Benton and to observe other teachers in the district. The time issue is imperative and it has been helpful also to have the extra "team time" right here in our building. The summer computer training has helped, too."

"All aspects were equally worth while to me."

One teacher valued the part to observe other schools. Another teacher felt both the technology and the opportunity to observe other schools most valuable. The following is their comments:

"I appreciated the time from the training to visit with other teachers teaching the some age students."

"The computer training was very valuable. I also gained a great deal from the opportunity to visit two other schools and observe in their classrooms."

ii) Teachers' suggestions/recommendations to future projects:

	S97
Knowledgeable training people/instructor.	17.4%
No.	17.4%
More time for the computer training.	13%
One-to-one computer training.	13%
Having enough support from the school district.	13%
More information/research about multiage grouping/grant.	8.7%
Different computer training levels.	8.7%
Having a computer lab.	8.7%
Keeping the collaboration time.	8.7%
Keeping the release time.	8.7%
More computers in the classroom.	8.7%
Having teachers' input at the beginning of the project.	8.7%
More opportunities to observe other schools.	8.7%
Using own computers in the training.	4.3%
More training in summer so less time out of the classroom.	4.3%
Having hardware/system support.	4.3%
Having the computer the first, training the second.	4.3%

Most of the teachers' suggestion to future projects center the technology part. 56.5% of the teachers focused on the computer training. There are 17.4% (4/23) the teachers concerned the technology instructor:

"An improvement I see could have been that the people "training" us would have had previous knowledge of what they were training us. It seemed at times that we were all grasping at concepts with nobody really knowing what was going on."

"Could use more knowledgeable instructors for the inservice training."

"More time spent instructing us on the computers by someone who knows what they are doing and with enough equipment for us to be able to use it."

"My recommendations would be to provide appropriate training to teachers. That is, keep in mind who you have to teach. Try not to have your very beginning group in with folks who are ready to develop their own program! Also, review a lot."

13% (3/23) were thinking about the time for the training:

"Small group instruction with plenty of practice time provided is important to learning how to use the computer."

"More time on computer training and time to "play" with it."

"I would like to have had more time to really learn how to do some of the things on the computer. I still can't bookmark sites and I have trouble doing some of the other "technical" things."

Five teachers (21.7%) were concerned about the training style: three preferred one-to-one training; two suggested to have different computer training levels divided.

". . . having an individual tutor for each participant would have been great . . ."

"I would still like to have 1-1 help to do more on the Gateway with the Internet, Pegasus, and Microsoft Scanner!"

". . . regular tutorial 1-1 computer help in the classroom with students during REAL class time."

"The only improvement that I can think of would be having different levels of training for people who are at different skill levels with the computer. That could change with the project for that period."

"To improve next time, keep higher level computer people separate from those who are just learning. I found it VERY frustrating in the beginning trying to understand a new skill, or try to figure out where we were going, only to have the lesson moved up many levels because the instructor was afraid she was boring the top level people. Meanwhile, those of us who had just learned to turn on the computer were completely lost and upset because we had no idea what was being said, and could not comprehend what was going on."

One teachers (4.3%) would like to use their own computers during the training session:

"It would have been wonderful if I could have learned new computer skills on my own computer instead of at another school's lab because all computers and set ups seem to be a little different."

Three teachers expected to have more support from the school district. They said:

"It would have been nice to have more technological support from Columbia Public Schools. They are so overwhelmed, it was not easy to get a computer technician to come to Benton to fix any problems with the computers."

"Again, I'm just a bit worried about the district support. I believe the 4th and 5th grade teachers have felt this lack of support particularly this year and have struggled somewhat."

"I feel the school system should better support a multiage project. Enrollment and support staff issues were a continuing concern. The staff assisting us in installing, implementing and teacher assistance was gravely understaffed."

Two teachers (8.7%) would like to have more information about the multiage teaching and the expectations of the project. The following are their comments:

"Provide more information and guidance about expectations of the grant, and for whatever area the project is in (i.e. multiaging)."

"More research on multiage programs/how they work, success, etc."

iii) Teachers' other concerns:

	S97
No other concerns/great grant/beneficial by participating in the project.	91.3%
Keep having up-to-date computers in the classroom.	4.3%
Showing our project to the people who want to know about it.	4.3%

At the end of the interviews, the teachers were asked about their other concerns. The majority of the teachers (91.3%) either said "no other concerns" or had positive comments about this project. The following are some of the comments.

"I feel lucky to have been a part of this project. I learned a lot that I didn't know before . . ."

"I think I have benefited by being involved in this."

"Thanks for the support and communication we received from you. I have always felt comfortable with that aspect of it. I love using the e-mail as a means of communication!"

"I am very happy that we got the money to purchase the equipment and be instructed on its basic use. I would still be back in the dark ages if it weren't for this project."

3) MicroENLIST Survey:

A adaptation of the ENLIST Micro instrument was again completed in the fall of 1996 by each teacher. The survey was used to assess the teachers' perceptions about technology, level of concern about the use of technology, perceived usefulness of the electronic network, and perception about access to technology. (A copy of this survey instrument is included in Appendix 2). The results of this survey are as follows:

A. The frequency of using computers in the classroom has continued to increase this year (daily - 83%; several time per week - 14%) in comparison with last year at this time (daily - 73.1%; several times per week - 19.2%)

B. This year only one teacher perceived him/herself as being a novice or non-user vs. 38.5% reported in Fall 1995. 96% now consider themselves intermediate or old had when it comes to using computers in teaching.

	Fall 1994	Fall 1995	Fall 1996
Use Daily	34.6%	73.1%	83%
Novice/Non-User	53.8%	38.5%	4%
Intermediate/old	34.6%	61.5%	96%

A sampling of comments regarding computer usage:

"We're using the computers everyday!"

"The children use the computer everyday at center time and during the reading time in the morning."

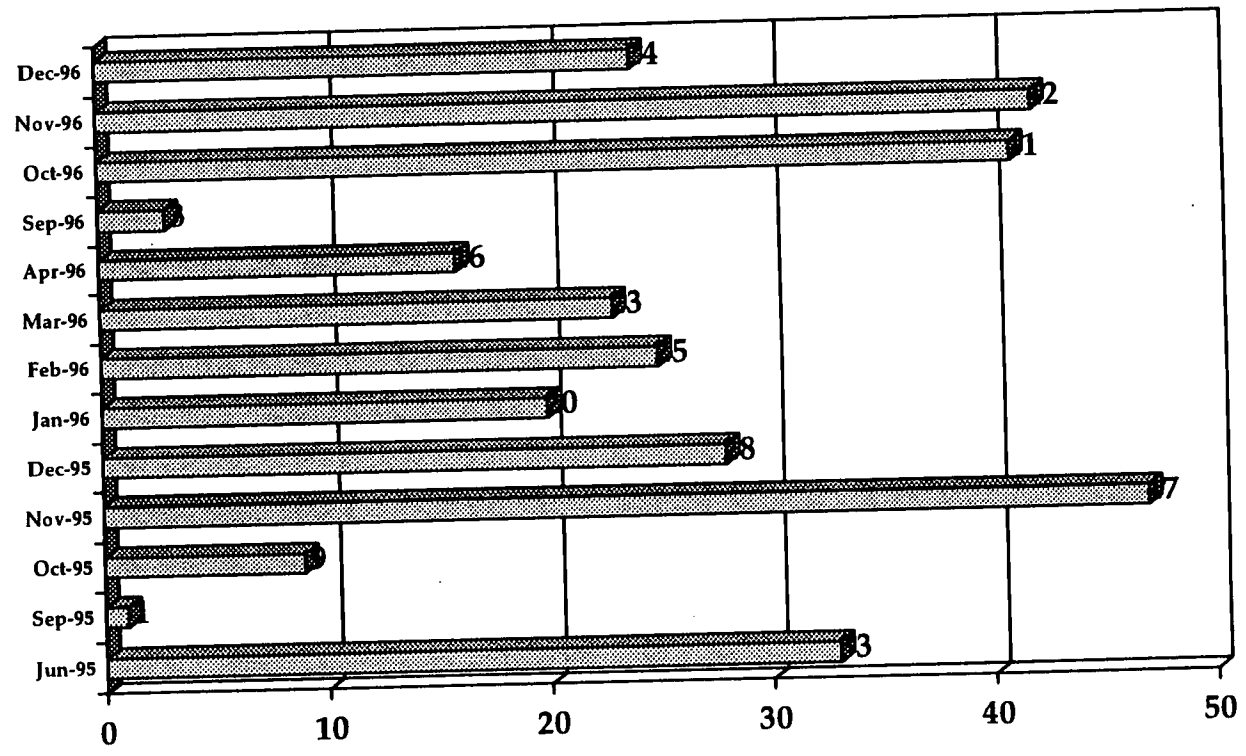
"I try to sue the computer at all times of the day. Before the grant I always used the Apple IIE during class for drills and practice. However now I use the Gateway during language arts and throughout math and choice times."

C. Time constraints are the biggest barriers to use this year as cited by 83% of the teachers. The remaining barriers were: availability of software (65%), lack of technical support (43%), availability of computers (43%), availability of supplies (26%), and personal lack of knowledge or skills (26%).

	Fall 1994			Fall 1995			Fall 1996		
	Most	Less	Total	Most	Less	Total	Most	Less	Total
	%								
Time to preview, order, plan, and prepare.	50	28.6	78.6	42.9	35.7	78.6	52.2	30.4	82.6
Availability of software.	32.1	60.3	92.9	39.3	39.3	78.6	21.7	43.5	65.2
Availability of computers.	53.6	35.7	89.3	35.7	21.4	57.1	21.7	21.7	43.5
Technical support.	10.7	35.7	46.4	14.3	14.3	28.6	17.4	26.1	43.5
Availability of supplies.	14.3	50	64.3	14.3	14.3	28.6	8.7	17.4	26.1
Personal lack of interest.	3.6	0	3.6	0	3.6	3.6	4.3	21.7	26.1
Personal lack of knowledge & skills.	10.7	46.4	57.1	21.4	32.1	53.6	0	0	0
Support from teachers.	0	7.1	7.1	0	7.1	7.1	0	0	0
Support from administrators.	3.6	7.1	10.7	0	3.6	3.6	0	0	0
No significant barriers.	0	0	0	0	3.6	3.6	0	0	0
Not applicable in the instructional areas.	0	3.6	3.6	3.6	0	3.6	0	0	0
Availability of classroom space.	0	0	0	3.6	0	3.6	0	0	0
Training at own level.	0	0	0	3.6	0	3.6	0	0	0
Slow typing speed.	0	0	0	3.6	0	3.6	0	0	0

Objective #2: Moderate the electronic exchange of information about multiage grouping locally, nationally, and internationally.

The teachers were asked to keep a reflection journal of weekly "critical events". Because new computers have been on-line in each classroom since November 1995, documentation of weekly "critical events" was recorded on E-mail. A total of 312 journal entries from June 1995 through December 1996 (202 entries from June 1995 to April 1996; 110 entries from September 1996 to December 1996). The number of journal entries received in each month is as follows.

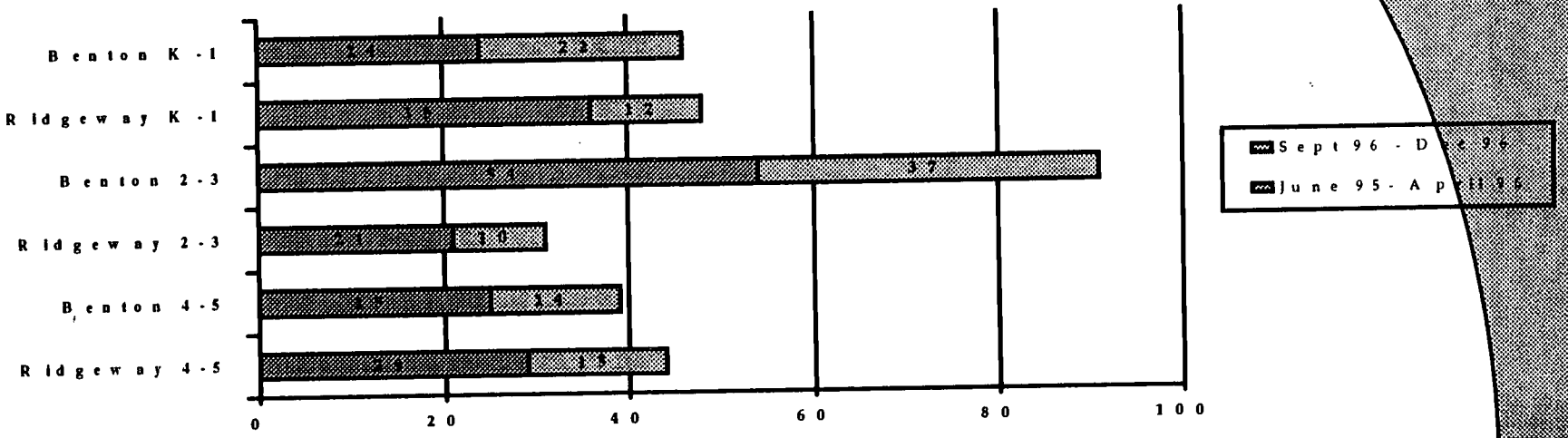


During June 1995 to April 1996, of the 24 teachers, 3 (12.5%) submitted more than 20, 3 (12.5%) submitted 11-15, 6 (25%) submitted 6-10, and 12 (50%) submitted 2-5 journal entries. During September 1996 to December 1996, of the 23 teachers, one (4.3%) submitted more than 10 entries, eight (34.7%) submitted 6-10, and 14 (60.8%) submitted 1-5 entries. A summary of the numbers of journal entries received between the two schools and among grade levels is as follows.

	June 1995 - April 1996 : teachers = 24			Sept - Dec 1996 : teachers =23		
# of Jounrals	Benton	Ridgeway	Total	Benton	Ridgeway	Total
1 - 5	7	5	12	6	8	14
6 - 10	4	2	6	6	2	8
11 - 15	0	3	3	1	0	1
16 - 20	0	0	0	0	0	0
21 - 22	1	2	3	0	0	0

Schools	Grade Levels	# of Journal Entries	
	June 1995 - April 1996		
Benton	K/1st (n=5)	24	107
	2nd/3rd (n=4)	54	
	4th/5th (n=4)	25	
	Others	4	
Ridgeway	K/1st (n=4)	36	90
	2nd/3rd (n=4)	21	
	4th/5th (n=3)	29	
	Others	4	
Unknown			5
Total			202

Schools	Grade Levels	# of Journal Entries	
	September 1996- December 1996		
Benton	K/1st (n=5)	22	73
	2nd/3rd (n=4)	37	
	4th/5th (n=4)	14	
	Others	0	
Ridgeway	K/1st (n=4)	12	37
	2nd/3rd (n=3)	10	
	4th/5th (n=3)	15	
	Others		
Unknown			0
Total			110



The journal content, from September - December 1996, can be categorized in the following areas (numerical data represents frequency and percentage of entries concerning each topic):

A. ***Describing feelings or classroom situations related to multiaged grouping (f=4; 3.6%):***

"I still love the multiage class grouping. I have some VERY low LD students this year and that is making teaching very challenging. I have 1 EMH and 3 identified LD students. I'm in the process of trying to get additional help for 3 more. Not that those numbers should be impressive or anything, but I'm really feeling overwhelmed with their learning needs. My older student, of course, help out, but you can take only so many high-need students in one room before you start to feel this way."

"Right now I am not happy with the multiage mix in my room. To many K's. Not enough strong role models."

"My fourth graders are finally getting the hang of unit C. Multiage with 4/5 is much harder than 5/6. I didn't realize the difference in maturity between 4th and 5th. I am having to constantly adjust my style to meet their needs. I think after this year I will have it under control. We have had to teach all new curriculum this year and it is time consuming. Once I am familiar with it things will get much better."

B. ***Describing class experiences related to the use of computers:***

i) Hardware basics and software usage (f=25; 22.7%):

"I have been teaching my second-third grade class the basic lay-out of the computer keyboard. They colored a paper copy of the keyboard to match the fingers that are used to touch each key."

"Today we had a substitute to help sit with them at the computer and review technology terms. They practiced with the mouse and reviewed vocab like mouse, icon and double-click."

"As part of their contract work, they use Microsoft Bookshelf to look up words. They love this instead of using the dictionary. One little girl tells me the dictionary gives her a headache but the computer doesn't!!"

"We're studying the human body in science. Some of the kids have been on the computer during reading time to do research using Encarta."

"The children have started using the Mavis Beacon Teachers Typing program during center time. They love it!"

"The children work in teams of two or three independently during various times of the day. Sometimes it is during our Centers time and at other times, it is during math or ABC/handwriting times."

"We continue to use Encarta to look up our animal visitors each week as a part of the animal excursion program through Columbia Public Schools."

"... we looked at the new software called History of the World. We played the game that goes with the CD. I divided the group into three teams. Each team did a different period in history. It was very cool!!!!! The kids learned a great deal and so did I."

"I am really excited about the computer connector that we got with our Links to Learning Grant. This allows me to demonstrate things on the computer tot he class so everyone can see at once. This makes it so much easier for all the students to be a part of the technology presentation."

"We are all using the hook up for the monitor to the computer to access the whole class. It really is neat. We wish the graphics were a little clearer. I know we are spoiled!! We have used it to do net searches get around in windows, and show the class our 500 Nations CD ROM. We are studying the Inuit culture and 500 Nations has a whole section on the Inuit."

ii) Internet use (f=10; 9%):

"I have my kids doing searches on the net and then presenting the information to the class. I print out the articles and the kids have to read them and then present the information to the class. They are limited to areas of study that we have touched on during the year. Right now we are finishing a study of the Arctic tundra so they are looking for info on animals. We also just finished our theme on Differences. Many students have done searches on disabilities. We have found a wealth of information."

"This week I had the chance to show two students at a time how to find things on the Internet. It was so fun to see how excited they got."

"My kids are really into email so I've been spending a lot of time helping them with the ins and outs of the Pegasus system. Because they are at least a bit slower than myself, I usually type for them."

"My class this year is working at establishing keypals around the world and we've connected with a few. We have high hopes to use the WWW for research and as a place to publish student writing. So far progress is quite slow. Time seems to be the biggest limiting factor."

"We are e mailing one of our students in Sweden and that has been fun for me and for kids."

"This week we started exploring the Digital Missourian for kids. Some like it, others don't like anything to do with reading and that's how they view this."

"Each group of 3 had a networked computer. It was really quality time because of this. I grouped according to interest. They searched for sites for the first session. The second session they shared what they found with the whole group."

"We have written letters tot he National Foundation for Blind, searched for information on seeing eye dogs and found a lot about disabilities and the Inuit!!!"

iii) Parent Volunteers (f=2; 1.8%):

"On Fridays, today, I have two computer dads come in and do computers much of the afternoon. One dad works on WWW with kids exploring some of their interests. The other dad makes sure they are proficient with computer basics, CD ROM, getting in and out of windows, etc."

iv) Future Plans (f=10; 9%):

"I'm looking forward to incorporating Power-point into my room -- but I'm not sure how yet."

"I'm thinking it would be fun to have the kids do something on the computer with their parents for Spring conferences."

"I'd like to get them into groups of twos and out on the Net during this time. Maybe we will try that next week! Also, I'm thinking of incorporating the computer in my room into my reading workshop time. There's so much reading to do!! Anyway, I'm just thinking about trying that."

C. ***Students' experiences in computer lab (f=8; 7.3%):***

"I had a full hour on the computers in the lab with my class today (8 at a time, of course), and it went great! They are working on typing a piece of writing that they have been working on, and it was wonderful to have 8 computers available at once! The kids loved it! Those who weren't on the computer worked on other things at tables in the library, quietly waiting for their turn."

"What a fun time we had at our computer lab. The students loved it. We go back again today. Some students know more than I do. I must practice."

"Students practiced using the keyboard, different fonts, different sizes, deleting written work, and just typing."

D. ***Describing how computer technology was used to assist their work:***

i) Successfully (f=9; 8.1%):

"I have also been using the word processor to make my weekly notes that go home to parents."

"I have been using the computer to print out some poems to use in the room and the usual word processor stuff."

"This week I did a web search on bats for a mini unit for my class. I received some really interesting information."

"I looked up a site form our Weekly Readers, but it was too difficult for K-1. I asked our media specialist to search for a few more sites appropriate for our age level. I have a couple more to check out."

"I have subscribed to Scholastic on the web for a trial period. I wanted to see if it would help me with curriculum and interactive activities for kids on the net without being concerned about inappropriate info getting into the wrong hands."

"We all used the computer to word process the theme contracts that we wrote."

"Last year I was able to find an address on Netscape for Winter holidays! I was able to pull a lot of information from that. They provide information on many countries and how they celebrate Christmas. There is also information that I use about Kwanzaa and Hanukkah."

"I have found some neat addresses for some reference on the various holidays celebrated throughout the world. I sent home with some students a print out of 33 ways to say Merry Christmas in various languages. We also found some background on Hanukkah in some network addresses . . . "

ii) With Difficulty (f=4; 3.6%):

"I went back to my saved mail and didn't find my last journal entry that you did not receive. I thought I had saved it. Wrong. I'm still having those kind of problems to figure out."

"When (the computer is) on the classroom account I can't access my personal mail on Pegasus Mail without closing down the whole class computer system logging out, and re-logging one. So, I don't tend to check my own mail often."

". . . I don't know how to keep this message from deleting after I have read it."

"We would all love to be using the Math Keys programs during our investigations time, but we are 'swamped.' Becoming computer literate on this new software requires much time that we have so little of!"

E. ***Describing difficulties integrating computer usage within the classroom (f=3; 2.7%):***

"For a journal entry I have got to say that with only one computer in my new community "B" assignment, I see it as a major distraction most of the time. So I have to ask myself: Other than the exposure (which is limited at best), does a computer really help these kids in my significant way. My answer is no."

F. ***Describing technical difficulties (f=10; 9%):***

"I tried to do a whole-class lesson on using Netscape last week. But I guess the server was down. What a bummer!"

"I sent the message to: multiage@mailconnect.more.net It was returned to me stating that I had the wrong address. (Or something like that). Anyway, I wanted to know how to send to the list serve."

"I use a disk to save the majority of the papers I create for class use. However, today when I put the disk in to search for an item, a message came up that said system error. After that my computer seemed locked up - I couldn't get away from the error message."

G. *Expressing lack of understanding regarding grant objectives (f-3; 2.7%):*

"I'm feeling some frustration with the way the grant workshops are set up this year. I don't feel as though we have enough information or guidance . . . What exactly are we supposed to do with (the students) on the computer? Do we have any guidelines or goals for this year other than the general outline we have been given?"

H. *Describing events occurring during technology grant training times (f=6; 5.5%):*

"I am presently in Benton's computer lab learning how to use Windows 95."

"We have completed our technology training times with students. We used Encarta and Student Writing Center. This time was worthwhile for us all."

"We all found the two half-days of Technology Training helpful for both us and our classes. We all used Encarta and Student Writing and Publishing on those half days."

"We all learned how to do Math Keys two weeks ago Friday at our teachers meeting day off. I like the program and looking forward to using it."

I. *Descriptions of available software (f=10; 9%):*

"I am still searching for addition programs that are easy enough yet challenging enough for my students. I really want an additional math program."

"I know how to use (Microsoft Works), but the graphics are very limited, especially for a school teacher."

"I have been trying to get my older children on a program called James Discovers Math by Broderbund for addition and subtraction skills. It as great graphics, and it pretty user friendly."

"Last week I put one of my students on the computer during math time. She is doing the MECC math program we already have installed. I really need other math programs for her. She is very smart and needs a challenge."

"My kids have enjoyed a program called Sierra. They have used it to get graphics for our dinosaurs theme. They have made games, calendars, word finds, and lost more."

"My kids enjoy the process of getting cool pics. etc. on Encarta more than the actual information they get. The text is pretty technical (I think for adults) so they get frustrated sometimes. We have ordered a more appropriate World Book CD-ROM that should be in soon."

"Finally, I did it! We tried the computer lab out -- just very briefly during our library check-out time. The children got to experience Windows 95 and I just let them play on the paint program. I know that is good hand-eye and mouse practice as well as experience using icons and windows."

". . . I also used Encarta as a reference. that entry was a little more detailed than we needed for kindergarten and first grade."

Final Summary and Conclusions

The overarching goal of this project, to use technology as a catalyst and support for systemic school reform, was ambitious and inventive. Data reporting the extent to which the two major goals of the project were achieved are included in the body of this report. The final evaluation data revealed several trends that warrant further discussion.

Multiage Grouping

The first goal, *"Create a learning community based on technology to acquire and apply knowledge about multiage grouping"*, was largely accomplished during the second year of the project.

During the second year, all classrooms were required to implement a 2-grade multiage classroom. This was initially received very positively by the teachers (100% had positive feelings after the second year) and coincided with an increase of developmentally appropriate teaching practices. However, by the end of year three, some (22%) of the teachers expressed negative feelings and concerns about the new grade configurations. At this point some teachers were questioning the original intention as well as the new grade combinations. This is not surprising given the challenges of teaching to wider and different developmental levels of students. After being confronted with the realities of multiage grouping for a short period of time, some teachers were doubting their own effectiveness. It is only speculative, but possibly with several more years of implementation and continuous support and mentoring, the high levels of teacher enthusiasm could return. If it is a goal to continue multiage grouping patterns in these two schools, then practical assistance and continuous support must be a feature of the inservice education provided.

Constructivist Teaching Practices

The degree of "developmental appropriateness" of the classrooms improved significantly after the first year of the project. By the end of the second year, the classrooms had significantly improved on all subscales of the PIP as well as in their overall scores. Those gains were not sustained during the third year of the project. Although the classrooms were rated as improved between the first observation and the final observation at the end of year three, the ratings decreased between the second and third year. This suggests that the training was not equally effective during the third year in helping teachers continue to understand and apply constructivist teaching

principles. After reviewing the content of the training sessions for the third year, it is clear that the emphasis was not on curriculum, but more on implementing technology in the classroom. The observations, journal entries, and interviews all reinforce this finding. This conclusion serves to further remind us that the outcomes of any training program will reflect the degree of emphasis placed on those outcomes. Or, if you want curriculum reform then it must be the centerpiece of all inservice efforts.

The fact that the classrooms improved as dramatically as they did during the second year of the project is remarkable given the short time period and small sample size. The decrease at the end of the project might also reflect a "burn out" factor, or a regression to more traditional teaching methods once the initial enthusiasm waned. The findings also suggest that for future projects, trainers will need to focus more intensely on **how** to integrate technology into constructivist teaching practices.

Implementing Technology

Although some of the elementary teachers in this project were initially "technology-shy", almost all (96%) eventually became frequent users who felt confident. They were universally enthusiastic about using technology for their own professional development. Their primary concern about using computers for themselves was time. This project very successfully created both the expertise and opportunity for the teachers to become technologically literate.

The primary concern about using computers in the classroom was the availability of computers. Teachers also expressed concerns about how to manage time when only a few computers were in each classroom and having appropriate software. Although it was beyond the scope of this evaluation, a good question to ask is how are the computers being used in the classrooms? A cursory review of the types of software being used and the ways the computers were utilized during the final observation suggested that many teachers were using skill-based software to reinforce specific lessons. Only occasionally did we observe teachers using computers to support independent inquiry and student-driven investigations. Again, although speculative, we surmise that future training needs to include a focus on project-based learning and **how** computers can enhance student work. It is our conclusion that while all teachers can effectively become technologically literate, and most can learn

constructivist teaching practices, the challenge is in the intersection between these two domains. Specific, targeted assistance coupled with in-classroom follow-up would be necessary for teachers to be able to understand and apply technology-driven constructivist teaching principles.

The development of the multiage lis-serv was a real contribution to other educators interested in this topic. The results of this evaluation both reinforce what we know about systemic school reform, that it is slow, arduous, and requires intensive effort, and presents challenges to other projects of this nature.

A final conclusion centers on the role of technology in supporting professional development. Taking all the results into consideration, one can view technology as an *inflator*. If the teacher's beliefs and practices are constructivist, then technology can inflate that practice and further the teacher's ability to promote student inquiry; if the teacher's beliefs are more traditional and behavioristic, then the technology will most likely be used to reinforce basic skills through repetition and practice. In other words, curriculum is the big challenge. Understanding the applying constructivist teaching principles is the primary task. Technology can help us better apply the principles, but it can not substitute for basic understandings, knowledge, and beliefs.

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