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ABSTRACT

A study examined a new collaborative consultation process to enhance the classroom implementation of whole language science units that make use of computers and multimedia resources. The overall program was divided into three projects, two at the fifth-grade level and one at the third grade level. Each project was staffed by a team of one college-based consultant, one or two classroom teachers, and two or three preservice teachers enrolled in a college teacher education program. Using a model of collaborative consultation, the team developed and taught science units that were based on whole language philosophy. Data were gathered through interviews with team members, observations of actual classroom presentations, and written summaries and evaluations of the project completed by the preservice teacher team members. Results indicated that the team approach, drawing upon the expertise of the classroom teachers, the preservice teachers, and the college consultant, was highly successful, both in demonstrating new educational methods to experienced classroom teachers and in providing valuable field experience in these methods to preservice teachers. (One figure describing the model for collaboration and three tables defining the roles of the college-based consultant, the preservice teacher, and the classroom teacher are included; 18 references are attached.) (RS)

A SCHOOL-COLLEGE CONSULTATION MODEL FOR INTEGRATION OF TECHNOLOGY AND WHOLE LANGUAGE IN ELEMENTARY SCIENCE INSTRUCTION

Field Study Report No. 1991.1.BAL, Christopher Columbus Consortium Project at York Central School and State University of New York at Geneseo

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Past experience in the education profession has convinced many that change is the one stable constant on which they can depend. Change brings excitement and renewal to the profession, presenting new challenges. It can also bring frustration and disappointment.

The "microcomputer revolution" of the 1980's serves as an example of both aspects of change, the excitement and renewal as well as the frustration and disappointment. As initial enthusiasm for the potential of microcomputer technology began to wane in the mid-1980's (McClintock, 1988), disappointment set in and many schools relegated their microcomputers to closets or to the back of classrooms for students' free time recreation. A "rising tide of criticism" (Balajthy, 1988a) of computer-based instruction made many proponents of computers in the classroom reevaluate their efforts to promote technology.

The purpose of the present study was to examine a new collaborative approach to teacher education in implementation of new technology. A wide variety of authors and researchers have identified the cause of the decline of interest in educational computing to be related to teacher education, enthusiasm, and commitment (Balajthy, 1989; Blair, Rupley, & Jones, 1986; Cosden, Gerber, Semmel, Goldman & Semmel, 1987; Cuban, 1986; Johnson, Maddox & O'Hair, 1988; Semmel & Schnorr, 1987).

The concern for teacher education in classroom technological applications comes at a critical time. The technology of the 1980's emphasized direct instructional programs delivered by microcomputers of very limited sophistication. A new wave of technology has more recently become available to teachers, emphasizing "computer as a tool" applications with more sophisticated computers that are easier for children to use and that provide voice synthesis capability and are able to access multimedia devices such as videodisc players.

It is clear that the old, top-down approaches to inservice teacher education failed to bring about successful change in the "microcomputer revolution" of the 1980's. If the new technologies of the 1990's are to truly transform classrooms, new approaches to inservice teacher education must be examined.

The basic goal of this effort was to develop a collaborative consultation process to enhance the classroom implementation of whole language science units that make use of computer and multimedia resources. The work was sponsored by the Christopher Columbus Consortium, a group of some 50 university-school partnerships brought together under the auspices of the Apple Computer Corporation to further the use of computers in public schools. In this case, the partnership was between a small northeastern United States state liberal arts college and a public elementary school located some ten minutes drive from the college.

The overall effort was divided into three projects, two at the fifth grade and one at the third grade. Each project was staffed by a team of one college-based consultant, one or two classroom teachers, and two or three preservice teachers enrolled in the college teacher education program. Tables 1, 2, and 3 outline their respective responsibilities. Using a model of collaborative consultation, the team developed and taught a science unit that was based on the whole language (Goodman, 1986; Newman, 1984) philosophy of purposeful learning and "learning by doing." A variety of researchers, theorists and teachers have suggested that whole language-based thematic units can greatly enrich the teaching of science (Balajthy, 1988b; Newman, 1984; Vacca & Vacca, 1986). Each unit incorporated a variety of subject and skill areas, including a heavy emphasis on purposeful reading and writing activities, and used computers and/or electronic multimedia resources as central components.

Key Issues for Satisfactory Implementation of Computers in Classrooms

The United States Office of Technology Assessment (1989) surveyed American schools to investigate the potential of computer technology in the late 1980's. Its assessment identified teacher training as the critical factor in increasing the impact of computers on student achievement. OTA researchers concluded that the potential of technology remains unexploited due to three major teacher-related factors: Lack of time, lack of access to computers, and lack of support during implementation. From observations of successful technology projects, the researchers suggested that success in teacher training to use computers is enhanced by seven factors. Since one of the major purposes of the present project was to bring about increased teacher commitment and expertise in using computers in the classroom, the initial project plans were designed to conform as closely as possible to the OTA guidelines.

1. Hands-on training. Teachers were provided the opportunity for supervised practice with all software, both in their free, planning time and during implementation of the project.

2. Trainers with close ties to the classroom. A collaborative consultation model, rather than a "training" model, was used to enhance the classroom validity of the project. All team members had a clear commitment to a child-centered curriculum and to the success of the project in the real world of classroom teaching and learning.

3. Access time for instruction and practice. All classroom teachers involved in the project had received prior training on use of computers in inservice sessions sponsored by the local school. In addition, a special conference highlighting classroom applications of computers was held at the college during the project's planning phase. There is no doubt, however, that training of teachers in computer use fell far short of the 100 hour minimum recommended by the Office of Technology Assessment.

4. Focus on use of computer as "tool." The project members were

committed to a philosophy of learning that highlighted purposeful, child -centered classroom activities. Each classified himself or herself as a "whole language" teacher, and viewed the computer's "tool" functions (such as word processing and database activities) as its optimum applications. This theme was emphasized in the training provided the preservice teachers prior to initiation of the project.

5. Integration of training with content area instruction. Topics of instruction were chosen from the students' regular science requirements, after consultation between the preservice teachers and the classroom teachers. A major focus of each project was the integration of computer applications in a science theme-centered unit.

6. Networking among computer using teachers. The collaborative consultation model employed in the present project led naturally to interaction, and sharing of ideas and discoveries was encouraged among all team members.

7. Teacher access to computers at home. This was not possible during the present project. Teachers were, however, allowed by their school to take classroom computers home over weekends and vacations.

An eighth and final guideline for teacher training was drawn from Balajthy's (1989) survey of computer-related curriculum change issues:

8. Follow-up support is crucial. The vital role of ongoing support for teachers once the initial implementation of computers has passed has been underscored by Guskey's (1986) contention that changes in teacher beliefs and attitudes occur after, not before or during, the implementation of new methods. It is only after the innovation has proved itself workable and has demonstrated improvements in student learning that teachers commit themselves to the new methods. No matter how good the prior training, it is when teachers actually try to use the new ideas that they encounter the most serious problems and doubts (Fullan, 1982). In the present project, the classroom teachers received intensive help and guidance in use of computers and whole language methods during implementation. After the project concluded, the support of classroom computer use by college consultants continued, through the school/college collaboration in the Christopher Columbus Consortium sponsored by Apple Computer Corporation.

The Model for Consultation

A collaborative consultation model of producing educational change was chosen as best fitting contemporary efforts to build the teaching profession. In traditional conceptualizations of consultation, flow of information tends to be one-way. In the present case, for example, the college "expert" would be expected to provide *information* and guidance about computer-based instruction and whole language to the classroom teacher. Recent research, however, has shown that a multidirectional process of consultation, one in which both the consultant and consultee offer and receive information, is preferred by teachers (Pryzwanski & White, 1983).

Five characteristics of the collaborative consultation process to be used in the project *were* adapted from Villa, Thousand, Paolucci -Whitcomb, and Nevin (1990):

1. Shared belief system. The three members of the collaborative team, the college consultant, the preservice teacher, and the classroom teacher, were perceived as providing unique perspectives and expertise.

2. Productive group relations. Team members attempted to carry out positive group decision-making, including face-to-face interactions,

conflict management, shared leadership, and clear individual accountability for agreed-upon responsibilities.

3. Situational and distributed leadership. Team members practiced a situational form of shared leadership, depending upon such factors as individual interest and ownership of specific objectives, willingness to carry out specific tasks, and their own particular background knowledge and expertise.

4. Interactive process. Decision-making throughout the planning and implementation processes was carried out collaboratively with the understanding that individual team members would often have diverse expertise and conflicting opinions.

5. Mutually owned outcomes. Final outcomes of both planning and project implementation were determined mutually and significantly differed from solutions that any one team member might have produced independently.

Project Descriptions

A detailed description of each project, including a list of resources and daily lesson plans, is available elsewhere (Balajthy, Cannon-Wallace, Cooper, Hendrix, Marrapese, O'Neil, Paniccia, Potter, Rifflard, & Walsh, 1991). One fifth grade unit was entitled "Beyond the Solar System," and dealt with such issues as stars, galaxies, and constellations. The other fifth grade unit was entitled "Plant and Animal Cycles," and focused on the life cycles of several plants and animals. The third grade unit was called "The Solar System," and dealt with the sun, moon, and planets.

Children engaged in a wide variety of activities typical of whole language classrooms, such as sustained silent reading, cooperative reading groups, library research groups, and writing process groups. In addition, units integrated skills such as mathematics, writing, reading, speaking, and listening, as well as other subject areas such as health, literature, and social studies.

Each unit included a significant amount of work with computers and/or electronic multimedia resources. Children and teachers used application software such as Crossword Magic for study of vocabulary using crossword puzzles, Children's Writing and Publishing Center for creation of classroom newspapers, and Award Maker for publication of classroom certificates and awards.

The "Beyond the Solar System" unit made use of the Voyager database program on the Macintosh computer to provide information about constellations and to promote higher level problem-solving skills in mathematics. The "Plant and Animal Life Cycles" unit made use of Plant and Animal Life Cycles, a videodisc-based collection of a wide variety of materials. The "Beyond the Universe" unit made use of Universe, two videodisc-based science documentaries.

General Evaluation and Suggestions

Figure 1 presents a linear model of the project's major stages. While such a linear model provides an understandable portrayal of the project's basic framework, it is does not acknowledge the continuous interactivity of decisionmaking and the reflectivity at all stages and among all team members which characterized the project.

Evaluation of the project was carried out using the two frameworks described above, the eight guidelines for teacher education in technology (Balajthy, 1989; Office of Technology Assessment, 1989) and the five characteristics of collaborative consultation (Villa, Thousand, Paolucci -Whitcomb & Nevin, 1990). Data were gathered through interviews with the team members, observation of the actual classroom presentations, and written summaries and evaluations of the projects completed by the preservice teacher team members.

In general, results were very positive. The preservice teachers found the experience to be invaluable in terms of their contact with actual classroom situations and their experience with computer technology and whole language instruction in science. The classroom teachers also rated the projects very highly, especially in terms of the projects' success with the children and value in terms of model science units for implementation of whole language and technology. Of most importance, the children were highly enthusiastic about each of the projects and wanted them to be continued.

A recurring theme in final project evaluations involved time for planning. The entire planning and implementation process took place in the course of a half-semester (two months). Team members requested that future projects allow for more time, especially for initial planning.

The use of computer and multimedia technology, and their integration as central components of science units of study, was also rated very successful. The "Beyond the Solar System" project, for example, found the use of a videodisc as an introductory, motivation-arousing tool to inspire initial enthusiasm. Evaluators noted that children raised a good number of questions following the videodisc presentation, indicating that they were interested and involved. The use of the _Voyager_ graphical database program also "promoted enthusiasm and sustained interest in all participating students," according to the post-project evaluation. Final project evaluations tended to call for more, rather than less, computer and multimedia resources in future units.

The integrative aspect of whole lanquage units, for example, bringing in related subject area emphases to the science units and involving a variety of skill areas, was also seen as a positive contribution to learning. In the "Beyond the Solar System" unit, for example, a literature component consisting of sustained silent reading of student-chosen science fiction novels played an important role. While using the _Voyager_ graphic database in teacher-directed small group work, children engaged in a variety of mathematical problem-solving and computation activities. The teachers, not the software or technology, played the critical role in setting up these problem-solving situations.

Among concerns raised in the post-project evaluations were the disruptive influence of scheduling conflicts with pull-out programs. The third and fifth grade projects were scheduled late into the school day, during standard science periods, when pull-out programs more seriously affect attendance than in earlier periods when reading, language arts, and mathematics are taught.

Concerns were also raised about the effectiveness of some innovative methods with which the children were unfamiliar. For example, brainstorming activities appeared to be new to the children and took more time and effort on the part of the teachers than had been planned.

Evaluation by the Guidelines for Teacher Education in Technology

1. Hands-on training. All team members engaged with the children in hands-on use of the computers during the units. Some concern was expressed about the limited use of computers and multimedia in certain units. For example, the third grade project did not involve children's hands-on contact with computers, though a significant amount of computer use as a teacher tool was carried out. The classroom teachers and preservice teachers believed that computers should play a more significant role. The college consultant, however, noted that computers should only be brought into classroom instruction when they have a

valuable and unique role to play. Using computers simply for the sake of using computers is not realistic or appropriate for the elementary classroom setting.

2. Trainers with close ties to the classroom. The project did not use a top-down, "training" approach, as implied in this Office of Technology Assessment criterion. Instead, the collaborative approach which intimately involved the classroom teachers in the entire process gave the projects a very close tie to the realities of the elementary classroom.

3. Access time for instruction and practice. One major advantage of the project was that classroom teacher time was provided for participation in the planning of the units and for some significant amount of practice with the software. The time was provided with no expense to the school district. It was the presence of the unpaid preservice teachers in the classroom, carrying out some of the class management and instructional tasks that the classroom teachers would ordinarily have handled, that provided the free time.

Classroom teachers, however, demonstrated little increase in their ability to handle computer-related tasks, except for those tasks that were specifically related to the software used in the projects. It is clear that this project does not offer a shortcut around Office of Technology

Assessment estimates of the time needed for preparation of teachers to use technology in the classroom. The real increase in understanding, as far as classroom teachers were concerned, appeared to be not in handling the technology per se, but in applying the technology to the everyday classroom science curriculum (see number 5 below).

4. Focus on use of computer as "tool." This focus fits well into whole language "project approaches" to studying science. The computer was used in a variety of ways as a tool, including classroom desktop publishing using Children's Writing and Publishing Center. The acquisition of and rearrangement of information was carried out by students using a variety of tool applications, including a graphic database program (the Voyager software), a collection of visual materials on videodisc (the Plant and Animal Life Cycles videodisc), and a traditional database program designed for children's use (Friendly Filer, which the children used as a research tool to collect and sort information on life cycles of selected plants and animals).

5. Integration of training with content area instruction. The college consultant's final evaluation of the project found this aspect to be of especially important benefit. The classroom teachers and preservice teachers were able to go beyond simple practice with the mechanics of

computer-based instruction to see the benefits of computers for science learning. This aspect of the projects demonstrated the validity of classroom computer applications in a unique and powerful way, unobtainable in most preservice and inservice training.

6. Networking among computer using teachers. Lack of teacher time to devote to the project was a concern, and certainly the amount of networking was limited because of this difficulty. For example, no general meeting of all classroom teachers involved in the projects was possible during implementation, due to time limitations and scheduling conflicts. Dissemination of results would also have been greatly improved if opportunity had existed for a joint meeting of team members and other computer-using teachers in the district.

7. Teacher access to computers at home. While greater access to computers would undoubtedly enhance teacher use of them in classrooms, the present projects did not seem to be adversely affected by limited availability of the technologies. Perhaps this is due to the fact that all team members brought to the project a fair amount of prior experience with computers (though not with the videodisc and CD-ROM applications), as well as a clear commitment to computer use in the classroom as demonstrated by their volunteering for the projects.

8. Follow-up support is crucial. As preservice and classroom teachers began to implement their units, it became apparent that the continued technical computer support provided through the projects was indeed critical. Basic operation of the videodisc, for example, required follow-up support by school and college technical advisors. One of the software operations manuals was unavailable, and consultant help was necessary to determine how to operate the software. Follow-up support kept minor problems from turning into major problems that inhibited effectiveness of instruction.

Evaluation of Characteristics of Collaborative Consultation

1. Shared belief system. The importance of team members' recognition that all members provided unique perspectives and expertise was deemed critical in the final evaluation. While at first, the preservice teachers might have been deemed the "weak link" in the collaborative network, due to their inexperience in the classroom, they quickly showed themselves to be willing to learn, especially in terms of management of students and classroom activities. Classroom teachers were impressed with the expertise these preservice teachers brought to the project, especially their knowledge of whole language approaches to science instruction.

2. Productive group relations. There was some degree of consensus that

support for additional free time for teachers to engage in more detailed group decisionmaking would have been very useful. Clearly the preservice teachers, with the project as part of their semester's college assignments, and the college consultant, with the project as a potential research vehicle, were able to devote larger amounts of time and energy to group process than the classroom teachers. These team members were somewhat frustrated by the limitations faced by the classroom teachers to engage in preparation and planning. More time on the part of classroom teachers to devote to the project might have resulted, for example, in greater involvement in making students accountable for homework readings, which was a recurrent problem in one fifth grade project. The final evaluation of the "Plant and Animal Life Cycle" project especially emphasized more group planning interactions, and suggested that the teams begin meeting earlier in the semester and that more frequent meetings, especially those involving the classroom teacher, take place.

3. Situational and distributed leadership. Virtually every evaluation of the project by the preservice teachers and the classroom teachers indicated a desire for increased input by the college consultant. One project's final evaluation noted, "More formal guidelines would have been extremely helpful" and another stated that, "College course instructor's

input was limited." Some of these feelings were apparently attributable to understandable concern, on the part of the preservice teachers, about grading criteria. They knew that their efforts would be graded by the consultant at the end of the project, and they felt concern that the specific and detailed requirements were lacking.

However, post-project comments indicated that much of the concern on this issue was more substantive than a simple desire for good grades. the preservice and classroom teachers honestly seemed to feel that there was a "right way" to carry out the assigned projects, and that the college consultant was holding out on them. The consultant was seen as the expert, and the other team members felt that, to some degree, they were stumbling around in the dark in their efforts, without the appropriate guidance. The preservice teachers, especially, did not seem to recognize that the intensive training they had received previous to the project on whole language and on computer-based instruction provided sufficient guidance.

Ironically, the desire for this concrete guidance was not allayed by the fact that each project was deemed highly successful by all team members involved. Much of the concern appears to be due to lack of prior experience and self-confidence. It may well be that, now that the preservice and classroom teachers have shown to themselves that they can succeed in producing and teaching innovative units involving advanced classroom technology, that future such efforts will be carried out more confidently.

4. Interactive process. The classroom teachers had been specially chosen for their flexibility and willingness to share responsibility in their classrooms with the other team members. Preservice teacher team members especially appreciated the latitude and flexibility in content preparation and presentation that was allowed by the classroom teachers. They felt that the classroom teachers treated them as professional equals, a vitally important attitude if true collaboration is to take place.

Amount of input by classroom teachers varied, and the attitude of the preservice teachers on classroom teacher input also differed. The "Plant and Animal Life Cycle" preservice teachers, for example, appreciated their greater degree of control and noted that "cooperating teachers allowed us to develop the unit in our own way." The resulting unit, while innovative, probably did not lead to as much classroom teacher ownership as might be desired in truly collaborative planning.

5. Mutually owned outcomes. All team members participated enthusiastically in the decision-making process during planning and

implementation. At first the classroom teachers in the third and fifth grades were somewhat reluctant to contribute to planning, perhaps especially due to inexperience with whole language approaches at the intermediate level. However, as the preservice teachers actively approached them for consultation and ideas, they began to contribute a wide variety of their own ideas and resources to the process.

Conclusion

Perhaps the most significant conclusion coming out of the projects deals with the collaborative approach used in creating an appropriate climate for educational change and the implementation of technology in science education. The team approach, which drew upon the expertise of the classroom teachers, the preservice teachers, and the college consultant, was deemed highly successful, both in demonstrating new educational methods to experienced classroom teachers and in providing valuable field experience in these methods to preservice teachers. There is no doubt but that the collaboration led the classroom teachers to a higher level of expertise in both whole language approaches to science and contemporary educational computing and multimedia applications. They all claimed to be more amenable to the implementation of such new methods in their classrooms. The collaborative training was carried out in a way that was satisfactorily thorough and intensive and, at the same time, cost-effective due to the use of unpaid preservice teachers who themselves were receiving valuable experience in the classroom.

Table 1. The Role of the College Consultant

1. To identify undergraduate or graduate preservice teachers with sufficient computer expertise and with an understanding of whole language approaches to curriculum.

2. To identify classroom teachers willing to work on the project, and to complete any necessary administrative details in preparation for the project.

3. To provide direction to the preservice teachers in obtaining computer and traditional resources.

4. To evaluate and provide feedback on the detailed instructional unit prior to implementation of the unit in the classroom.

5. To carry out formal and informal observations of the classroom implementation.

6. To consult with both the classroom teachers and the preservice teachers on a final evaluation of the project.

Table 2. The Role of the Preservice Teacher

1. To work cooperatively with the classroom teacher in choosing an appropriate unit of study.
2. To investigate in detail computer and traditional resources available for teaching the unit.
3. To prepare a detailed instructional unit in a subject area such as science or social studies, with integration of a variety of skill development activities and material from other subject areas, a significant use of computers and multimedia activities, and a central emphasis upon holistic, purposeful literacy activities.
4. To consult regularly with the classroom teacher during development of the instructional unit.
5. To carry out selected components of the instructional unit in the classroom.
6. To prepare a detailed evaluation of the instructional unit.

Table 3. The Role of the Classroom Teacher

1. To work cooperatively with the preservice teachers in choosing an appropriate unit of study.

2. To prepare the children for the presence of the preservice teacher as an instructional aide.

3. To provide information on computer and traditional resources available from the school.

4. To consult with the preservice teacher regularly during development of the instructional unit.

5. To carry out selected components of the instructional unit in the classroom.

6. To provide evaluative comments on the effectiveness of the unit and suggestions for future projects.

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Figure 1. Model for Collaboration