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Editor’s Note
As *Meridian* launches into its third year with the publication of our Winter 2000 issue, the last issue I will be privileged to serve on, I find myself reflecting on the world of electronic communication and scholarly publication that we first set out to enter back in 1996. At that time there were perhaps a few dozen electronic publications contributing to the scholarly record—now there are more than we can count.

Electronic access to information is on the verge of becoming ubiquitous in the developed world. The changes this new medium has brought to education, to commerce, to culture, to communication will be the subject of studies, of discussion, of activism, of investment for many years to come. And electronic publishing—a crossroads of copyright, information, commerce, and technology—is square in the middle of these changes and challenges.

At the university, electronic publication addresses so many pressures that have been mounting since before the advent of the copier and fair use in the 1970s. University libraries are experiencing decreasing funding and rapidly rising costs for print journals (the traditional "scholarly record"). Meanwhile they suffer the irony that the university library both pays to support the scholars who produce the articles (via salary, facilities, etc.), and pays to purchase the fruits of those scholars once it's recorded for posterity.

Given the existing campus infrastructure and all the free software available, the low startup cost for electronic publication (Bailey, 1994) naturally appeals to scholars, librarians, and administrators. The TRLN Task Force (1993), a coalition of university libraries, suggests that university libraries become primary “nodes” for scholarly publication. Colloquia such as the Scholarly Communication Colloquium (2000) held at NC State University support the idea that copyright and publication of scholarly materials should remain in the hands of its producers. We are experiencing a higher level of organization among those who construct the scholarly record, who are bringing together of a range of interests to discuss the reinvigoration of the scholarly communication system (e.g., Sosteric, 1998; Kling and Covi, 1995).

And yet what appears on the one hand to be an excellent step toward free and unrestricted access to knowledge everywhere, on the other hand is the source of much discussion, much concern, much trepidation. Libraries are actively reinventing themselves as they struggle to archive this rapidly changing “scholarly record” and to reposition themselves as the source for both authors and readers to exchange their ideas—the potential publishers of the future. Meanwhile publishers see electronic publication as potential anarchy (Bailey, 1994) and are carving out their niche via licensing agreements that are far more restrictive to libraries than copyright or fair use ever was (Hayes, 1996; Hersey, 1997).

Large-scale social forces are also at work, ranging from an overall flattening of university budgets nationwide to the value of the US dollar against European currency (Kling and Covi, 1995). Plus, we are all reacting to the cultural change that we are experiencing as electronic communications as a whole affects every aspect of our day-to-day lives—not only where we're going but also how we're getting there.

In the midst of all this change, relying on electronic communication to embody something so precious as the fruits of our labors and the record of our scholarly endeavors—across disciplines and through time—has brought issues of "perceived technological threats of depersonalization, of inauthenticity, of subjugation to the mechanical, and perhaps most centrally, of the substitution of quantity for quality" (Unsworth, in press, para. 6). Closer to home, questions still arise at the university regarding tenure value and other career rewards for electronic publication.

Many journals, to address these issues, are moving only gradually toward electronic publishing, often publishing both electronically and on paper to help us bridge the gap of our uncertainty (Kling and Covi, 1995). Those publications that are entirely electronic, such as *Meridian*, no longer have 10s to 100s of copies on the back shelf ready for orders (Friedman, 1996)—we have server space that must be continually maintained, with copious backups, to make sure that what is there today will still be there tomorrow (Boyd and Herkovic, 1999).

And so our uncertainty is a reasonable response to uncertain times because so often these days what was there yesterday is not still here today. In our shift “from analog to dialog” (Tapscott, 1998), the library is reinventing itself and how we access scholarly communication is changing. And so is our day-to-day communication via email, our ability to collaborate at a distance, and the content of what we teach our students and how, regarding not only the uses of technology but also its implications. New questions of assessing quality of content, reader access, and much, much more arise every day.

As if all this change isn’t enough, some call for us to reinvent the notions of what it means to construct a communication system in the first place. This would involve not only new models of journals, libraries, and publishing, but also “new interpersonal and institutional mores, customs and practices, and a new basis for the economic conditions associated with communication” (Wilson, 1995). All these changes make constructing an overall picture of electronic communication extremely difficult. Too, on a practical, day-to-day basis, these changes present scholars and teachers with very real challenges on all fronts, and present our students with more to learn, both from the Internet and about it, and more to learn about using computers to get there. With all this change, no wonder we are trepidatious regarding something so intangible and changeable as electronic communication.

Despite the disconcerting nature of this change, some optimistically foresee a move toward a higher form of organization as scholars take back control and access to their work (e.g., Kling and Covi, 1995; Sosteric, 1998). By so doing perhaps we will experience a higher form of self-awareness in the way we communicate, among ourselves as scholars, as researchers, as practitioners, as administrators, as librarians, and as students, all of whom *Meridian* wishes to serve. We are certainly experiencing a new perception of our roles as our traditional forms of communication become obsolete.

And perhaps this is a major source of our trepidation, our uncertainty about just what our new roles will be—what this change will bring us. In a very personal way. Just as we find the teacher becomes the student and the student the teacher, on the Internet and with other forms of electronic communication our role distinctions are gradually being erased. The separation of author and reader is blurring as electronic collaboration expands beyond the initial authorship of a paper to series of ongoing contributions and discussions—a “living article” that reflects up-to-date thinking on a subject. The role of researcher and practitioner blurs as practitioners collaborate and document their observations, and researchers work directly.
though perhaps remotely, in model schools to observe the effects of teaching techniques.

And the sheer amount of information is expanding rapidly as we generate more and more contributions to the scholarly record—in classic forms and in new experimental ones we have yet to conceive. With these experiments we have the opportunity to set precedents now that will affect our activities for many years to come (Kling and Covi, 1995; Gilster, 1997; Unsworth, in press). With so many changes, each of us must feel at least a little disoriented as we constantly find ourselves sorting out where we “want to go today.”

At Meridian we have long recognized that we are working with a sense of disequilibrium (Wilson, 1995; Gerler and Mason, 1998). As a board member with Meridian for its first issue, and now co-editor of the Winter 2000 issue, I have seen our contributors, board members, and advisers struggle to choose the best technical approach, the most comprehensive copyright policy, the most reader-accessible format, and on and on. We are stretching the envelope as we join in the attempt not only to share in constructing the scholarly electronic record but also to reach out and expand the record, to expand our readership and authorship, and to increase the electronic advantages in communicating both research and practice.

Along the way we have encountered practical questions regarding techniques for electronic peer review and appropriate design, and logistical issues such as copyediting, artwork, scholarly consistency, ergonomics, and the range of electronic capabilities and experiences of our readers and authors (Rowland, 1996). We have had a great deal of assistance from many individuals and organizations as across NC State University, including the University Attorney’s Office, D.H. Hill Library and its many services and centers, and many major professors (Gerler and Mason, 1998), without whom our navigation of this new territory would have been far more tortuous.

And through all this Meridian continues to define and redefine its own role in both scholarly communication in general and also computer technology in the middle school in particular. We wish to be a bridge between researchers and practitioners of classroom computer technologies—their use for teaching, teaching their use, administrating the infrastructure that supports it, and experimenting and expanding its capabilities so that the constant change we experience will be for the better. We hope that through Meridian we can share our ideas, our experiences, our observations and predictions, not only in the area of computer technologies in the classroom but also of how well Meridian is addressing the needs of its readers and authors.

To help reach our mission, Meridian is sponsoring a special upcoming issue for Summer 2000, calling for papers to explore the role of research for computer technologies in the middle school. As a prelude to this special issue, in this Winter 2000 issue we include a reprint of a chapter on Action Research, one of many methodologies we can apply as we try to understand how we teach ourselves and others.

These are just two examples of many new steps that Meridian will take over the next several issues, as we try to better serve and better understand our readership and our authorship (Watson, 1999). Meridian is changing as rapidly as everyone and everything else that is connected electronically. We can only hope that we are changing to meet the needs of our constituency we hope to support, encourage, challenge, stimulate, and grow alongside with as we struggle with disequilibrium, and enjoy the satisfaction of helping to direct the changes we experience.

So that we may better adapt ourselves in this ever-changing milieu that is electronic scholarly communication—and to help minimize the disequilibrium many of us feel in communicating without the touch of the paper to hand, the sound of the voice on the phone—Meridian now includes a survey asking our readers for feedback to help us gauge how well we are accomplishing our primary goal: serving our reader/authorship. Are we reaching both researchers and practitioners of computer technology in the middle school? Serving as a platform for communication of ideas? Encouraging research among all elements of our readership as we try to tap the potentials that we may find in computer technology?

I hope that each of you will take a moment to send us some feedback—a moment to join your voice to the construction of our electronic future, to share the role of reader and contributor, and to help make our own adaptability a constant. And I hope you will join me in supporting Meridian’s efforts to continue to carve out an electronic niche for research and practice of computer technologies in the middle school within the broader issues of electronic communication.

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Manuscript Submission
Guidelines and Policy

Manuscripts are now being accepted until April 27, 2000, for the Summer 2000 special issue:
"The Role of Research for Computer Technologies in the Middle School" (see the call for papers).

SCOPE:
Meridian is an electronic journal dedicated to research and practice of computer technology in the middle school.

MANUSCRIPTS:
Manuscripts should be approximately, but are not limited to, 20 pages, double spaced.

Articles should follow APA style. References should be included at the end of the paper. Authors should provide complete references with the manuscripts, including page citations, photo credits, and graphics credits.

The use of graphics, links, animation, video, or audio components is encouraged. Meridian editors will provide assistance to authors who are unfamiliar with nontext file formats. Editors will attempt to use the author’s suggested presentation formats.

Article files will not be returned. Authors should retain an original copy.

A cover sheet should be included with the manuscript listing: (a) title of the paper, (b) brief biographies of authors and (c) email and mailing address and any other relevant contact information.

Electronic submission of manuscripts is preferred. Articles should be sent via email or on diskettes. HTML, MS Word, or text formats are preferred.

Acknowledgments will be sent via email within one week of the date we receive your manuscript. All manuscripts will be reviewed in a double-blind fashion by the graduate student review board.

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Call for Papers

The Role of Research for Computer Technologies in the Middle School

Meridian: A Middle School Computer Technologies Journal (http://www.ncsu.edu/meridian), is producing a special summer issue on doing and using research on computer technology issues for the middle school. Suggested topics are listed below.

The submission deadline for the special issue is April 27, 2000.

**Suggested Topics** for this special summer issue include (but are not limited to):

- Research reviews on computer technology issues as they apply to middle schools
- Methodologies applicable to research projects for middle school computer technology
- Examples of innovative research applied to middle school computer technology issues
- Teacher issues regarding applying research in designing uses for computer technologies in the middle school classroom
- Administrative issues regarding selection of computer technologies and approaches informed by research

For questions or further information, see our submission guidelines, or contact the Meridian editors at meridian@poe.coe.ncsu.edu.
Meridian is an electronic journal dedicated to research and practice of computer technology in middle school classrooms. It is published twice yearly by an interdisciplinary team of NC State graduate students representing a broad range of fields, from education to forestry. Located at

http://www.ncsu.edu/meridian/

Meridian features research findings, practitioner articles, commentary, and book excerpts by educational researchers, technology designers, middle school teachers, and authors who wish to share and expand teaching and learning experiences with computer technologies in middle school classrooms and beyond.

Editorial Board

Indexing Information

Submissions

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the following key words:
- lesson plans
- classroom
- examples
- hands-on learning
- middle schools
- computers
- virtual field trips
- international
- world wide web

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- Netscape Search
- Northern Light
- Planet Search
- The YellowPages
- WebCrawler
Girls on Track with Information Technology

Sarah B. Berenson, Maria A. Droujkova, Laurie O. Cavey, Nancy H. Smith, and Tiffany M. Barnes

Center for Research in Mathematics and Science Education
NC State University
Raleigh, NC

Introduction

Imagine a math classroom that hums with activity and debate as to how the community can change its dependence on the automobile. Students gather data from the Internet to build their argumentation to support different solutions. Excel is used to generate graphs and tables to portray the quantitative dimensions of their problems. "What if we made an HOV lane on Interstate-40—would that work?" questions one twelve year-old. "I think we need to have better public transportation," chimes in another. "Yeah, but how do you go about getting people to leave their cars at home," retorts a third student.

This type of dialogue was repeated again and again during the Girls on Track Math Camp for 40 talented seventh and eighth graders last summer. This National Science Foundation project aims to keep talented middle-grade girls on the fast math track into college. Principle investigators at NC State University are Sarah Berenson (Mathematics Education), Mladen Vouk (Computer Science), and Tracy Robinson (Counselor Education). They collaborate to integrate mathematics, information technologies, and leadership skills into a comprehensive treatment to address the problem of decreasing interest in mathematics and computers among females. Over the next three years 200 girls, 50 teachers, 30 preservice teachers, and 15 guidance counselors will participate in Girls
on Track, investigating community problems with information technology tools.

Nationally the underrepresentation of women in science, engineering, mathematics, and information technology careers is of great concern. Over the past 20 years, female enrollments in computer science have declined more than 40% (Rogers & Kaiser, 1995). Rigorous undergraduate mathematics preparation is a gateway to high-paying careers in science, engineering, and information technologies. While girls are increasing their enrollments in high school mathematics courses, they tend to drop off the fast math track in high school and college tool (American Association of University Women, 1998). Girls' interest in mathematics begins to change dramatically in the middle grades and high school. Studies have found that girls do not see mathematics as a useful tool. For this reason, Girls on Track focuses on mathematical investigations of community problems that are compelling and engaging to talented middle grade girls.

In this article we highlight the information technologies used as tools for the mathematical investigations and some positive, first-year results. First, we examine how uses of information technologies enhance the context for learning. Second, increases in girls' interest in using the technology are reported. Third, a description of ways that the information tools increased girls' confidence is provided.

Tools to Enhance

Investigations depend on rich and authentic contexts to engage students' interest. While they may know some things about the selected context, more information is usually required to support the learning experience. The web provides this background information so that information concerning the context is provided to the students. We begin our investigation of population increases in the community by asking students to determine the population in Wake County in 20 years. The girls engage in a web exploratory activity to connect their ideas of population growth in the world before moving to the population growth in the community. Two valuable websites for population investigations are: http://www.popexpo.net/eMain.html and http://www.co.wake.nc.us/planning/Demographics.
"The girls engage in a web exploratory activity to connect their ideas of population growth in the world before moving to the population growth in the community."

With some background information, students are ready to begin asking questions they choose to explore about population growth. Which town in the county is growing the fastest? What area will need new schools? What area of the county has an aging population? Where are the more dense populations for public transportation routes? Once again, the web becomes a source of data to answer the students' questions.

Excel is used as a data collection and data display tool for the investigations. Then girls select from a variety of tables and graph formats to convey the results of their investigations to others. For this communication aspect, girls use PowerPoint with Web and Excel graphics to convey their results and concerns. There were several benefits accruing from the uses of these tools. First, the girls were deeply interested in the community problems but did not know how to find current and up-to-date information. The web was exactly the right tool to fill that void. Second, a tool that can manipulate, calculate, and graph numerical data is extremely useful for collecting and analyzing the data of the investigations. Finally, PowerPoint provides a multimedia palette for girls to communicate the results of their investigations to others. Their individuality and creativity can be fully expressed with this semi-professional tool.

Interest in Math, Science, and Technology

In addition to the community investigations, girls learn how to build their own web pages and send e-mail to each other and their counselors. E-Mail reflections at the end of each day provide an ideal source of evaluation data to the counselors. When asked what they enjoyed most during the two-week camp experience, more than half of the girls selected information technologies as a favored activity.

S: My favorite part of GOT was learning about computers. Before coming here I wasn't very good at computers and the web. I am now very excited about technology as well as Algebra.

T: The best thing I liked about GOT was the web page. I've always wanted to know how to do it,
but I never got the time to learn and this was a really good opportunity.

**U:** The websites rocked!!!

While the web page construction was a definite favorite, PowerPoint and E-Mail were camp highlights too.

**V:** My favorite part of GOT was using the computer to do E-Mail and our websites. It was really cool how GOT put together math real events and computers to make presentations [PowerPoint]. I wish school was like this!!!

An important component of Girls on Track is career awareness. Women with interesting jobs in science, engineering, and information technologies speak enthusiastically about their careers with the girls. To highlight the importance of studying mathematics, one of the investigation problems considers why men earn more than women do. The combinations of investigation and speakers proved to have a powerful effect on the girls' thinking.

**D:** GOT has changed the way I think about my education by making me think about how good it is to take math classes. I'm going to be taking a lot of math classes now! GOT has changed the way I think about future jobs too. I didn't know what I wanted to be before, but now I want to be in a computer related job.

**E:** Girls on Track has helped me become more interested in mathematics and computer sciences. This camp has changed my mind about what I want to learn and what job I want to try to get. GOT has made me think about getting a job as a web site manager, a computer engineer, or something that has to do with computers and involves math.

Seventy-five percent of the girls reported changes in thinking about their careers because of the summer camp experience. These changes were all related to increased interest careers in computers [28%], mathematics [32%], and science [32%].
Increased Confidence

Building girls' confidence is one of the more important objectives of Girls on Track. Two activities are noted as confidence builders for girls participating in the summer camp. It appears that the activities involving Excel, PowerPoint, Web design, and E-Mail give girls confidence with information technologies.

**M:** GOT has changed my thinking by making me more confident that I can pass the computer test. By me being in the band I did not have the chance to take keyboarding of any type. Now I have had to use the computer more then I would have been able to at home.

Additionally, the PowerPoint presentations of investigations were given in an auditorium setting before their peers. One day, community and university dignitaries and two US congressmen were part of that audience. Each girl participated in these public speaking activities and counselors noted the changes in the girls' confidence with each presentation.

Impact of Information Technologies

It is an established fact that women earn 70% of the average male salary. Part of the problem is that women are underrepresented in science, math, engineering, and technology careers [SMET] that traditionally command higher salaries (American Association of University Women, 1998). While enrollments in high school mathematics have increased dramatically for females, their enrollments in college mathematics are considerably less than males (Secada, Fennema, & Adajian, 1995). Significant changes are needed in education, in particular mathematics education, to better motivate and retain girls and women in SMET curriculum and careers. From one perspective, many girls' discomfort with traditional mathematics may result from its presentation as an utterly abstracted exercise, devoid of connectedness to real people, real contexts, and ways to help improve others' lives. Girls on Track creates learning environments centered on community problems where information technologies support the girls' problem-solving efforts.
References


Marshian Chronicles: Looking at the Past to See the Future of EstuaryLIVE

Cris Crissman
Catalyst Consulting

"We strive to move beyond the gee-whiz of technology to technology supporting real-life, real-world conceptual understanding and critical thinking."

Ray Bradbury, relax. This is no sci-fi thriller though even five years ago the technology involved may have seemed futuristic. And the "marshian" in our little play-on-words refers to a space here on our own small planet, a marsh, one of the estuarine habitats. Poetically described as "where the rivers meet the sea," an estuary is a vital ecosystem found along coastlines around the world where fresh water flows into the oceans.

This is a chronicle of EstuaryLIVE, a project that uses wireless video transmission and internet technology to enable thousands of preK-16 students across the country to visit the Rachel Carson Site of the National Estuarine Reserve in Beaufort, North Carolina. The field trip is webcast real time, live streaming video from an island on the Reserve (for a semi-live view of the field trip site, visit the EstuaryLIVE webcam at http://www.ncnerr.org/). This is not some heavily funded, glitzy technology project but a grassroots internet field trip developed by a partnership of naturalists, educators, and a professional videographer/internet enthusiast.

In this article, the project's organizers in partnership with a participating middle school team describe the perspectives and
issues involved. Our focus is on how to best integrate such a
technology-enhanced, interdisciplinary project into the middle
school curriculum. We strive to move beyond the gee-whiz of
technology to technology supporting real-life, real-world
conceptual understanding and critical thinking. What's more,
through this virtual journey we want students to learn to care
about this special part of their world and to join in important
conversations about environmental issues. In these chronicles,
we describe the technology required, the curriculum
framework, and the values and challenges of such a project.
We also introduce you to the project's extensive website and
evolving future plans.

This chronicle is organized into six main sections:

- **EstuaryLIVE: The Largest Field Trip Ever!** . . . an introduction to the Project
- **EstuaryLIVE in the Classroom** . . . a description of EstuaryLIVE Project
implemented in two contexts—a middle school and an undergraduate
Reading in the Content Areas course for preservice elementary and middle school teachers
- **Lessons Learned from EstuaryLIVE** . . . reflections and insights pertaining to the
practical as well as the theoretical
- **What Next?** . . . future hopes and dreams for the Project
- **Related Sites**
- **References**

**EstuaryLIVE: The Largest Field Trip Ever!** . . . an
Introduction to the Project

North Carolina's beaches are famous for their deep sandy
shores and warm ocean waters. Not so well-known are other
estuarine habitats such as grasslands, marshes, tidal flats, and
maritime forests. Recreation draws people to the estuaries.
"We wanted to explore how technology could be used to further the educational mission of the Reserve, so we decided that we would find a way to 'bring' more people to the estuary."

1998 Video: "Waters of Life"

Locals and tourists sun, swim, fish, walk, and bird-watch. But the estuaries serve a larger purpose in the environmental scheme. They provide a nursery for much of the seafood we enjoy, a storage basin for the nutrients washed down from the inland, a sponge to soak up excess run-off, and a buffer against storms.

The North Carolina National Estuarine Research Reserve was established in 1982 to help keep these valuable estuarine habitats healthy. The Reserve accomplishes this mission through long-term research, monitoring, and education. Field trips to the Reserve by the public and school groups are an important part of the Reserve's educational program. Many school children in eastern North Carolina but few in the Piedmont and Mountain regions are able to take field trip excursions to one of the four estuarine reserve sites: Currituck Banks, Rachel Carson, Masonboro Island, and Zeke Island.

We wanted to explore how technology could be used to further the educational mission of the Reserve, so we decided that we would find a way to "bring" more people to the estuary. The Rachel Carson Reserve, a series of narrow islands just across from Beaufort, was the nearest to a populated area with internet access and seemed the most likely site to begin our experiment.

Our online field trip began in the fall of 1998 when approximately 2000 diverse students from elementary classrooms to teacher education classes at East Carolina University traversed the internet to reach this unique environ off the North Carolina coast. Two field trips (Spring and Fall 1999) and approximately 4000 students later, the field trip has become a semi-annual event that many students and teachers look forward to. Participants from eight states in addition to North Carolina have now joined our trips. Though we are continuing to collect research data in the form of surveys and interviews with participants, we decided it was high time to begin to write about what we have learned so far.
It all began with a drop of water . . . a drop of rain that fell on the lush vegetation of a mountain valley in Western North Carolina and then plopped into a winding stream, barely more than a trickle. The story of how such rain drops make their way to the rivers and eventually to the seas was how we chose to begin a 1998 video we called, "Waters of Life" (RealPlayer video online at http://streamer3.galaxy-net.net:8080/ramgen/margraf/waters.rm). "Water may flow in a thousand channels but it always returns to the sea" is the wisdom of an African proverb, and where these channels reach the sea is an incredibly unusual and uniquely beautiful place—an estuary. North Carolina alone has over two million acres of estuary along its coast.

Estuary, which comes from an ancient Sanskrit word meaning "surge" or "swell" is not an everyday term and, in fact, sounds a bit foreign and scientific to most people unfamiliar with its usage. I confess that when I was first contacted about writing a video script about the estuary, my first stop was Webster's. I had never heard, let alone, experienced such a place. That all changed when I began to research estuaries, both in a secondary way reading what others had written, and in a primary way, working as a grip to film the video. The videographer, Bill Lovin, and I laugh now that the shooting of the video, "Waters of Life," was an extensive project in which we shot over thirty hours of footage—not because it was necessary for a 16-minute video but because we were intrigued by the beauty, the mystery, and the serenity of this exotic world. There is not a great deal of biodiversity here because life is hard and extremely demanding—the plants and animals must become incredibly adaptable to the rapidly changing environmental conditions. Those that survive and thrive here are remarkable and fascinating to study. There is an unearthliness about this place—far different from those habitats from which we come.
"We know that there are easier and more technologically advanced ways to do this. But we feel fairly confident that no one has figured out a less expensive way to do this."

"How Did They Do That?"

Sample of One of Our Field Trips

University-School Partnerships, The University of North Carolina General Administration

You Are There

Our model for a live interactive internet field trip includes students who, under the guidance of a naturalist, explore the island's estuarine habitats. A volunteer uses a video camera to capture the field trip in progress while simultaneously transmitting the signals wirelessly to a receiver on shore and a digitizing computer. Then the digitized video is sent via the internet to a video server on the other side of the country and then out again to virtual participants. These virtual participants see their peers on camera making their way through the tidal flats, the salt marsh, and the maritime forest to learn about the incredibly adaptable plant and animal creatures who thrive there. The naturalist and the student hosts carry on a lively informative dialogue about what they are finding while their peers back in the classroom email questions sparked by their studies of the estuary and the live pictures they see beamed back from this unique ecosystem they are virtually experiencing. Our resident techie has provided infinite details in the "How Did They Do That?" (http://www.estuarylive.org/dothat.htm) section of our website.

Our first two field trips (Fall 1998 and Spring 1999) were accomplished using what we have come to call "Chat Video"—a live picture refreshed often enough (once or twice a second) to closely resemble video but without audio—communication among the naturalist guide and the participating classes takes place through a chat window (again, check out "How Did They Do That?" for more information). Even though with the Fall 1999 trip we successfully used live streaming video (RealVideo—you can see a sample of one of our field trips at http://www.estuarylive.org/vidtest.htm), we continue to use the "Chat Video" technology as our backup and as an option for those unable to use the RealVideo technology.

We know that there are easier and more technologically advanced ways to do this. But we feel fairly confident that no one has figured out a less expensive way to do this. Bottom-line, we do this on a shoestring budget. The original idea for the project was developed by a video producer (Bill Lovin of Marine Grafics) and a naturalist-educator (Susan Lovelace of the North Carolina National Estuarine Research Reserve). But EstuaryLIVE would still be just an idea without visionary sponsors such as Alisa Chapman, Director of Instructional Technology for University-School Partnerships, The University of North Carolina General Administration (http://www.ga.unc.edu/21stcenturyschools) and Dr. Helen...
"Bill has endeavored to bring this field trip experience within the grasp of any class that has an internet connection."

The Beginnings of EstuaryLIVE

Bill Lovin is at heart an underwater cinematographer—one of the few professionals in the world. He keeps his business, Marine Grafics, afloat though by shooting educational as well as nature videos. It was his interest in the world of the estuary and knowledge of the videography and the internet that led him to explore the possibilities of conducting estuary field trips and inviting the world. He reflects on his guiding purpose:

The National Estuarine Research Reserve—that's a hard thing for kids—for people to understand. This way people could grasp it a little easier. I thought that if the Reserve could get a little publicity, and people could see what it is even though they had never visited it—that they would get a good feeling about it and they would be able to understand it. So that was basically my interest in this project, plus, you know, to prove that it could be done. Nobody seemed to be willing to prove that it could be done—except us.

"It" refers to the production of "live" internet events as a grassroots initiative—requiring a minimum budget for production and no cost for participating teachers and students. Bill has endeavored to bring this field trip experience within the grasp of any class that has an internet connection. The software needed to view the field trip, RealVideo, is free for downloading. There are other "live" virtual field trips such as the famous JASON Project (http://www.jasonproject.org/) but participating schools must invest in a satellite downlink system and project curriculum materials.
“EstuaryLIVE seems to fill a unique niche—it's live, it's interactive, it's easy to access, and it's free. The focus of these trips is on environmental education set within an interdisciplinary approach.”

EstuaryLIVE seems to fill a unique niche—it's live, it's interactive, it's easy to access, and it's free. The focus of these trips is on environmental education set within an interdisciplinary approach.

The educational coordinator for the North Carolina National Estuarine Research Reserve is Susan Lovelace. I asked Susan about her motivation for creating "live" virtual estuary field trips.

Professionally, it gives people a vision of what an estuary is so that when they hear things on the news that relates to fishery issues, to coastal issues, they will have a mental picture of where an estuary is and all the different things that interact to make it work. I guess that's one of the best things I learned in teacher education—if you don't have an idea of what something is then it's important to see and have a feel for it. It's like when we go out to the marsh pond, and I have some kids over there in person. I have them look at it and I say, "Now close your eyes and see this picture in your mind so that when someone says estuary this is what I want you to know." It's making mental notes. That's what I'm trying to achieve with this professionally. Personally, I want kids to look beyond just where they live and see the big picture and how everything fits together.

I also asked Susan how she sees technology changing her job and efforts to help people learn to see the "big picture." Her comments:

In a lot of different ways—I hate to say this but start with money—we can reach a much larger audience with a lot less staff. Although this does cost money, it doesn't begin to
cost the staff it would take us for these same functions for a lot of people. Also, travel … we're finding that it's getting hard for kids to travel places. This is a way, though it's not as good as being there, I do think it's the next best thing. I think the fact that it's interactive makes a tremendous difference. We can create a beautiful video that would look a lot better than the video we're sending out. But this way, the students can ask questions and they can hear other people's questions and see and hear what we find. When it's off the cuff, I think it can make more of an impression.

Susan's response points to a guiding question we are constantly returning to as we develop this project: "Why live?" "Why real-time?" "Why fight the difficulties inherent in producing a live internet event when we can produce those beautiful canned videos?" That's one of the most important lessons we are learning as we forge new virtual territory with our live virtual field trips.

"After years of working with inservice teachers, I was convinced that such a constructivist approach is by far the most successful in helping teachers begin to control their own professional development."

EstuaryLIVE in the Classroom

My goal as a teacher educator is to learn how EstuaryLIVE and similar projects can bring a new vitality to the classroom. In the first story, a story from my own teaching experience, I describe how I used the EstuaryLIVE project as a catalyst for encouraging more active and project-based learning in my Reading in the Content Areas course. In the second story, we hear from a creative sixth grade middle school team and their enterprising technology specialist.

EstuaryLIVE In Teacher Education

Opportunistic teacher that I am, EstuaryLIVE to me represented a unique way to have my Reading in the Content
Area students experience a real-world application of a unit that integrated thinking-skill development and content area instruction. That's what Reading in the Content Areas or actually Literacy in the Content Areas means to me—making the most of language-mediated opportunities to learn to think while also developing subject matter understanding, both conceptual and procedural. Often the strategies that provide support for the learner as s/he attempts to use text to learn new content or skills are referred to as "scaffolded reading strategies" (Vacca & Vacca, 1999).

Thinking-skill development, content area instruction, plus technology—this project had it all! Even more important than the opportunity to model for my students what this unit represented, these soon-to-be-teachers themselves would experience Literacy in the Content Area strategies and technology in their own learning. After years of working with inservice teachers, I was convinced that such a constructivist approach (more on this theory in Lesson #4) is by far the most successful in helping teachers begin to control their own professional development. And so I set about developing an interdisciplinary unit for my preservice teachers that would engage them in learning about the estuary while they applied the strategies they were learning for scaffolding instruction. The culminating project would be several website resources that they would develop for teachers and students who were participating in the EstuaryLive event.

I began the estuary unit with a favorite scaffolded reading strategy, a predictive one called "Possible Sentences" (Vacca & Vacca, 1999). The students were asked to make connections among the ten words I had written on a chart (words like estuary, spartina, detritus, nutrea, horse, turbidity, salinity) and create sentences in which they connected at least three. This strategy works like a charm and in no time you have a fairly good assessment of the students' prior knowledge of estuaries and you have successfully piqued their interest. I then showed just the first five or so minutes of the "Waters of Life" video—just enough so they could begin to understand what an estuary is and what these words meant in this context. This introduction flowed naturally into the next scaffolding reading strategy, Donna Ogle's KWL or "What do you Know?" "What do you Want to know?" (or sometimes "What do you wonder?") and "What did you Learn?" Because I like to stress the practical application of knowledge from the very beginning, I have added "CD" for "Can Do." "What can you do with what you learned?" After we listed everything that we knew about the estuary (which was not a lot), we created a graphic organizer or map on which we represented the

"We have proven that this grassroots internet field trip can be done. Now the larger question echoes Caroline's own: 'Is this really worth doing?'"
concepts/information and the connections among them. What we knew could clearly be chunked as topics and small research groups formed to explore their topics and guiding questions for inquiry. Topics included the adaptability of the plants and animals of the estuary, protecting the estuary, the cultural significance of the estuary, etc. Each group researched their topic on the web and then created a PowerPoint presentation for the class to share what they had learned.

All this was done in advance of working toward the "Can Do"—we decided that what we could do with what we learned was to develop a website (http://soe.eastnet.ecu.edu/fore/crissman/5317/Fieldtrip/estuary.htm) that would be of value to teachers and students who would be taking the EstuaryLIVE trip. Three groups formed, each devoted to developing a webpage about a special project on the estuary. One group developed "Literary Estuary" page on which they published an annotated list of books about the estuary and invited teachers and students to submit their favorites. The second group designed a project they called, "The Kids' Guide to the Estuary" in which they invited students to submit all kinds of stories and poems about their experiences with the estuary. The third group designed a simple survey for students to conduct and submit the data to us for compilation. We completed our pages and invited the EstuaryLIVE site to link to ours. Their inclusion of our work in the extensive EstuaryLIVE site was affirmation for us and we felt like we had arrived! The fact that as far as we know no one used our pages until Paul Brinkley applied the survey idea at East Lee did not discourage us, and we learned a lesson from this—which you will read more about in our lessons learned section.

You take a risk when you move university students out of their safe rows made for lecturing and into the uncharted waters of technology-mediated collaborative inquiries. Fortunately many of my students made the connections from their own learning experience to how they might create the conditions in their own classrooms. Linda wrote:

Your involvement with the estuary project is only a small part of how you incorporate technology and real life situations into the classroom.
You have taught me so much about alternative ways to teach a subject.

And Beth picked up on the modeling going on:
It meant so much more to me learning about scaffolding as you were actually scaffolding the activities we were doing in class.

And Kirstin capped off the semester with this comment:

It was really exciting to see you guys "live at the estuary." I think that kids would really get a kick out of this because they are getting answers to their questions, but it is not in a tedious textbook fashion. I also learned a lot by doing this project. I hope to use something like this when I get my own classroom.

Ralph wrote:

I have never done a project like that before. It was interesting and informative. Students will definitely have fun with online projects like this. They would really enjoy developing the website like we did in class. Having the chatroom to talk with the estuary directors was a great way to get students to realize how technology can be implemented into the classroom.

Thank goodness for the skeptics who serve to keep us on our toes. Caroline, on our original class "technology assessment" rated herself more toward the "peril" side of the continuum than the "promise" as in the "Promise and/or peril of technology." The live interactive internet field trip project only served to heighten her skepticism. She wrote:

I found it [the interactive internet field trip] an incredible tease—I imagine the kids out in the field were having a blast, and envied them for being able to take in the smell of the estuarine water, feeling the occasional breeze. Is it an arguable second-best to be able to talk to those students virtually real-time as they experience it? Dunno. With all
the lag time, and the way the messages just (eventually) scrolled across the screen in stark black-and-white, I couldn't help but think how much more I'd enjoy simply talking with someone who'd been on the field trip. I'd have to wait until after they got back to ask my questions, but I can't think of a single disadvantage to the wait. Moreover, I'd be able to see their face as they talked. Sometimes I think maybe I just have little patience for sterile, mind-numbing, time-intensive technology. But then I think, should I be trying to develop patience for it? I'd rather spend five minutes face-to-face with a friend, or fifteen with a good book...and get the feeling that I'll be a lot richer for it than investing hours in technology . . . I just think it's really important not to ask ourselves "What can we do with technology?" but "What can we do with technology that we couldn't do before, that's really worth doing?"

We would like to believe that Caroline's estimation of the project would improve with the RealVideo technology but maybe not. She asks tough questions—the kind of questions a professor is pleased to see in the spirit of technology assessment and the development of a critical awareness of technology. We have proven that this grassroots internet field trip can be done. Now the larger question echoes Caroline's own: "Is this really worth doing?" "What's happening in classrooms?" "What lessons have we learned that will enable us to make these experiences truly valuable for students and teachers?"
"These teachers are teaching us so much about how such a project can spark some exciting teaching and learning in the middle school."

EstuaryLIVE in the Middle School

We found some encouraging answers to these questions at East Lee Middle School in Sanford, North Carolina. Led by their school technology specialist, Paul Brinkley, the Sixth Grade Math and Science teachers have enthusiastically embraced the project. Located near the Sandhills in the Piedmont region of the state, the teachers reported that few of the students had any idea of what an estuary was when they began their unit. In retrospect, this was probably a positive because the students felt that they were learning something new and different—something that most of the adults in their community did not know. Cynthia Wicker, a sixth grade math and science teacher, attributed some of the success of the unit to this fact: "The students were excited about the estuary because a lot of people didn't know what they were talking about so they felt really smart." This was a finding in the survey they conducted to learn about what people in their community knew about the estuary. This survey was just one of the successful strategies that these teachers used to get the students excited about the estuary unit and teach them conceptual and procedural knowledge at the same time.

It has been said that the walls (both inside and extending outside to the halls) reflect the life of a classroom. A walk down the sixth grade hall at East Lee would tell a story of exploration and learning represented in a giant mural of an estuary complete with many plants and animals from that environ and the results of the estuary survey presented in colored bar graphs. Another attractive wall decoration represents a teacher's success with a scaffolded reading strategy (Vacca & Vacca, 1999). Cynthia Wicker, a math and science teacher, explains:

When the kids saw the video I gave them what we call the learning quilt. On the back of the page they were to
write six facts that they learned that
were interesting to them. It was the
only time that I have ever had kids
ask for more paper. You know how
hard it is to get kids to take notes—
they were taking notes from the
video to make their learning quilt and
they ran out of space. That was really
exciting to me because I had
struggled trying to get these kids to
write down important facts. That was
really neat. And then when they
produced their learning quilts they
were so beautiful that we hung those
up. I was proud of all of that and it
was important to me.

Cynthia went on to describe her efforts to integrate math and
science by following up a unit on graphing and surveying with
a practical application to the estuary unit.

So this was a wonderful tool because
they surveyed about the estuary to
find out who knew where it was and
why it was important . . . then we
took that information and we
graphed it. It was real to them and it
had special meaning because they
were experiencing it. This was the
best way I've ever seen to teach
surveys.

Cynthia was also pleased with her students' response to the
word problems that she modified to reflect an estuary focus.

So instead of going, "Oh, no, word
problems," they were interested in
reading the problems because they
were related to what they were
doing—that was a big plus.

It is a wonderful way to get them
excited about the curriculum, and I
feel like the only way children will
ever learn and remember. You could
drill it into them all you want, but
unless they experience it . . . it's not
going to have meaning for them.
They can spit it back next week but
long term it's not going to be there. If they take it and use it in something they are enjoying then I feel like we are truly educating.

It was her partner, Bonnie Marshall, a science and social studies teacher, who Cynthia credited with the idea of theme teaching in science. Bonnie described her experience with thematic teaching:

I'm trying to head more toward that direction. In other schools, at other grade levels I've actually done this through the science curriculum. I can see that it works more effectively with kids this age. It works so much better than, "We're going to do this and then we're going to do that." I like to tie it all together. They'll go back and they will say, "Oh, yea I remember when we did that—so that's what that means." So it shouldn't be, "We studied heat in the fall," and that's it, or "We studied estuaries in the fall," and that's it. It should always be, "We're getting back to that," or "This is still a part of it." Because themes will give students a message. They learn themes in communication skills so they can pull out what this story is telling you. I want them to be able pull out what science and social studies are teaching you this year. I want them to know that it is not isolated, and it does have a message all year long.

Cynthia was also excited about the potential for using the estuary as a unifying theme for her year's science instruction:

And then this year I saw where I could take this one unit and teach all the science—all the curriculum . . . technology brings it to life for us.

Sherry Groves, a language arts teacher, joining the project for her first live virtual field trip experience, spoke of how exciting her students found the technology: "They got into the internet
part of it—they just couldn't believe that we were on the internet." Bonnie also spoke of the value of the interactive component of the trip:

These kids, when they see their questions typed in and they hear their questions answered, are so excited that they have been "in" this technology. They are a part of it, and people are actually paying attention to them and telling them that these are good questions. I think they feel like they're an active part of it. They are getting feedback immediately, and I think that's very important. They have played games on computers but now they are actually learning through the computer. It's a new age.

Paul Brinkley, who has supported these teachers every step of the way to this "new age" is a great spokesperson for the internet and this internet-based project:

. . . the internet when it's used properly is one of the best educational tools that a teacher could ever hope for. So many wonderful sites open up opportunities for students that they would not ever get to be a part of any other way. We're trying to use it as much as possible. And the internet field trip is an absolute perfect example of how the internet can be an excellent teaching tool . . . I see the excitement and the enthusiasm on the kids' faces as you walk down the hall and see the bulletin boards that they have made and all the activities that they have done and they are so proud of it. When you can see kids having that much fun in education you know you're doing the right thing. To me it's the most fun unit that I do with kids all year long in any school.

It's schools like East Lee who make EstuaryLIVE worthwhile for students and gratifying for us. We have been beaming ever
since we left their school. These teachers are teaching us so much about how such a project can spark some exciting teaching and learning in the middle school.

Lessons Learned from EstuaryLIVE

Upon those that step into the same rivers different waters flow. . . . It scatters and . . . gathers . . . it comes together and flows away . . . approaches and departs. All things are in process and nothing stays still. . . . You could not step twice into same river.

Heraclitus

We have certainly not stepped twice into the same estuary—literally or metaphorically. We are not the same nor is the estuary. We have worked through three live interactive internet field trips now, experimenting sometimes successfully and often times not, with new ideas and technologies. Eastern North Carolina since our first field trip has experienced the devastating floods and lingering environmental problems brought by the Hurricane Season of 1999. When the question came up during our Fall 1999 field trip about the impact of the latest hurricane, Susan answered, "We've had so many hurricanes that we don't remember what 'normal' is like." "All things are in process" and the lessons we have learned from EstuaryLIVE field trips guide us as we work toward our fourth field trip—EstuaryLIVE 2000—scheduled for May 2000.

Lesson #1
It's a Relationship Revolution

Michael Schrage (1998) has written convincingly that we are not so much experiencing an "information revolution" as we are a "relationship revolution." Schrage writes for the business
Suggested Readings:
- The Relationship Revolution
- Dewey and Technology
- Teaching Technology with Hands-On and Minds in

are a "relationship revolution." Schrage writes for the business world but his message certainly extends to all areas of human endeavor. He observes that the new Web dynamic is "not a craving for new data and a lust for new information. Instead, people crave the chance to communicate and relate to each other in new ways" (http://www.ml.com/woml/forum/relation.htm).

We thought that EstuaryLIVE would be a great way to teach students science content and convey something of the importance of the estuary environment. What we are only beginning to understand is that with a live virtual field trip a new social context for communicating and relating is created.

If we consider the social context created when students such as those sixth graders at East Lee join with other classes and the naturalist to participate in a live interactive internet field trip to the estuary, we begin to understand how powerful this new social context can be. There is novelty at work here no doubt, but beyond novelty is the appeal of reaching beyond the classroom walls and joining in something ultimately larger than themselves and their class. To reiterate something Bonnie Marshall said, her students were excited because "... they have been "in" this technology and they are a part of it and people are actually paying attention to them." It's all about feeling important.

Hobson (1999) picks up on this question of the importance that students attribute to the learning when he writes:

> Clearly students will have a strong emotional commitment to ideas that are well-established and have been used successfully by them in contexts they regard as personally and/or socially important (p. 243).

The students at East Lee obviously felt that their live interactive internet field trip experience raised the ante on their participation. It is a wonderful example of Sherry Turkle's theory that we can "externalize the good things, the hopeful things that were within the computer environments that can maximally leverage the world of the virtual to increase the quality of life in the 'real'" (Turkle, 1999, p. 347).

One of "the good things" is that students can watch as a naturalist interacts with nature, in an environ that she shows fascination with and respect for. When the students along on the field trip display some knowledge of and appreciation for the estuary, their peers are also impressed that this may be
something "cool" enough for middle school kids.

Another "good thing" is that feeling of being an important part of this big event. Susan, our naturalist, and the teachers at East Lee have spoken of the tremendous appeal of the interactivity of the live interactive internet field trip. It was important to the students that their questions were recognized as good ones. Other teachers have emailed responses in which they write of what an emotional appeal shining the spotlight of recognition had for their students. A teacher from a middle school in Mississippi wrote, "The students cheered when our school was recognized."

And students are not the only ones who get something from this interactivity. Susan commented: "Now, with that last field trip I really feel that we have moved beyond the gee whiz of technology to real content learning." Her interpretation of the Rachel Carson Estuarine Research Reserve is influenced by the level of questions coming in from the students. As with any teaching experience or live performance there is also an emotional satisfaction that comes with the response of the audience.

The live interactive internet field trip experience actually enables participants and guides to transcend the interactive level of technology and create a relationship that Dewey and Bentley (1949) referred to as "transactional." The distinction between interaction and transaction is much more than semantics—Dewey and Bentley's concept of transactional marked the beginning of a new paradigm—one that moved us beyond the mechanistic, behavioristic view of the world to one that presented a more holistic, ecological way of looking at humans and their relationship with the natural world (Rosenblatt, 1985). Perhaps Rosenblatt, a scholar and contemporary of Dewey, has best explained the inherent but not readily apparent distinction between interaction and transaction. She wrote that "...recent developments in ecology have made this way of thinking [transactional] clearer to many people" (1985, p. 203). This reference to ecology is quite appropriate for our discussion of live interactive internet field trips to the estuary. Rosenblatt continued to explain that "transaction designates an ongoing process in which the elements or parts are seen as aspects or phases of a total situation" (1985, p. 203). Clearly then, our live interactive internet field trips are more transactional than interactional. It is from the transactions among the naturalists, the students onsite, and the students with remote access that the interpretation and experience evolves. A live interactive internet field trip is an unfolding drama.
"Why live?" We had asked ourselves. Because as compelling and informative as a beautiful video can be, when an experience becomes transactional we have created, in Freinet's words, "a social context to motivate" (as cited in Cummins & Sayers, 1996). Freinet was an early advocate (1920s to 1960s) of expanding the school community to include the surrounding neighborhood and even schools in distant communities. In their book, Brave New Schools, Cummins and Sayers (1996) build on Freinet's "interschool" networks to create their collaborative inquiry projects made possible through the internet. These projects, both interdisciplinary and intercultural, share Freinet's purpose of using literacy as a powerful tool to engage students in worthwhile social activism. Technology enables schools to communicate and relate in more immediate ways.

Would Dewey, clearly the most influential educator of this century, see value in today's evolving technologies? Bruce (1999) has theorized that "Dewey would certainly value learning technology, if it means that students become more capable of participating in society and enlarges the scope of their abilities to communicate" (http://www.readingonline.org/electronic/jaal/Nov_Column.html).

Rheingold, an early Web pioneer, has reported on several Web-based school projects that meet Dewey's criteria (http://www.well.com/user/hlr/tomorrow/teched.html). We believe that EstuaryLIVE has this potential.

With EstuaryLIVE students reach beyond the walls of their classroom, feel part of something important, and they care about what they are learning. In a real way, students come to feel that they have "joined the conversation." Applebee used this metaphor to explain the importance of engaging students in real world, real-life problems and issues. He wrote, "Our traditions of teaching and learning must be transformed so that students learn to enter the ongoing conversations that incorporate our past and shape out future . . . conversations about things that matter . . ."
"And feeling important, whether you are serving as a young naturalist in the field or a student who submits a thoughtful question from a remote site, is a powerful motivator."

Lesson #2
The Young Naturalists

Patrick, a sixth-grade onsite field trip participant, "joined the conversation" in a big way when Susan, our naturalist handed him the mike and asked him to describe a tidal pool. This is Patrick's interpretation:

> It's really muddy and there are small crabs. There's one right here—and he's in another animal's shell. There are periwinkles and mud snails crawling around, and you can see their tracks on the bottom in the mud. There is also a lot of dead plant material on the bottom. You can see the ripples over here from small minnows like the ones we just showed you.

He carried out his first internet webcast with confidence. Later, Maya, another sixth-grader onsite, had a similar opportunity. Maya, when asked to reflect on the experience, commented:

> It actually feels pretty good. I mean you don't really notice it when you're there doing it, but afterwards you kind of notice it—it makes you feel kind of important.

And feeling important, whether you are serving as a young naturalist in the field or a student who submits a thoughtful question from a remote site, is a powerful motivator. The next day we received this email from Paul Brinkley at East Lee, who never misses a good opportunity:

> We have a question about the student tour guides. We would like to know if it would be possible for 2-4 students from East Lee to serve as tour guides for the spring trips. If so, then what we would like to do is have an essay contest as well as perhaps a PowerPoint slide show contest. The students could either write an essay or prepare and present a Powerpoint presentation to be
judged. The winners could then travel to the estuary to serve as a tour guide for one of the spring field trips. This would help us make the project cross-curricular, covering writing and technology in addition to life science and North Carolina social studies.

It is a great idea that we plan on follow up on for the EstuaryLIVE 2000 trips. We had found from informal conversations with teachers and students that both the perceived knowledge and enthusiasm exhibited by the students taking the field trip on-site seemed to make a big difference in how well the virtual field trip participants enjoyed their trip. Our goal now is to structure opportunities much like Paul has proposed so that students can develop a level of "expert knowledge" about the estuary and earn a spot as an onsite "Young Naturalist" (See our project scrapbook at http://www.estuarylive.org/scrapbook/scrapbook.htm for photos of our "Young Naturalists" at work).

"As we reflect on this estuary project though, we can see that we have only touched the tip of the iceberg of the potential here for developing science content, critical thinking, language-mediated learning tools (English language literacy), and technology skills."

Lesson #3
Teaching and Learning on the Internet

John Wardle (1999) in his article, "Science Teaching and the Internet" writes that with the many active learning activities the internet makes available, "the pupil is increasingly taking control of the learning and taking it outside the traditional classroom" (p. 243) while the teacher is more and more assuming the role of facilitator. These are true signs of a more student-centered, constructivist approach to teaching and learning.

Often cited but not so often clearly explained, the concept of constructivism can be a slippery one. We have found Gill's and Burke's (1999) four basic steps common to all constructivist approaches serve well as the foundation of a framework helpful in guiding our live virtual field trip curriculum. Stated simply, these four basic steps are:

1. Ascertain students' ideas and views about the phenomenon and events to be studied;
2. Create opportunities for students to explore and justify the ideas, and to test their robustness in explaining phenomena, accounting for events and making predictors;
3. Provide appropriate stimuli and experiences for encouraging students to develop, modify, and where necessary, change their ideas and views;
4. Provide, supplement, and reinforce experiences as students struggle to understand and accept and use new ideas (p.105).

Our teaching and learning at East Lee and in the teacher education classrooms have incorporated constructivist principles in the service of teaching science and math content while creating opportunities for language learning and the beginnings of inquiry into the social and ecological dilemmas associated with protecting the estuary environment. As we reflect on this estuary project though, we can see that we have only touched the tip of the iceberg of the potential here for developing science content, critical thinking, language-mediated learning tools (English language literacy), and technology skills. This project also holds much potential for encouraging authentic inquiry into environmental issues, leading to what the National Research Council refers to as "scientific literacy" or inquiry-based learning that connects science content and real world problems. We intend to work with teachers to develop curricular resources that will help us all tap that potential.

Lesson #4
The Curricular and Professional Development

Bill's "expert knowledge" hardly lies in the area of curriculum development [he's our streaming video expert] but he was quickly impressed by the dramatic results realized by those teachers who did extensive preparation for the field trips. He commented:

I had a lot of satisfaction that certain classes seemed to get a lot out of this and if some classes didn't get a lot out of this I think it certainly had to do with the teacher. That's why we
developing an integrated math and science unit about the estuary to, most recently, building an entire year's curriculum around the estuary."

Realistically though, it has taken us several field trips to even begin to approach the degree of technological effectiveness we hope to achieve. So it is with teachers making the effort to learn how best to take advantage of this live interactive internet field trip. The teachers at East Lee described their evolution from simply participating in the live virtual field trip to developing an integrated math and science unit about the estuary to, most recently, building an entire year's curriculum around the estuary.

Our plan is to enlist teachers who have displayed real insight and creativity in developing curriculum for these online estuary field trips in an effort to plan a workshop for others on how to make the most of EstuaryLIVE. We hope to obtain the funding necessary to bring a core group of experienced EstuaryLIVE teachers in to plan the curriculum for such a training session and then have them lead the instruction.

Associated with this lesson on curricular and professional development is the insight we have gained about publishing teaching ideas on the Web. The activities that the preservice teachers developed were hardly used. Our thinking is that next time we should include some actual teacher stories of implementing these and similar activities and samples of students' work. We will create a gallery of sorts. We plan on "priming the pump" so to speak by sharing many of the ideas that our East Lee and many other outstanding teachers have already proven effective. Our gallery will exhibit actual student work.
"The beams from twenty flashlights danced across the water and the red glowing lights tied to the tagged Blue Crabs looked like ghosts of shipwrecked pirates searching for their lost mates."

Lesson #5
EstuaryLIVE, Day and Night

Like we said, planning and implementing live interactive internet field trips is a challenge and it is taking us several tries to get it right. Of course, with each new success we manage to up the ante and create a new challenge. For our most recent field trip, Susan began "Tidal Creeks meet Video Streams: Interpreting Research for Resource Managers and Students through Interactive Internet Live - Streaming Video—a Pilot Project of the Rachel Carson Site of the NC National Estuarine Research Reserve." This is a project devoted to utilizing live streaming video for discussions of ongoing research from the field, or in this case, estuary. The first brave researcher to take us up on this offer was Dr. Dan Rittschof at the Duke University Marine Laboratory, who with his students, is studying the behavioral ecology of organisms in the western end of the tidal flat between Bird Shoals and Town Marsh Island. Rittschof's goal is to understand how environmental factors contribute to the distribution and abundance of organisms. Once movement patterns are determined the group will construct hypotheses and conduct experiments in the lab and the field to show how chemical and physical factors control communities of animals such as crabs, whelks, mud snails and flounder. The catch, literally, is that these creatures prefer to make their movement patterns at night. In fact, Dr. Rittschof commented that he rarely visits the estuary in the day anymore—relatively speaking, he says, there is just not much going on. But, at night, the estuary comes alive. Bill was so excited about the night trip to the estuary that he bought an infrared camera so our viewers would not miss one flounder.

What we learned in our first effort at a night-time EstuaryLIVE is that we cannot depend on our RealVideo past 8 pm. Our RealVideo crashed and we continued our field trip with ChatVideo coverage only. We have some serious problem-solving to do to figure out if the problem is at our end with our system server or in California where our RealVideo server is located.

We are determined to make this "EstuaryLIVE at Night" field trip work. Trudging through the estuary with Dr. Rittschof and his students at night was an incredible experience. The "other worldliness" of the estuary was almost eerie and as exotically beautiful as a moonscape. The beams from twenty flashlights danced across the water and the red glowing lights tied to the tagged Blue Crabs looked like ghosts of shipwrecked pirates searching for their lost mates. Probably
the scariest thing though was watching our fearless videographer lower and contort his substantial 6 foot 2 inch frame and $30,000 worth of camera equipment and transmitter into the bottom of a light canoe. Seriously though, now we know that the estuary is most beautiful and reveals most of its secrets at night. Even Susan, who knows more about the estuary than we can even begin to imagine was awed by how much could be learned from Dr. Rittschof and his night trip.

Great minds think alike. At least two teachers, Paul Brinkley, of course, who has become an EstuaryLIVE entrepreneur when it comes to marketable ideas, and Carlann Osborne from Saluda, another of our outstanding participating teachers, working independently have come up with a wonderful idea for making the most of these night-time field trips. Their plan is to hold a special parents' session on the night of the field trip so that the parents can participate in a live interactive internet field trip and experience firsthand the internet as a learning resource.

". . .we were struck by the potential that "live" virtual field trips may offer for students whose physical, mental, or emotional needs may preclude actual field trips."

Lesson #6
Special Promise for Special Populations

After all the planning is said and done, sometimes it is the unexpected consequences that may take us down a path we never dreamed of. When we received an email from Mike Everhart, a teacher of children with behavioral disabilities, we were struck by the potential that "live" virtual field trips may offer for students whose physical, mental, or emotional needs may preclude actual field trips. Thanks to Mike and his students, we intend to explore how we might bring the world to other students with special needs via this "live" virtual field trip model.

Lesson #7
Making It Happen on a Shoestring

Bill, our video and internet specialist, had this to say in response to a question about the most challenging technological problem of this venture:

I think finding streaming people and sources that would be willing to help such a small-time, especially associated with education, operation. When you mention education people take one giant step backwards.
The challenge was to find an affordable low-grade satellite ISP (internet service provider) for streaming video from remote locations. We went with our ISP because, frankly, they were the only people who would talk to us. Our cost is low but customer service is less than desirable. We are, after all, small potatoes. Ironically, the companies on the cutting edge of low-cost live video on the web have soft porn businesses as their biggest clients. We did find with our "chat video" service provider, a company that took a special interest in our project and has given us a lot of attention.

"We hope to see the project evolve into more of a socio-scientific study where our focus will be on the social, cultural aspects of the rivers' influence on life in Eastern North Carolina as well as the scientific, environmental connections."

What Next? . . . Future Hopes and Dreams for the Project

We take these hard-learned lessons to heart as we prepare for EstuaryLIVE 2000. Our future plans include "Rivers2SeaQuest"—a project in which we will develop a core group of students and teachers who will participate in live virtual field trips to the estuary and then learn to design and conduct their own live virtual field trips to rivers near their schools. In this way students and teachers from participating schools can invite other North Carolina schools and the world beyond to learn about our rivers as they make their way to the sea. We hope to see the project evolve into more of a socio-scientific study where our focus will be on the social, cultural aspects of the rivers’ influence on life in Eastern North Carolina as well as the scientific, environmental connections. Students will learn about their role in the cycles of life and the necessity of learning to live in balance with nature. And through this live interactive internet field trip technology, students will not only "join the conversation" but they will be leading it.

EstuaryLIVE has helped us crystallize new insights, and though we have many more lessons to learn, we face the journey more confidently and hopefully. Live interactive internet field trips bring a new reality and the promise of transformation to our classrooms . . . and that's no science fiction.
Related Sites

- **EstuaryLIVE Website** (http://www.estuarylive.org/)... Field guide, lesson plans, online and print resources. Don't miss our scrapbook at http://www.estuarylive.org/scrapbook/scrapbook.htm!

- Sample field trip clip at http://www.estuarylive.org/vidtest.htm

- Semi-Live Web Cam on the EstuaryLIVE Field Trip Site (http://www.ncnerr.org/camera.htm- catch a glimpse of Town Marsh Island - the site of EstuaryLIVE)... this web cam refreshes its photo every 20 seconds.

- **North Carolina National Estuarine Research Reserve** (http://www.ncnerr.org)... all about the Reserve and its work

- **Carolina Estuarine Reserve Foundation** (http://www.ncnerr.org/cerf/home.htm)... information about this not-for-profit group dedicated to sensible stewardship of our estuarine areas

- **Waters of Life** (http://streamer3.galaxy-net.net:8080/ramgen/margraf/waters.rm) a RealPlayer sixteen-minute video introduction to the North Carolina National Estuarine Research Reserve System

- **Come On DownEast!** (http://soe.eastnet.ecu.edu/fore/crissman/5317/fieldtrip/estuary.htm) Companion website for EstuaryLIVE developed by preservice teachers

About the Author and Contributors

- Cris Crissman (http://www.writinglife.org/)
- Bill Lovin (http://www.marinegrafics.com/)
- Susan Lovelace (http://www.ncnerr.org/)
- Paul Brinkley, Sherry Groves, Bonnie Marshall, and Cynthia Wicker at East Lee Middle (http://www.estuarylive.org/tech/)

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Stories About Children and Teachers as They Create Multimedia Documents in a University Influenced Small City School and a Large Inner-city School

Michael Orey, Huey-Ling Fan, Edith Scott, Todd Thuma, Brooke Robertshaw, Jan Hogle, Shyh-Chii Tzeng

Department of Instructional Technology
The University of Georgia

and

Kathleen Crenshaw
Clarke Middle School

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Abstract

This paper presents a series of stories about students. Each story was written by a different researcher. Together, the stories represent what one might expect children to experience from a project-based teaching strategy. In general, the results indicate that children are very motivated by these projects. In some cases, they learn how to cooperatively create a product. They refine their technological competence through applied use of computer tools. These computer tools allow the children to be creative in the generation of their products.

If you would like to get a feel for the kind of products that children created as part of this project (though for anonymity reasons, not the specific ones described in this paper), then click here.
Project-based Education and Motivation

We have found, along with others, that it is difficult to discuss project-based methods without discussing motivation (Blumenfeld, Soloway, Marx, Krajcik, 1991; Fan, 1996; Orey, Fan, Zhao, & Crenshaw, 1995). From our perspective, project-based methods of learning can be framed by a combination of the ideas from cognitive apprenticeships (Collins, Brown, & Newman, 1989) and motivation (Turner & Paris, 1995). The key concepts from cognitive apprenticeships are scaffolding, coaching, and modeling. While there is much more to cognitive apprenticeships and the parallel idea of legitimate peripheral participation (Lave & Wenger, 1991) such as the importance of context, these three concepts are well suited to our project-based methods.

The key concepts from motivation are the six C’s of Turner and Paris (1995)—choices, challenge, control, collaboration, constructive comprehension, and consequences. A description of these perspectives will follow the individual researchers' stories.

Project-based Education

Project-based education has reemerged as a popular instructional approach. The roots of this approach date back to Dewey’s (1938) notion of experiential education. Dewey demonstrated his method by involving a group of students in the first-hand construction of a building. In the process, the students could learn such diverse topics as geometry, construction, management, cooperation, mathematics, and language arts. Once the building had been built, however, the question became "what do you do next?" The current answer may be to build metaphorical buildings using computer technology. For our purposes, these buildings are the documents created by children using a variety of materials including photographs, video clips, graphics, charts, audio clips, and text. The buildings can be social studies reports, science reports, creative writing pieces, or any other document that a student chooses to construct.

The Foxfire approach has used this method for years (Wigginton, 1985). The building created in the Foxfire program was a book, written and edited by students, then sent to a
knowing that their stories and articles will be read by many other people."

"If school knowledge were learned in the context of solving "real" problems, then perhaps the application of this knowledge would be more readily apparent."

was a book, written and edited by students, then sent to a publisher. There have been more than ten of these books published over the years with topics centered around the culture and heritage of the students in the classes—the Appalachian mountain communities in northern Georgia. A characteristic feature of this approach is that students write about what they know very well and have the additional motivation of knowing that their stories and articles will be read by many other people. This long-range goal remains a consideration throughout the duration of the project and results in students taking greater care in editing and finally completing their documents.

Katz and Chard (1995) suggest that the process learners go through as they participate in a project approach includes planning, research, and generation. With the strong emphasis on publishing, the learners will also focus on editing and formatting. In addition, because our approach includes the use of technology, strategies are needed to help learners with the technology, or at least to minimize its complexity. One of the outcomes of this approach is that a knowledge of multiple disciplines is required for project completion. While technology is a definite part, other disciplines such as science, social science, mathematics, art, and language arts are often necessary for success.

Besides the integrated curriculum, the project-based teaching method has other conflicts with traditional curriculum. Scott (1994) found that standard class periods, standard curricular goals, and traditional time requirements are impediments to a project-based approach. In a traditional forty-minute period, once students have planned the day's goals, set up equipment, and/or made arrangements to collect data, classroom time has been reduced to approximately twenty-five minutes. The project-based method is an immersive activity, which usually requires longer class periods.

A parallel to the project-based approach is the problem-based method employed by the medical education field (Barrows & Tamblyn, 1980). The problem-based method emphasizes an application orientation to medical education that has been largely missing in recent years. Medical educators have complained that many doctors are beginning their internships with very little ability to apply the knowledge they have acquired in their formal schooling. In an effort to facilitate the application of school knowledge, medical schools have widely adopted the problem-based approach. In this approach, traditional knowledge is acquired in the context of problems, which are presented via cases. Diagnostic methods are employed to gain information about the patient, while a knowledge of medical procedures, anatomy, medicine, and other
relevant knowledge is required in order to solve the problem. As with many problems, there is no one correct answer, but many possible solutions.

The Cognition and Technology Group at Vanderbilt (1990) have linked the problem-based approach to the literature on situated cognition. One of the most important results of this paradigm is that knowledge learned in one context often is not readily transferred to another context. For example, knowledge learned in school is often not transferred to real life situations. This seems to be what is happening in medical education. The knowledge that medical students gain in traditional classrooms is learned in a way that can be efficiently retrieved during tests, but not so easily accessed in an applied medical situation. One of the classic examples of situated cognition is one taken from Lave (1988). In this case, there was a man who was involved in a diet program. He was trying to cut his intake of food by three-fourths. One of the menu items was a two-thirds cup of cottage cheese. Instead of selecting the appropriate school-learned algorithm and performing the calculation, this man used a somewhat unorthodox approach. He measured a two-thirds cup of cottage cheese, emptied the contents of the measuring cup on the counter, shaped the substance into a circular (pie-shaped) figure, cut it into quarters, and removed a one-quarter section (Lave, 1988).

If school knowledge were learned in the context of solving "real" problems, then perhaps the application of this knowledge would be more readily apparent. This can be as true for learning to communicate using the latest technologies as it is for using concepts from mathematics. If knowledge is applied while it is being learned, then the learner may be organizing this knowledge in a way that it can be applied later. Cognitive apprenticeship is the instructional model that has emerged as a consequence of the data collected on situated cognition (Collins, Brown, & Newman, 1991).

One of the main strategies of this model is scaffolding. Essentially, the idea of scaffolding is to provide supports to the learner in the context of their learning in such a way as to allow them to perform beyond their abilities. During this performance, they are actually acquiring the knowledge. For our efforts, we developed a set of job-aids that could show the learner exactly how to put photographs, video clips, and audio clips into a word processing document. The learners needed to have a basic knowledge of typing and the word processor before beginning the project. Further knowledge could be gained while they engaged with the project. Therefore, most of their time was devoted to designing and developing their project, and not spent
on formal instruction in how to use technology. In fact, no formal instruction was provided except when specifically requested by the learner.

While cognitive apprenticeships inform some aspects of what we were doing with project-based education, further insight is provided via the paradigm of goal-based scenarios (Schank, 1990). This paradigm suggests, in part, that people store information in the form of stories (Schank, 1990), an important element for the present discussion in two ways. One, this memory structure is quite relevant to the project. That is, all of the knowledge components acquired through participation in the project are organized around the story or stories learned in the context of its design and development. The second aspect of this theory revolves around the methodology employed in this experiment. The qualitative data will be reported in the form of stories. The fundamental unit of analysis for this study is the story.

Goal-based scenarios are grounded in the idea that all learning occurs in the process of trying to meet a goal. For a toddler learning language, verbalizing a grammatically acceptable sentence is not a goal. Rather, their goal is to communicate with parents and siblings. As a consequence of this goal, the child learns to speak in coherent sentences. The former goal is one typically found in traditional education, while the latter is a goal that is internal to the learner. Another aspect of these two goals is that the latter is achieved in an efficient and effective way by all those who have this goal (with the exception of some mentally handicapped individuals), while the former is difficult to achieve and often is forgotten long after it has been achieved. The mission of goal-based scenarios is to prompt learners to internalize their goals and facilitate learning as the consequence. While some of these goals can be artificial (like creating a new animal based on existing animals), it is most important that the learner internalizes the goal. In our context, the learner's goal is to create a multimedia document that will be published on CD-ROM or on the World Wide Web. The learning that occurs as a consequence is technology literacy, planning, and all the content that is inherent in their particular project.

Schank (1990) suggests that curriculum ought to be changed to three primary emphases—communications, human relations, and reasoning. These are the three kinds of knowledge competencies that we should expect of people in our society. Again, the project-based approach that we are proposing here focuses on communicating the ideas in their project. The project itself is so large and complex that it constitutes a problem requiring complex reasoning. Finally, because the projects revolve around
groups, it requires learners to gain competence in human relations.

"The students learned as they went about creating their documents. A set of planning sheets were provided at the beginning of the project and participants were not permitted to begin their projects until their plans were clearly articulated as judged by their teacher or assistant."

Methods

The basic idea of this methodology is to make the reporting of anecdotes more explicit and to treat the anecdote as data. While this is an unusual approach, we feel that it captures the essence of what has been done by the children who have worked on projects over the past three years in three different middle schools. Most of the stories are about children from a middle school that is located in a small city in the southeast that is largely influenced by a university in that town. There are two stories that come from two different large inner city middle schools. Two of the authors of this paper wrote two of the stories and each of the other authors wrote one. The authors wrote their stories as masters or doctoral students, a teacher, or a professor.

Participants

The stories in this paper were written about children that were in either an advanced seventh grade language arts class, a special needs class for children with behavior/emotional disorders, or an at-risk language arts class from a university influenced small city (population 80,000). This school is interesting in that it has an inordinately large gifted population (20 percent) while it also has a large poor at-risk population (over 50 percent qualify for meal assistance).

In addition, two of the stories were about children in a regular language arts class at two inner-city schools. The population of each of these schools was nearly 100 percent African-American and more importantly, 100 percent poor.

Materials

At the two inner-city schools, four computers were set up in rooms adjacent to the regular classrooms for the purpose of giving 6th grade students experience in project-based education. Participating students were to create multimedia documents in ClarisWorks, choosing their own topics and incorporating text, graphics, sound and/or video to tell a story or create a report. The four computers were 486-25 PCs with 170 megabyte hard drives each equipped with sound card, CD-ROM drive and a
video capture board to capture stills and video. The resulting documents were to be published on a University of Georgia (UGA) web site.

At the small city school, we had several different configurations. In one setting we had two computers in the back of an advanced language arts classroom. In another, there were five computers in the back of the room (the following year). In another, there were six computers in a separate classroom (mini-lab). Finally, there were two computers in a separate classroom. The computers were mostly configured the same as above (with the addition of a couple of Macintosh computers in one setting). In the mini-lab, we also added HyperStudio in the last year of the project.

Besides the computer setups, we also created a set of "cheat sheets" to help students develop their multimedia documents. No large class instruction on how to use the computers was provided. The students learned as they went about creating their documents. A set of planning sheets were provided at the beginning of the project and participants were not permitted to begin their projects until their plans were clearly articulated as judged by their teacher or assistant.

**Procedure**

We asked all students to write on a sheet of paper their perceived knowledge and experience with computers and camcorders. Additionally, we asked them to specify with whom they might like to work. From this data, we were able to select groups of two and three students. We went back to the classes with these groupings and asked each group to work together to write a proposal describing their intended project, the only constraint being that it be "appropriate" for the classroom. From these proposals, we selected the first groups to participate. This selection was based somewhat on the teacher's perceived judgment of the students' ability. We hypothesized that the higher ability students were likely to be successful, and their documents could then be used as models for later groups. In order to be equitable, all students in each of the two classes participated at some point in the study.

On the first day of the marking period, we asked the participants to complete the pre-testing or post-testing (depending on whether they were starting or finishing). This took approximately one hour. We then spent the rest of the week helping the students to plan their projects. The last five weeks of the marking period were spent in completing the project. The
researchers tended to be more available towards the beginning of the project and less towards the end. We averaged about one day per week. Our visits served two purposes: to assist the students and to make observations of them as they completed their projects.

**Analysis**

The qualitative data was analyzed in terms of Schank's idea of stories. Because he believes that the story is the fundamental unit of memory that is of most interest, we decided that the story would be our unit of analysis in this study. We found that early on, when asked about the project by friends and colleagues, we tended to tell stories about the participants in an attempt to characterize the learning experiences of this approach. We have chosen to make this the formalism for our analysis. Therefore, we will include a set of stories about the individual groups to demonstrate what went on during this experiment and provide conclusions based on these stories at the end.

**The Stories**

There are eight authors and ten stories that constitute the data for this study. Two of the current authors wrote two of the stories each (Orey and Fan). The remaining six stories were told by the other six authors. These authors are or were either doctoral students who were assigned to work at the middle school (Hogle), doctoral students who volunteered to work at the middle school (Thuma and Tzeng), or masters students who volunteered to work at the middle school (Robertshaw and Scott). In addition, one story was written by the seventh grade advanced language arts teacher from the small city school (Crenshaw). You can link to each of the stories below.

**Story One: The Beatles Project** - This story describes how five children working very well together, created a large scale and successful multimedia document.

**Story Two: The Movies Project** - This story describes how some groups did not work so well together.

**Story Three: The Video Games Project** - This story details how a not very popular student worked in a group.

**Story Four: The Dark Boyfriend** - This story describes a very interesting group who were able to restructure their entire project as a result of their misunderstanding of the technology.
Story Five: Mrs. Iyoshi - This story describes a much less open-ended approach to projects.

Story Six: The Colors Project - This story describes how technology problems interfere in the process and how a project can be more organic than planned.

Story Seven: Travius - This story describes the process of a project for an at-risk student.

Story Eight: Olympics - This story describes a partnership that did not work very well.

Story Nine: The Washington Story - This story describes a successful implementation of our project-based approach in an inner-city school.

Story Ten: The Carver Story - This story describes a failure in our implementation.

"The balance between teacher and student control is a very important one in our projects. In a traditional teaching approach, teacher control predominates. With the project-based approach, student control predominates."

Discussion
The Six C’s and Our Approach

Because we have conducted a series of studies using the same project-based approach, we will present observational data from the study in the context of this literature review. In this way, we can fully describe the treatment and review the literature at the same time. Again, we are using Turner and Paris’s six C’s of motivation to describe the project.

Choice. Choices seem to be a focus of our efforts. First, we allow the children to have complete choice in a topic for their multimedia project. We try to help support this decision by suggesting that their choice might fall into the category of research, opinion or narrative. These three categories can loosely define the diverse topics chosen by the children that participate in the projects. In addition to the choice of topic, we allow the children to choose the development tool they use for their project. The choice was between HyperStudio (which in the Windows version with our current computer setup allowed the students to use sounds, photos, graphics and links) or ClarisWorks (which would allow the students to include sounds, video, photos, and graphics). As a prelude to the C for consequences, we informed the children that we would convert ClarisWorks documents to HyperText Markup Language (HTML) and put their documents on the World Wide Web. The HyperStudio projects would be placed on a CD-ROM and
stored forever in the media center. As a consequence of this choice, we also told the students that none of the material in a ClarisWorks document could be copyrighted material, whereas, the HyperStudio documents could include copyrighted material that was owned by the school (since it would not be seen outside of the school).

Another choice that the students could make was which planning method to use. We gave them a choice between creating a web of ideas, a cluster of main topic/supporting ideas/details, or a traditional outline. However, we required that they complete one of these. We found in previous research that structuring the planning process was necessary because of the students' lack of planning knowledge and because it facilitated later collaboration. We also required that they define goals, audience and conclusions as part of the planning process. In addition to these choices, there were myriad choices throughout the project with regard to layout, color choice, image choice, font choice, etc. Choice was a key attribute to the project-based approach that we followed.

**Challenge.** The second C is challenge. Like the story "The Three Bears", the key to challenge is to have the level of challenge "be just right." Because of all the choice that was available to the children, challenge was a key issue in topic selection and planning. If the topic were too easy, the children would not be able to remain interested in the topic for six weeks. Guidance was provided in helping the children choose a topic and project that would provide just the right amount of challenge to the children. We tried to minimize the challenge associated with the technology by having a set of "Cheat Sheets" available to help children "capture" photographs, video and audio (Fan, 1996). Another aspect of challenge is the fact that we give the children six weeks to work on their projects. While some people in the school expressed an interest in these projects, the fact that they only gave their children a week or two to work on the project really minimized the challenge in the project.

**Control.** The third C is control. This seems to overlap with "choice." Because the students had control over topic selection and project implementation, they also had control over these parts of the project. Because we "required" the students to plan their projects, this part of the project always seems to be the least motivating phase. Perhaps this result is because the students do not have control over this choice. However, in working with seventh graders in this middle school for two years, we have found that without the planning phase projects are not as good and cooperation seems to be hindered. The
balance between teacher and student control is a very important one in our projects. In a traditional teaching approach, teacher control predominates. With the project-based approach, student control predominates. We have used teacher control to eliminate "inappropriate" topics, to require planning, and to maintain appropriate behavior in the classroom (generally, behaviors seem to be louder, though these behaviors are usually the result of enthusiasm toward the project).

"A second aspect of collaboration is that complementary skills could result in something that was greater than the sum of its parts."

Collaboration. The fourth C is collaboration. We have followed a collaboration model from the outset of our partnership with the local middle school beginning two years ago. In our first year of this partnership, we varied the group size from two to five. Based on our informal observations, we found that the optimal group size was two. With two people, we were able to make sure that each child got to spend time on the computer. Further, we found that partners and groups worked out very well. They could pool knowledge and experience. A key aspect of these projects has been that we only provided a minimal amount of computer instruction. These projects have taken place largely in language arts classes and we did not want to take up language arts instructional time with technology skills learning. A consequence of the collaboration between learners was that the partners could usually figure out how to do things themselves.

A second aspect of collaboration is that complementary skills could result in something that was greater than the sum of its parts. If, for example, one partner had good language skills and the other had good visual skills, the resultant product was enhanced because of the integrated perspective. Also, as a consequence, the student with better language skills would model good language usage for the student with poorer language skills.

Constructive Comprehension. The fifth C is constructive comprehension. It is not enough to just work in collaborative groups, but the groups need to engage in the construction of meaning. That construction can be in the form of crafting a story (for example, Big Heads) or it may be in the form of making meaning of a particular content area (for example, Prejudice in the School or The Most Popular Shoe in School). In each case, the task was open-ended. It required the students to not only find answers, but also to formulate the questions.
In the case of stories, the children seemed to feel fairly at ease with the idea of crafting the story. However, each of them then struggled with the idea of integrating other forms of media into their documents. In many cases, the media was an afterthought (now that we have the story written, how can we use media). In one case, the intent was to create a video story. Only later did they realize that video was too costly in terms of disk space and that they needed to rethink how a multimedia document might be done. In the end, they chose to include their script as the text of the document, use still images from the dramatic enactment, and record the dialogue directly into sound files (this was The Dark Boyfriend project).

Another important part of the learning process of constructing their own multimedia products was that each child needed to struggle with copyright laws. In one instance, a group was engaged in a document about the Galapagos Islands. They were able to find much information about the islands from a multimedia CD-ROM owned by the school. From this CD-ROM they were able to find photographs to weave into their document. It was our understanding that as long as we owned a legitimate copy of the CD-ROM and we only used the data within the school for educational purposes that this was within the "Fair Use" guidelines of the copyright law. However, soon after learning how to copy the photographs and put them into their document, these children then copied text and put it into their document. It was at this point that these students needed to examine the copyright law and plagiarism more closely.

**Consequences.** The final C is consequences. Perhaps the biggest consequence for participation in this project was that their final products were either going to be placed on a CD-ROM and kept in the Media Center for perpetuity and/or placed on the World Wide Web (assuming that they had not used any copyrighted material). This fact was used as a constant reminder to the children as they worked on their projects. This also aided them in keeping an "audience" in mind throughout the development process. It may be worth noting that when we started these projects three years ago, we told the students that we would not only press a CD-ROM, but we would press multiple copies and try to sell them much like the Foxfire series of books (Wigginton, 1985). Throughout the projects several students expressed their concern/interest in any profit from selling their products. Unfortunately, the projects used a great deal of copyrighted material and we never attempted to market a CD-ROM and in fact, now we have a web server that demonstrates the products without cost or profit.
Conclusions

There are several things that we can conclude about projects implemented in middle schools using off-the-shelf software for multimedia document creation. They are:

- Overall, students found these projects to be quite motivating. This was partially due to the fact that new technology always has that kind of impact on children. However, it was so common an outcome that we believe that it is a natural outcome of these projects. Orey, Hardy, Peng, Tzeng, Robertshaw, Hamilton, Thuma, Scott, Fan, and Crenshaw (1997) used Turner and Paris's six C's of motivation to explain this phenomena and it seems to fit quite well.
- Having a teacher or assistant that buys into the idea of project-based methods is a key to success. In one of the inner-city schools, there was no advocate and it failed.
- Children gain technological competence. These students were clearly engaged in the use of these tools and they enjoyed using them. There was no large learning curve. The use of technology can be easily integrated in to regular curriculum areas without a huge amount of time spent on teaching the technology.
- More structured activities are less motivating. The reason for this is easily explained through Turner and Paris's (1995) six C's. Without choice and control, you have really cut into the six C's. Structured activities remove both choice and control.
- Projects are effective with at-risk students and students identified as having behavioral and emotional problems. In fact, these stories suggest that the projects allowed these students to get more involved in their own learning. This increased motivation and that motivation spilled over into other academic areas.
- Because we generally used groups of students in these projects, the projects provided the opportunity for students to engage in collaboration. At times this collaboration led to conflicts, but that is almost always true in collaboration. Therefore, the students had the opportunity to learn how to be more collaborative. The risk to not being collaborative is a failed project and students did not want this to happen.
- School became so engaging and interesting that students came to school on their days off, before school started and after school. This is a problem that I wish everyone would introduce into the schools. The problem of
children struggling to find extra time to get into school.

Summary and Comments

The purpose of this paper has been to describe the projects that we have conducted over the past three years at a local middle school. Besides benefiting the students in that middle school, these projects have resulted in two doctoral dissertations. In addition, the authors of the current paper include doctoral students who wanted to see children learn from technology in the school to begin to frame research ideas, to get research experience, or just to work with some students who were thoroughly engrossed in a learning experience. Similarly, several of the current authors are masters students who wanted to see technology in the schools while they were taking classes that talked about how technology might be used in the schools. They came away from the experience more knowledgeable and also inspired about how the use of technology and project-based methods can engender a high level of motivation in children.

The partnership started between one of the current authors and a local middle school. That partnership has enriched the lives of the children in the school, the teachers in the school, the students at the university and the professor who formed this partnership. We believe that other faculty at other universities, if they were so inclined, could do the same thing. The result would be that the colleges of education around the country would be more influential on the shaping of schools and schools would be more influential in shaping colleges of education as well as the field of education.

References


Stories About Children and Teachers

Story One: The Beatles Project

This project was created by a group of five seventh graders, three boys (John, Adam, and David) and two girls (Sarah and Beth). As they mentioned at the beginning of their documents, "we hope that you enjoy our multimedia project as much as we have enjoyed making it." They enjoyed creating this project, and they expended intense effort in order to complete a 26 page document that included many photographs and sound files.

The most significant component in the Beatles project was the well-organized structure. They started with an explanation of why they chose the topic, who they were, the basic information about each member of the Beatles, how the Beatles were formed, the great success of the Beatles' appearance on the Ed Sullivan Show, an introduction to the Beatles' most famous albums and hits, the reason for their break up, and how the three living Beatles members are doing now. Lastly, they interviewed their classmates in order to gain a better understanding of what seventh-graders thought about the Beatles. Readers can get a very clear picture of the Beatles after reading this project. Of special interest was the fact that they properly inserted various sound files to make the project more attractive. This project has successfully established an exemplar model for a biographical report in the multimedia format.

With a group of five, the management skills became the most important issue. They assigned roles to group members after conferring during their initial planning meeting. Since the boys dominated the discussion during this meeting and seemed to know more, the boys assigned themselves the most vital roles, such as: manager, designer, camcorder operator, and typist. The two girls were assigned the roles of writer and evaluator. John, the manager, wrote the letter to get the copyright

http://www.ncsu.edu/meridian/winter2000/stories/beatles.html

03/10/2000
permission from the publisher and was the person who took charge of all the audio recording. The other two boys, Adam and David, operated the camcorder to shoot the video, connected the camcorder to the computer, and used the "VidCap" program to put these photos in the computer. After David finished writing one paragraph, he asked who was the typist. (Adam was the typist.) When the researcher suggested letting the girls do the typing task, (thereby, giving the girls time on the computer), all the boys responded, "They type very slow." However, the boys finally realized that they did not split the tasks evenly enough, so they started to give the girls tasks, such as typing and writing.

The students took pride in what they were doing. For example, the researcher told them that they needed to write a letter to the publisher to obtain permission to use their materials in the project. The very next morning, John stood up immediately and showed me the letter he had written at home, printed on a laser printer. It appeared very neat and professional. However, David had accidentally signed his name in the wrong place on the letter. This made the rest of the team members angry, especially John, because he wanted this letter to be perfect. In addition, when they tried to record some audio for the project and their classmates were talking, they yelled at them, "Be quiet! We have work to do here."

As the project proceeded, the group became "stuck" and seemed unable to determine the next step. They looked forward, rather than back, to see how the plan was proceeding. After the researcher suggested that they read what they had planned and written, the group created a list of outlines that they wanted to add to the project. During group discussions, they demonstrated again that they did not understand the planning process, as they seemed to become enmeshed in details and continually lost sight of the big picture. Therefore, proper advice from the teacher would be to remind them from time to time to keep to their plan.
Story Two: The Movies Project

The Movies project was created by a group of three students, one boy, Harry, and two girls, Katie and Linda. This topic could be very interesting to write about, but they seemed to fail to make the most of it. Compared to the Beatles project, the Movies project was loosely organized and much less comprehensive. Three boys in the Beatles project dedicated themselves deeply to the project; they assigned the tasks evenly between themselves and cooperated with each other in a harmonious fashion. Somewhere in the middle of the project, they realized that the two girls were not involved in the project to the same extent as the boys, so they started to delegate some tasks to them. Basically, every team member of the Beatles project was involved in their project and did their best to contribute their own efforts to accomplish their goals. One might argue that as the Movie team consisted of only three students rather than five, we should not expect them to create a project of a quality equal to that of the Beatles project. However, we believe that the poorer quality of the Movie project was caused by the constant complaints and quarrels between Harry and Katie.

At the very beginning of the project, Linda was very enthusiastic about the planning activities. She volunteered to document all their group's decisions. She even wrote an outline that listed all the contents of their project. This document became one important guideline for them throughout the project. Katie, who loves to sing, spent a lot of time singing with the microphone and paying no attention to their project. Katie also seemed more curious about what the other group was doing. Harry complained to us about Katie's behaviors which led to more conflicts between the two of them.

Harry was very interested in operating the camcorder and
computer. He learned very quickly and was able to capture the photographs and video by following the procedures on the job-aids that were provided to him. He always asked for more advanced skills after he had mastered the old ones.

Linda and Katie were quite fond of using a drawing program called PaintBrush, both of them spending a lot of time exploring its various functions. Harry could not do anything while they were playing with PaintBrush, so he just sat far away from the two girls. He thought Linda and Katie were doing something that was irrelevant to the project. Actually, the girls wound up using PaintBrush to create a colorful pie chart for their survey results later on. On the other hand, Katie complained that Harry was not cooperating on their project by not participating in the group activities. The misunderstandings kept growing and the quarrels between Harry and Katie never ended.

Harry did not like the idea of doing a survey on favorite movies; he thought that was a stupid idea, completely unnecessary. He also complained that his suggestions were not accepted by the two girls. He told us that he preferred to work alone.

The lesson to be learned from this project is that group dynamics can destroy any learning benefits. There seems to be several factors at play here. First, Harry seemed to want to proceed in a linear fashion, while the girls seemed to want to use a more organic approach. Either they needed to accommodate each other, or these two styles should not be mixed together.
Stories About Children and Teachers

Story Three: The Video Games Project

We will call the three students in this project James, Keisha, and Shanika. James was perhaps the most intelligent boy in the school. However, he was also not well liked by the other students. When we were forming groups, we asked people to list other people with whom they might like to work. Only one person listed James—that student being Shanika. We believe that she chose to do this because she realized that, given James’ inclusion in a group, the project would be very good. She further knew that no one else would be vying for his participation. This strategy led one researcher to suggest that perhaps Shanika ought to be considered the most intelligent person in the school.

Their initial work with this project tended to focus on getting photographs of themselves and an audio clip introducing themselves into the document (this kind of experimentation with their images and voice seems to be one of the first things that students do with this technology). After this initial "play/learn" period, they began to immerse themselves in the task. James came up with a classification scheme that included High, Medium, Low and No Violence games. The group then got together and identified a variety of games that were popular for them and their peers. They classified these particular games into the categories that James had identified. Finally, after a short verbal explanation by a professor of instructional technology, Keisha went home and connected her game player through the VCR to the TV. As she played the games, she would press the record button on the VCR and came to school the next day with footage of actual interactions that they had identified in the games. These videos were digitized and integrated into their report as examples of the different categories.

Next, they decided to construct a one-item questionnaire on
whether their fellow students thought violence in video games was okay or not. They printed their questionnaire, copied it, distributed it to the entire seventh grade in their school, collected the data, and analyzed it. To analyze it, they entered the data into a spreadsheet program. After calculating totals and percentages, they selected a graphical representation that would best communicate the data (they had a pie chart). This chart and the data were integrated into the document (including the instrument as it appeared to the subjects in the study). Finally, they conducted interviews with people who had responded differently to the questionnaire. These interviews were integrated into the document with photographs of the individual respondents and audio clips of their comments. Within the context of this six-week project, these students applied social science methods and mathematical visualizations to their language arts activity. They learned how to use technology to express themselves. They worked in the mornings before school, in the afternoons after school, and at home to try and complete their project within the time frame provided to them. Finally, their work was published on a CD-ROM.

As you may expect, all was not perfect within this group. There was some tough negotiation on roles within the project. The girls wound up collecting the data, conducting the interviews, and videotaping. James seemed to do most of the writing and classifying of games. He tried to dominate the project, but Keisha and Shanika were able to prevent James from achieving this goal. This caused several conflicts throughout their project.

Return to "Stories"
Stories About Children and Teachers

Story Four: The Dark Boyfriend

The last project narrated here was produced by a group of three girls: Heather, Keiko, and Stephanie. All three girls were "best friends" and requested to be grouped together. They agreed very quickly on a creative writing piece rather than an informational or biographical document, generally the preferred genres in this project. (It was later noted that while students were working in the pen and paper writing workshop group, they wrote creative pieces almost exclusively, yet when working in the computer groups, they preferred nonfiction.)

The three girls wrote a plot synopsis of their story and submitted that as their project proposal. The writing piece involved two teenage girls who were close friends and attended the public high school. One of the girls met a teenage boy and was immediately attracted to him, primarily because he was "pleasantly unique." As the story progresses, it is revealed that the "boyfriend" was, in fact, a being from another planet and planned to harm the girls. Fortunately, the plucky young women were able to outwit the "dark boyfriend."

An issue immediately arose when the school principal read the proposed story line, as the original plot called for the "dark boyfriend" to be possessed by the devil. The principal thought that this might be offensive to some (parents) and instructed the group to revise this one aspect of the story. Heather, Keiko, and Stephanie received the news very amiably, quickly conferred, and asked could the boyfriend be an alien instead?

The "Boyfriend" group was characterized by a spirit of camaraderie, cooperation, and determination. The girls chose to act out a series of scenes from the story, taking turns videotaping each other. They found suitable locations both inside the school building and outside on the school grounds to dramatize their piece. Heather appeared to be least satisfied with her role; she played the only male part—that of the
boyfriend—and made some initial remarks about her costume being unflattering. However, she shrugged off those sentiments and put intense effort into all aspects of the production.

After the text was typed into the computer, still frames (photographs) from the group's videotaping were captured and inserted into the document. It was then decided that all lines of dialogue would be read by the actor/group member, and audio files would be created for inclusion in the story. The group recorded in the afternoons after school. They somehow lost all of their first recordings and had to remain a second day after school to redo these. When the recording session was over, some time remained before their parents would pick them up, so the three girls experimented with their voices over the microphone. They took turns singing, both solo and in trio, harmonizing, and giggling.
Stories About Children and Teachers

Story Five: Mrs. Iyoshi

My first contact at the middle school was Mrs. Iyoshi, facilitator for the Social Studies program. She was enthused by having another graduate student help her and other teachers with multimedia projects. For the first three weeks, I assisted several students who participate in the gifted program. These students come to Mrs. Iyoshi's class for an accelerated curriculum. Mrs. Iyoshi has incorporated multimedia into this curriculum.

Mrs. Iyoshi told other teachers that I was available to assist in multimedia production and curriculum integration, and I soon began working with Mrs. Johnson-Smith. Mrs. Johnson-Smith wanted her students to create projects on the topic of vertebrates. Her organization of the entire project, not just the multimedia development, played a large role in the success of these students' work.

She first divided the students into groups of three and four, then assigned each group a category of vertebrates (mammals, reptiles, birds, amphibians, fish, animal adaptations). She then gave the students folders with the criteria for the projects, as well as some references from which the students could begin their research. Each group was responsible for teaching their topic, incorporating several activities. One of the activities was the multimedia demonstration.

As the students created their projects, there was concern over colors, fonts and some other graphical issues. I had given them storyboards to use as a guide during development, but had not set true standards about graphics.

For the second project involving topics on Russia, I gave another group of students storyboards and persuaded them to deal with fonts and colors toward the end. Students worked
well at incorporating video and audio files to their projects, as well as including basic information about their topic.

On the presentation days, I realized a different perspective of these multimedia projects for the middle school students. After being 'designers' and 'developers,' they became teachers, who referred to, and took pride in, their creations and new knowledge. Future students can refer to their work and/or get ideas from them, as they create their own projects. My two major concerns are (1) finding a way for students to keep their work, so possibly to have a portfolio of sort to show at the end of their middle school years, and (2) not setting too many standards or providing cookie-cutter templates into which students just drop information. Storyboards should merely provide guidance and serve as an organizational tool, not a template. With enough guidance and organization, I think it is possible.

My work with middle school teachers and students was a gratifying, learning experience.
Stories About Children and Teachers

Story Six: The Colors Project

Being a new doctoral student in Instructional Technology and trained strictly in the sciences, I was inundated with new terminology and ideas about education. Project-based learning was one that had a particular appeal to me. I was fortunate to be able to participate on this project because it gave me experience and a unique perspective about hands on learning. This perspective was formulated in large part thanks to two young girls with whom I worked. They taught me that hands on learning projects have a unique ability to bring out creativity and interest in learning.

From the start these two girls were a cause for concern. During the first couple of sessions when the groups were brain-storming and beginning to plan these two had no interest, focus, or ideas. The others were quick to decide, excited about their ideas, and jumped on the planning. These girls were both stuck before they even started. Both were intelligent—a fact that the teacher brought up when I voiced my concerns. One of the two girls reads at a level higher than the rest of the class and reads avidly. The other girl was shy and quiet. I would characterize both girls as introverted.

Together they lacked imagination, but they eventually had begun decide to do a creative essay. I was cautioned by the project leader that previous creative writing projects lacked the integration of multimedia presentation that HyperStudio enables and were marked down for it in their assessment. Fearing this might be the end result of their slow start and lack of steam, I challenged them to come up with a way to make it creative in an audiovisual way. I had them suggest ways to make it different. They suggested pictures, sound, text, animations, videos, even special effects.

Generally I solved technical problems for the teams and this
took a great majority of my time. This left very little time for me to focus on the two girls. I wasn't able to spend time with them while fixing technical problems because they rarely had them. This wasn't because they had better equipment. They simply didn't do very much in the beginning. They made a few cards, wrote some text, and played with the colors of both.

After the break for the holidays, I was able to examine what they had done. They had decided to do some creative writing and poetry about colors. I asked what they thought of their work so far. They said it was boring to which I suggested making it "un-boring." I asked them what the colors sounded like to them. I suggested they find music or create sounds that reflect how the colors made them feel. They also wanted to know if they could add pictures of objects that incorporated the colors they had written about.

They initially started adding pictures of the bean bag animals popular among the girls of this middle school. Between the two of them they had about 30 different animals of multiple colors. They used the video camera to frame and add the graphic to the card. This required some team work as the camera had to be held by one member and the capture button had to be pressed on the computer screen by the other member. It took some trial and error before they were able to coordinate their actions to achieve success, but these two girls that had barely communicated with each other initially were now working well as a team.

Eventually they added sounds from their favorite music. The music was mostly pop and rock, but it did include some instrumentals and classical. They even worked out navigating from the menu to each individual page and back again. They used the colors consistently with the color they were writing about and provided contrasting colors to highlight headings. They asked others how to do things while I was busy with technical problems. Eventually their project took shape.

These two girls that had started with very little excitement were still a little reserved, but they were greatly improved over day one. The computer was not a friendly tool for them though. It took both awhile to get started clicking and creating. To their credit, they learned how to do things generally on their own. They experimented and revised what they didn't like. They even began to excel a little over the others. Certainly they had a better graphical feel for their work and more creativity.

Unfortunately a computer error corrupted their file during an
attempt to save their stack and they lost everything. I thought it was all over for them. Both seemed completely heartbroken. Here they had come all the way from disinterested to interested and excited, only to have a computer glitch destroy their work. With only a week left and only three sessions left it seemed impossible that they would finish. They surprised me though. The next time I came back both wanted to see if they could redo their project. With a little bit of assistance and extra time on their part, they rebuilt their cards.

The lesson they both taught me is that when students find an idea they are interested in, it becomes a rewarding activity in which to participate. They turned around their slow start and brushed adversity off to complete that which only 7 weeks earlier they had no interest in what-so-ever. They each placed a piece of themselves into their work and they felt rewarded by their abilities. The project activated their interests, motivated them to learn, and encouraged self expression.
Stories About Children and Teachers

Story Seven: Travius

I worked with a class of students with behavioral disorders and a class of academically gifted students. It was the students with behavioral disorders that I enjoyed working with the most, because it was those students that I felt really needed me in the classroom for something beyond technical help. It was out of that group that one student in particular caught my eye, Travius.

Travius is the kind of student who would just sit in the back of the room and not say anything, and not even learn anything, unless you noticed him and got him involved. Travius was the one who didn't ask for a lot of help from me and it was Travius from whom I expected the least. It's amazing what happens with those from whom you expect the least. By the end of the project, Travius produced a viable multimedia piece of work and one that had quite a lot of information. What makes Travius come to my mind is not the work that I did with him, but the work that I saw him do on the computer. Travius really got into what the project was all about. To watch him discover the idea of putting sound into his project, or watching him put a picture just so, or even typing information showed me the real motivational power in the use of computers for some students.

What did I learn from participating in this project? Good question. I learned about the use of Hyperstudio and its various components. I learned about planning with students in the middle school and how crucial it is to do that planning. On the other hand, I also learned how crucial it is that the students get a chance to explore a new medium before they can successfully plan. A lot of the students didn't know the full capabilities of Hyperstudio and ClarisWorks when they were in their planning period. This seemed to be an inhibitor to some of the groups. The most asked question I got was "Can I do
this, or can I do that?” I also saw, with the students with behavioral disorders, how computers can help self-esteem and motivation. With Travius, who never vocalized what he had done, you could tell how proud he was of himself. You could see it in how he reacted to his project when you asked to look at it.

Overall I found this project to be a lot of fun. It was exciting to see the kids get into working on the computer and also to think about further possibilities.
Story Eight: Olympics

Nick and Alex were in the advanced writing class. Though they came to the computer laboratory in the last period of a school day, they were always energetic and appeared eager (at least they both looked so for the first five minutes) to work on their project. Nick and Alex share several things in common. They are of the same height; they both have curly hair; and both like to talk.

Nick and Alex quickly decided to create a multimedia project about the Centennial Olympic Games. After weighing the resources and the amount of time they had, they then decided to focus their discussion on Olympic souvenirs. (Nick did not want to miss the opportunity to show some of his more than 250 Olympic pins to others.)

On a typical lab day, Nick would start up the application and get everything ready for work. While Nick proceeded to work on their project, Alex would provide feedback and sometimes serve as an assistant. After working on their project for a short time, Alex would leave his seat to begin his conversations here and there or to play with neighboring groups. Undoubtedly, everybody in the lab loved to talk to Alex.

Without much contribution from Alex, Nick still managed to produce a good multimedia project. As a matter of fact, among twelve students in this section of the experiment, Nick was the first one who learned how to record sound, capture pictures, and create buttons in HyperStudio. It was obvious that as time progressed, Nick seemed to enjoy working on the project more and more. He would sing while working and would play the Olympic song he recorded on the computer again and again to express his sense of achievement.

My job as a research assistant in the study was to help students
organize their ideas, provide technical support for the operation of computers, and observe students' learning processes. In retrospect, I feel that I was more of an observer than a facilitator though I did answer two or three spelling questions and offer some suggestions. These students in the advanced writing class were bright enough to work on their own once they learned the basics.

There were, however, behavioral and motivational issues that are noteworthy. As a whole, these students were full of curiosity and tended to have short attention spans. Consequently, dialogue between group members often became an ongoing conversation among other groups. In addition, one group in this section of the study was unmotivated to work hard on their project owing to a lack of good partner relationships. Oftentimes, the girl in the group would lie down on a table after finishing her part of the work and the boy would read his novel or even throw pencils and clay to other students after he completed his part. I feel that to a certain extent the attitudes and behaviors demonstrated by these two partners did affect the rest of the students.

Despite the problems stated earlier, it is fair to conclude that the majority of students in this section of the study were motivated and worked hard on their projects. As for me, I am really glad to be a member of this research team for I have not only learned how to use HyperStudio but also had my first experience of working with public school students.
At Washington, up to 80 students had access to the four computers. These 80 students were team-taught by three teachers: Ms. Watson, Ms. Jones, and Mr. Black. When the computers were first placed in Washington, we requested that 8 students from each homeroom (a total of 24) would be involved in using the computers to produce multimedia documents. This was to allow teams of two students per computer to create documents during each grading period. The time allowed for each group of 24 to create their projects was not specified, but the time was initially assumed to be one grading period.

The four computers at Washington were set up in a narrow resource room located between the classrooms of Ms. Watson and Mr. Black. This resource area was fairly secure to prevent theft and misuse of the equipment, and was accessible only through a locked door or through the two adjacent classrooms. Locating the computers in this resource room allowed relatively easy access to the equipment by the students and teachers.

The structure of 24 students per marking period was not adopted by the teachers at Washington, nor did the teachers embrace the idea of allowing student groups to create their own multimedia projects. The teachers instead incorporated the computers into their established teaching styles and used the computers to enhance those methods. For example, before having access to the computers, students made travel brochures using cut and paste, paper and pencil methods. With the computers available, students used a CD-based encyclopedia to locate information (text, maps, and other graphics) about the areas chosen for their brochures. Students selected by the teachers then used the software program
ClarisWorks to assemble text and clipart used in the brochures. Details such as the country's name, types of businesses, local language, common animals, etc., that were contained in the brochures were highly structured and outlined by the teacher. Students were allowed to design their own documents, but the design was within the constraints mandated by the teacher.

In another example, the students wrote poems about being African American. Students who wrote the "best" poems were assigned to transcribe their poems into ClarisWorks after the poem was written out longhand. Students then used the video camera to take individual pictures of themselves, and placed the video pictures in their ClarisWorks documents with their poems. The final documents were printed and taped up along the 6th grade hallway for display.

Students at Washington were not getting much experience in self-directed project-based education, but they were gaining computer skills, and most of the students (as well as the teachers) were gaining exposure to the possibilities of computers in the classroom. Whenever there was a break in the coursework or when students finished assignments before the rest of their class, they were allowed to use the computers, often to transcribe what they had just finished in class into a text or graphics file. Some students also learned how to display math problems using the spreadsheet and graphing functions of the ClarisWorks software.

The students at Washington were initially interested in games on the computers such as the solitaire card games, but as the school year progressed, they seemed less inclined to play the card games in their free time and instead explored ClarisWorks or the CD-based encyclopedia. For example, one student opened up ClarisWorks and discovered the "assistants" or templates for making commonly used documents. On her own, she decided to make an invitation for her mother's birthday party from one of the ClarisWorks templates, and proceeded to change the clipart, the fonts, and the wording on the template to make a custom invitation. Three other students in the room saw what she was doing and they made their own versions of invitations, showing each other how to find the clipart and how to change the template so that it could be customized, and then printed in the proper orientation.
Stories About Children and Teachers

Story Ten: The Carver Story
Back to Paper

At Carver, 24 participants were chosen from about 50 students taught by two team teachers, Ms. Mabry and Ms. Evers.

In the fall, a group of 16 students were chosen to work in groups of two children per computer. 8 students were assigned to the morning group, and another 8 students were assigned to an afternoon group. In the late winter, another 16 were chosen to work in similar groups, but the students refused to work cooperatively in groups. Since the students only worked on the multimedia projects when someone from UGA was with them, the winter group was soon reduced to 8 students in order to allow equal access to the computers. 4 students were to work in the morning and 4 in the afternoon.

Both fall and winter groups were told that they could choose any topic they wished to write about. The fall group chose the following topics: "the ultimate video game" (5 boys were in this group), "dance," "black on black violence" (three groups chose this topic), and "peer group pressure." The winter group chose topics such as "famous people of the 90s" (musicians), "famous songs of the 90s," "famous singers of the 90s," "dance," "shoes," "dealing with violence," and "baseball cards."

At Carver, the computers were originally set up outside the team-taught classrooms, in an open area which provided no security for the equipment when the classrooms were unattended. A more secure resource room adjacent to the classrooms and the open area was discussed as an alternative set up location, but use of the resource room would have required some modifications which never happened.

Around November and December, the classrooms were moved down the hall to allow re-tiling of the floors. The computers remained where they had been originally set up. When the
classrooms returned to normal, the computers were moved to the media center. Three of the computers were set up in a room off the media center, in an area not directly visible to the media specialist, Ms. Goodwin. The fourth computer was set up in the main room of the media center, directly in the view of the media specialist.

It was hoped that placing the computers in an area of higher security and somewhat increased supervision would increase the time spent on the projects. However, the time spent by the 6th grade groups on their multimedia projects was not affected by the move to the media center. The computers were used mostly by students not associated with the project after being moved to the media center, since Ms. Goodwin encouraged students from different classes to explore CDs such as "Grandma and Me" and "Where in the World is Carmen Sandiego?" In addition, the computer that was within Ms. Goodwin's view was connected to the Internet via modem in April. This computer came to be used almost constantly while the media center was open, either for Internet exploration or for reading CDs.

No one in the fall or winter groups at Carver completed their projects due to lack of time on the computers, sabotage of files, and abused equipment. The fall groups working on dance and video games came close to completing their projects, but the ClarisWorks files containing their work were all emptied of the contents and re-saved as empty files. The manner in which these files were deleted was suspicious and almost certainly sabotage.

The fall dance group worked exceptionally hard to gather information and videotape examples of dances for their project, but their documents were deleted prior to completion. The fall video game group also showed considerable effort, but it became clear after a few weeks of work that the effort was not distributed evenly among the group members. Several drawings of villains and heroes were hand-drawn for the game, but little other work was evident as far as structure, accompanying text, or other organization.

In an effort to avoid some of the organizational problems found in the fall group, the winter group members were taken aside on the first days of work on the project and shown some basics in idea mapping and organization. However, this seemed to lead to misunderstandings about the type of product the students were expected to produce. Even after seeing examples of documents made by students at other schools, the winter group seemed unable to visualize how to put their
projects together.

The students in the winter group focused on two ideas: (1) reconstructing the organizational "idea map" from a paper representation to a computer version (they mistakenly believed the organizational tool was actually their final product); and (2) the students spent a great deal of time writing personal introductions to accompany their idea maps. Only one of the students was able to come close to organizing and assembling a document. Several students rewrote their introductions every week and never completed or moved past that element.

The student who came close to producing a project was still unable to fully conceptualize what she was to do with it. She filled in text with accompanying video capture pictures of "famous people of the 90s" (musicians), but the text was mostly nonsense and was copied out of context from magazine sources. The text that did make sense was written for her by an older friend from another class.

In addition to the deleted project files, equipment sabotage became another problem after the computers were moved to the media center. Mouse balls were stolen at least 3 times, along with the locking rings that held the balls in place. A cable and battery from the video camera were also stolen, although the battery was eventually recovered.

General abuse of the computer equipment was also observed, as when students expressed frustration with the software by throwing keyboards to the floor or striking the sides of the monitors with their fists. Stated one student when told not to treat the equipment in this manner, "What's in this school belongs to me. I can do what I want with it." Another student added, "My dad says anything doesn't work, give it a good smack." Three of the computers were removed before the computers were damaged beyond use. The Internet computer was left in the care of Ms. Goodwin.
What Results From a Four-Year Partnership Between a University Professor and a Local Middle School?

Michael Orey

Department of Instructional Technology

The University of Georgia

Abstract

What results from a four-year partnership between a university researcher and a local middle school? The major outcomes have been a readily available research environment and a "real" place to learn about integrating technology into schools. For the school, there were two principal outcomes. We provided technical support to the school. In addition, we helped them acquire over $120,000 in grants. This paper offers the chronology of the partnership and a discussion of how this approach might apply to other schools and other professors of Instructional Technology.

"Each of us provided a technical service to the school while we learned about the realities of integrating technology into teaching and learning."

Over the past four years, I have formed a partnership with a local middle school which I will call Lincoln Middle School. This paper focuses on the results of this partnership. Some of these outcomes are positive and some are negative, though on the whole the partnership has been quite positive. As a faculty member, I tend to see things in terms of the big three roles of a university: research, teaching, and service. Each of these has been affected by my partnership. From the school's perspective, students and teachers have benefited in three specific ways: grant money, technical expertise, and technical support. While I will describe each of these viewpoints, I would like to begin by giving definitions of two terms that I use in this paper.

"Partnership" is a commitment to work closely with a school. In this particular partnership, all of my service and research and some of my instructional time occurred in the school. This means that sometimes I had no reason to be at the school, but I went anyway just to keep connected.

"Service Learning" is a derivative of situated cognition, a
learning theory that emphasizes the importance of context
(Brown, Collins, & Duguid, 1989), in that students are expected
to learn in the context where they will be working as they
perform a service to that institution. Each of us provided a
technical service to the school while we learned about the
realities of integrating technology into teaching and learning.

These definitions might not fit perfectly with the literature, but
they represent the nature of the relationship I had with Lincoln
Middle School. The best way to talk about my partnership with
Lincoln is to describe what happened over the four years.

**A Four-Year Partnership**

During the first five years of being a professor, I partnered with
the Army Research Institute (ARI) at Fort Gordon. I worked
with them on several projects relating to intelligent tutoring
systems. One of the key constructs that came out of my
experience with ARI was that I devoted all of my research and
development time to projects with ARI. Unfortunately, in 1994
there were a series of base closings. As part of this process, ARI
closed several of its field offices, including the one at Fort
Gordon. As I began to cast around for ideas about how I might
employ my interest in intelligent tutoring, I was approached by
one of my students, a language arts teacher named Kate, about
the idea of helping her figure out an interesting way of
integrating computers into her classroom.

I began to brainstorm ideas for integrating intelligent tutoring
system technology into a language arts class, but all the ideas
seemed like a lot of work and not very important. Also, around
this time, I went to the biennial Artificial Intelligence in
Education conference where I heard Elliot Soloway excitedly (as
only Elliot can do) tell about his new approach to learning called
project-based learning (an old idea wearing a new technology
cap). This sounded like just the kind of thing that would work in
this teacher's class, but Elliot was doing science projects and
Kate was a language arts teacher. One of the computer tools
Elliot talked about was called MediaText. It would allow
children to create multimedia documents easily (including
sounds, video, animations, graphics, and text). Kate's students
spent a lot of time writing. It seemed like MediaText might be an
interesting way of getting her students to write and use more
than just written words.

Unfortunately, Kate had no computers. I had an old 386 I was
no longer using and a 486 that I had used on an Army grant that
had already been completed. However, MediaText worked only
on a Mac. As I worked on this problem, one of my colleagues at
the University of Georgia (UGA) named Mike Hale discovered uses of Write (a simple word processor included in Windows) which gave us the options we needed. Specifically, Write would allow us to create multimedia documents that included text, graphics, photographs, videos, and sound clips on a PC. At this point, I had the needed software. But, I still needed some way of getting the photos and video into the computers.

I begged, borrowed, and—well I stopped short and did not steal—and was able to get two video capture cards and two video cameras from colleagues, the university, and from my own supplies. With this equipment, the students could capture stills for photos. They could capture stills of anything that they would have scanned, and this ability would compensate for not having a scanner. They could capture video and add that to their documents, though the computers only had a meager 100 megs of free space.

The next problem was that Kate was unwilling to spend a lot of time teaching technology to her students in a language arts class. "Keep It Simple, Stupid" was our guideline. Our solution was to create a separate "cheat sheet" for each of the tasks that students would need to do. There was one each for putting a video clip, an audio clip, and a photograph into their document. Most of the students did not need instruction on how to use a word processor, and those who did learned from their fellow students. Computer instruction took one class period to show the students each of these processes using a borrowed data projection system. Between the demonstration and the cheat sheets, the students easily figured out what to do, though a graduate student (Huey-Ling Fan) would visit the class once a week to work out problems.

We put the two computers into Kate's classroom and arranged for students to work in groups of two or three (4 to 6 students around the two computers). We rotated groups onto computer projects each 6-week grading period. When they worked on the computer, their writing grade for the marking period was based on their final multimedia project. With this rotation, we were able to give each of her students the opportunity to work on a multimedia project once during the year.

Each marking period we collected data. In an exchange of duties, I managed to secure Huey-Ling an assistantship which allowed her to work 13 hours per week with me in the school. We worked together in figuring out what data to collect and how to collect it. In the end, Huey-Ling was able to treat each of these opportunities as a pilot for her dissertation. She implemented this pilot or trial in the fall of the following year in
Kate's classroom. We also got better at the implementation each time.

A grant opportunity came up during this first year. I showed some of the work that Kate's students had done to the other teachers and the assistant principal working on the grant. They all agreed that this looked like a good direction to pursue. As a consequence, we not only wrote the grant around this model, but also received the grant, which could be used only for computers. We were able to purchase about 30 Macintosh PowerPC's with video capture cards. This State of Georgia Model Technology grant was for about $90,000. The proposal was based on a Georgia Research Alliance grant that I had successfully acquired earlier in the year. We combined these grants for a total of about $120,000. In other words, anyone attempting to assist schools with technical support must be willing to write grants aggressively to fund the technology.

The next step in the partnership was for me to come to a faculty meeting and talk to all the teachers about what we were doing in Kate's class. I did this by describing the process and showcasing the student projects. However, rather than telling the teachers that we had the solution and all they had to do was implement it, we simply described what we had been doing. The next step was for them to figure out what they could do in their own classes and to write a brief proposal. The best proposals would then get the computers. Fortunately, we were able to put computers into the classrooms of every teacher who wrote a proposal. Getting the computers was one of the two major achievements of the entire project from the school's perspective.

In the second year I was able to get three graduate assistantships. One assistantship was Huey-Ling's, and she used it to work in Kate's classroom and to work with one other teacher. The other two worked throughout the school assisting teachers as they began to implement their projects. One other doctoral student signed up to work with a social studies teacher to implement the multimedia projects with a history application. She then made her findings a part of her dissertation.

This is one of the most powerful aspects of my partnership with Lincoln. This particular student had been trying to find some place to do her dissertation and had only a general idea for what the dissertation was to be about. Because I was there in the school and because we had successfully secured the grant for computers, Lincoln Middle was an ideal place to conduct research on technology integration. Teachers were very willing for my graduate students to come into their classrooms because the students brought technological expertise with them.

"In other words, anyone attempting to assist schools with technical support must be willing to write grants aggressively to fund the technology."
This child's special education teacher told us that he had previously been totally alienated from school and his other classes. She saw this project as the vehicle that had brought his mind back into school and gotten him involved with learning, perhaps for the first time!

The remainder of the second year revolved around supporting teachers as they tried to implement the project-based ideas using the new computers. By the end of the year, teachers had a few concerns. One was that it was difficult to implement this approach using four computers in the back of the classroom. The model we used to implement the grant was to put the classroom teachers in control of the computers. So, if a team of four teachers wanted to implement computers in a classroom, we gave them four computers to share. They could move them to whichever class was currently using them and did not have to deal with the bureaucracy of a lab. Another issue is that not everyone got a computer. This situation was not "fair" even though we gave computers to every teacher who wrote a proposal. Anyway, the consequence of this action was that the technology committee and principal reconfigured the computers so that all teachers (or nearly every teacher) had a computer in their classrooms by the third year of my partnership.

In the third year, I was able to continue working on project-based approaches because I was able to place six 486-based PCs into a vacant classroom across from Kate's classroom. This acquisition allowed us to have a mini-lab. Two interesting things happened in this lab during the third year. First, during one of my classes at UGA while I was enthusiastically describing the benefits of the project-based approach, one of the teachers from Lincoln suggested that the success I was experiencing was the result of having highly motivated students (Kate taught "advanced" language arts). He said if I tried these things with his lower achieving students, it wouldn't work. I took up the challenge.

We set up a replication of Huey-Ling's study with a few variations. Huey-Ling found a significant improvement in writing ability from pre to posttest with Kate's advanced language arts students. However, there were a variety of alternative explanations for this improvement other than the use of multimedia projects. We ran the same experiment, but controlled for the alternative explanations along with using a control group. No significant differences resulted. We also set up Huey-Ling's approach with a special education class for students who were classified as behavior disordered (BD).
"Each partnership yields new and important understandings for me about the field of instructional technology."

and a class unofficially described as an "at-risk" language arts class. Both of these classes were quite successful. One of the BD students did a multimedia project on lions and tigers. Later in the year, he was able to add some content and then show this product in his science class where they were studying mammals. Still later in the year, he showed it again in a social studies class where they were studying India. This child's special education teacher told us that he had previously been totally alienated from school and his other classes. She saw this project as the vehicle that had brought his mind back into school and gotten him involved with learning, perhaps for the first time!

A second interesting thing that I did in the mini-lab during the third year was to solicit volunteers to come work on this "replication" experiment. I got four of our current doctoral students and three masters students (whose goal was to go into government or business and industry, not K-12 schools) to volunteer to work at the school a couple of hours a week for six weeks. These graduate students offered moral and technical help when students needed to know how to word something or when they needed to import video or other media. I still hear from these people and they talk about how great that experience was because they could see the immediate results of their helping the students.

Besides the mini-lab activities, we also initiated our "Teacher Tools" project. The goal of this project was to design and develop a computer-based tool that would help teachers do their job. If we designed it well, then teachers would use it everyday and as a consequence, would become more competent with computers. We began this project by conducting an environmental and a task analysis. There was a computer in every classroom that was connected into a local area (10 base-T) network connected to the world on a T1 line. The task analysis involved following teachers around all day and writing down exactly what they did. The results suggested that the Teacher Tools ought to include email in the building, grading, planning, communications outside the building, and a variety of other tools because the teachers spent considerable time on each of these tasks.

One of the lessons we learned over the first two years was that after spending six weeks on the creation of a multimedia document, the children were very competent with using the computers. We also observed that as long as we supported the teachers, they were willing to implement the project-based approach in their classrooms. Without our support, they no
longer used this approach. In informal discussions with the teachers, I discovered that the reason for this was that the teachers had not become comfortable with the computers. We concluded that the students gained competence by using computers every day for their projects, but teachers did not gain competence because they did not use the computers regularly. So we needed to provide the teachers with some reason to use computers every day: the Teacher Tools project.

In the spring quarter of the third year, I had a multimedia class at the university design and develop the Teacher Tools software for their course project. Because the class taught students how to use Macromedia Director, this development tool was used to implement the Teacher Tools. This prototype was taken to the teachers during the end of the school year and used to prompt the teachers for ideas about how it could be improved. It is interesting to note that when we conducted the task analysis we asked teachers for ideas on the Teacher Tools program, but they were not able to come up with many ideas. When we were able to put a prototype in front of them, they were able to generate many ideas. Once they saw the kinds of operations the technology could do, they were able to creatively generate many ideas for getting the computer to help in the classroom.

Three other important events happened during the third year that deserve mention. First, Joi Moore, one of my doctoral advisees, took on the Teacher Tools project as her own. Macromedia Director was the wrong development environment. Director is an excellent multimedia tool, but the Teacher Tools project was a database problem. Joi re-implemented the Teacher Tools in FileMaker Pro (a database tool) during the summer and on into the fourth year.

A second important event happened when another one of my advisees bent his research interests so that they fit in with a middle school population. He had worked on some of the Intelligent Tutoring projects with the Army and had wanted to examine scaffolding in this context. Scaffolding is a powerful teaching tool because learners take as much control of the learning process as they are able to do. Instead of working on an Army project, he created an arithmetic game that could be used at the middle school level and implemented the desired scaffolding approach in this game. During the third year, he was able to go into our computer mini-lab and conduct all three of his pilot studies in this setting. Because he had used several students from each of the grade levels, he wound up going to another middle school to collect the data for his dissertation, but it was through my contact at Lincoln that he was able to do this. He collected his dissertation data during the fourth year.
Third, another dissertation was completed as part of this project. The principal had been working on his doctoral degree in Educational Leadership during the project (he is referred to as the assistant principal above, but he became the principal during the third year of my partnership). He looked at implementation issues with regard to the technology grant. One of the major consequences of this study was that he found that students were not getting access to the computers during the third year. Students were not doing projects anymore because they had only one computer and did not seem to think about sharing. The outcome is that they redistributed the computers in the fourth year into three mini-labs with about 10 computers per lab. This decision had serious consequences for Joi's implementation of the Teacher Tools during the fourth year.

By the way, if you have been keeping tallies, the total number of dissertations completed as part of this four-year partnership was 5. There were the two project-based dissertations (Fan, 1996 and Wang, 1996), there was the principal's dissertation (Sherman, 1997), the Teacher Tools dissertation completed during the fourth year (Moore, 1998), and the arithmetic/scaffolding dissertation completed in another middle school during the fourth year (Zhao, 1998). I might add that one other student conducted some pilot work for his dissertation during the third year, but, for a variety of reasons, is now doing his dissertation in veterinary medicine. One other student who worked on Huey-Ling's replication experiment is currently considering working with a science teacher at Lincoln on a project-based science dissertation. So there were many opportunities to conduct research as part of this relationship.

The fourth year was a kind of winding down of the partnership. The only major project was the Teacher Tools project. There were a variety of problems that arose as part of this project. The first problem was alluded to earlier. We designed the Teacher Tools with the idea that teachers would have their own computers in their classrooms. This was not the case during the fourth year. There was a mini-lab available to each of the grade levels (sixth through eighth). These labs were placed in each of the grade level's hallways. While the labs were physically close to the teachers, the situation was not the same as having one in the classroom. Another problem with the Teacher Tools project was that it required a lot of programming in addition to the fact that Joi needed to write a prospectus for her dissertation. The combination of these two issues was that the Teacher Tools software was not available until January of the fourth year. This is not a good time to get teachers to change the way they work although it was an excellent time for Joi to get her dissertation
done by the end of the school year. Bad timing along with a bad configuration of computers (bad for teacher use, good for student use), resulted in only a few of the many features of the Teacher Tools being used.

If you are in a partnership and detect a problem, you seek a solution. Because we found that the Teacher Tools program was not being implemented well, we went looking for funding sources that might help solve the problem. If we could get a notebook computer for each teacher that had an ethernet card, a modem, and a display system, then we would have a useful setting in which to implement Teacher Tools. We found a funding source, but it required us to scale up from the school level to the district level along with other partners. I began to set up this alliance and at the same time began the creation of the grant proposal.

Unfortunately, after investing many hours in this grant proposal, the district decided that they did not want to participate. The grant was supposed to originate from the district, so the grant was dead. This was the second time that I had put time and effort into a proposal to help Lincoln and the district had gotten involved and wound up not allowing us to submit the grant. While this was not the primary reason for ending the partnership with Lincoln, it was a contributing factor. The primary reasons were all personal.

I continue to contact people at Lincoln, but the whole-hearted partnership that I previously had with Lincoln no longer exists. I have now moved into a partnership-like relationship with one of the local instructional design firms. My plan is to try this for four or five years and move on from there. Each partnership yields new and important understandings for me about the field of instructional technology.

Having described my four-year partnership with Lincoln, I turn now to some generalizations based on my experience. Finally, I turn to the literature to see if there might be some generalizations that might be made about partnerships.
"By and large, the partnership with Lincoln was beneficial to both parties. It is my belief that others may also benefit by forming such partnerships."

How Lincoln Middle School Benefited

Everything that I did in this partnership was a form of service to Lincoln Middle School. I was constantly contacted for my technological expertise. This expertise helped others in planning for computer integration in the curriculum, in the writing of grants, and in fixing equipment and software. I was also used as a general idea person. Related to technological expertise is the idea of technical support. My students and I often filled the role of a technical support persons. We were always troubleshooting a variety of technology problems. Much of this effort benefited the school. Although it was time consuming, I was willing to invest time because of the other benefits.

The number one benefit is perhaps that over the four-year period, we were successful in securing more than $120,000 dollars in grants for the school. Most of this money was spent on computers and networking in the building. It is because of the pilot work that we were able to clearly articulate the benefits of a project-based approach, contributing directly to the success of the grants. By and large, the partnership with Lincoln was beneficial to both parties. It is my belief that others may also benefit by forming such partnerships.

Partnerships

I consider my four-year partnership with Lincoln Middle School to be a great success. I have learned a great deal about integrating computers into the schools, and Lincoln has come a long way towards having technology successfully integrated into the classrooms there. So far, you have heard the story of the partnership. I would like to turn now to the nature of that partnership and how others might establish partnerships with other schools in other places.

One really important aspect of my partnership with Lincoln is that of relationships. My students and I developed good and trusting relationships with the teachers and administrators at Lincoln. Time spent at Lincoln was valuable for me, for my students, for the teachers, and for the Lincoln students. When I attempted to expand and include the district, there were new players. These new players did not have a relationship with me, so it was nothing
As many have noted, the relationship between colleges of education (COE) and elementary and secondary schools has benefits for both. As Goodlad (1990) suggests, renewal of schools is linked to research activities in universities. This was certainly true in my relationship with Lincoln. Teachers were increasingly being pressured to integrate computers into their classroom learning activities, but few of them had enough technical knowledge to figure out interesting solutions to classroom problems. The ideas came from the universities through me. I use "universities" here to indicate that many of the ideas that I brought to Lincoln were ideas that others in the research community had conceived. However, it was not a one-way street. It was not just telling them what to do. I brought to the local school a certain amount of technical expertise and instructional theory. They brought instructional theories and a wealth of practical teaching experience. It was through this collaboration that we were able to conceive of a variety of interesting solutions to classroom computer integration problems. These solutions helped not only the classroom teachers at Lincoln but also my instruction at the university (and made me much more empathetic to the needs of classroom teachers).

Fullan (1993) also suggests that colleges of education ought to be closely aligned with K-12 schools. A separation between them is not healthy for either. The field of instructional technology is problematic with respect to this view. The problem at UGA is that our department has students who are interested in school media, students who are interested in school technology coordinator positions, students who are interested in instructional design in business and industry, and students interested in going into academia. Three of these four types of students fit in well with Fullan's idea, but those students interested in business and industry align more closely with a business school. Interestingly, when I was able to get student volunteers to go work at Lincoln for a couple of hours per week, I was able to recruit from all these types of students.
The reality for most instructional technology departments is that they exist in a college of education and are increasingly being asked to play a larger role in working with K-12 programs both in their teaching at the university and their research. My partnership with Lincoln fulfilled this responsibility. In fact, the schools are so needy concerning technical expertise that if every instructional technology professor in the country were to partner with a school, we would not come close to meeting this need (but it would be a powerful thing to see!).

Fullan (1993) suggests that there are benefits for schools and there are benefits to the university as a result of the partnership. In terms of the latter, it has been my teaching that has benefited most from the partnership. It is relatively easy for me to stand up in front of a class and lecture my students on some of the current concepts in the field such as constructivism, situated cognition, goal-based scenarios, intelligent tutoring, and so on. It is quite a different thing to try and put these theories into practice.

My partnership with Lincoln allowed me to grapple directly with the issues of applying theory to practice. The result is that I have built a repertoire of stories to describe how these applications might work. The stories from an actual classroom add a measure of validity to my instruction. Because this work involves relying on a teacher's expertise, the resultant application is a combination of practical and theoretical knowledge, an important aspect of educational theory construction (Carr, 1989). A consequence of this team-based work is to credit all key members of the team in the authorship of any publication. Therefore, authorship might include as many as ten authors on a single manuscript (e.g., Orey, et al., 1997).

"Collaboration means that the players combine to carry out their common interests in improving the quality of life in educational institutions and programs" (Shive 1997, p. 37). This assessment is true, but it takes more to make the extensive efforts of a partnership worthwhile for all. I was able to have four of my doctoral students conduct their dissertation research (along with all the pilots) in this setting. I was also able to give my masters students the opportunity to try out their ideas in an actual educational setting. In sum, my partnership allowed me to create a venue for research and application for myself and my students. For the teachers, they were given access to several people who had technical expertise to assist them in fulfilling their need to integrate computers into their classrooms. My students, the teachers, and I each had motivations that "sweetened the pot."

Shive (1997) describes these benefits of a partnership: 1. Teachers can emerge from isolation in their classrooms to working on a team. 2. Everyone learns. Everyone "researches." 3. Partnerships...
provide the opportunity to share successful practices. 4. Because teachers are involved in the change, they have investment in the change and will continue with the new practices after collaboration ends. While we do not have direct evidence of and did not really focus on the first of these benefits, our work at Lincoln did result in less isolation for all parties. The second issue was certainly true: my partnership with Lincoln was a great learning experience for everyone. Perhaps it is selfish of me, but I think I was the one who learned the most. It clearly was an opportunity to get out of the ivory tower and "get my hands dirty" in the real world of a real school.

In addition, lots of research happened. Much of the research was informed if not guided by the teachers. Clearly, everyone was researching. The opportunity to share practice occurred for at least Kate, if not for many of the teachers. Kate was our prototype for the project-based application. We designed this project in collaboration with her, so our implementation was shared with the entire school. Others refined this approach and adapted it to their classes; these modifications were shared across the school.

We did all that we could to invest the teachers in the change. At this point, approximately 6 months after the end of the partnership, project-based activities continue and many teachers still use the Teacher Tools application.

**How do you form good partnerships?**

Carriuolo (1991) provides a useful guideline: value the knowledge and skills of the teachers and allow them to use the consultant’s knowledge and skills. This is key. I don't know how many times I would say things like, "I know the computer can do this, but I don't know if your students can do this. You know what will and will not work with your students." At a faculty meeting in the middle of my partnership with Lincoln, I showed the faculty some projects that some students had created. I then told them I knew computers and had some book knowledge, but needed the teachers’ experience to help me figure out what would and would not work in the classroom. While it sounds somewhat pretentious in print, comments like these led to some really powerful ideas for integrating computers into their classrooms. It was an opportunity to cooperate with me rather than submit to an activity I wanted to do to them. This difference is important because it allowed me to take on a legitimate role in the school as a consultant.

Lieberman (1992) describes how she was able to establish legitimacy in a particular school. She started by working with one teacher. The result of their work could afterwards be shown to other teachers, and they could be told what could be done because
that specific project happened in Ms. Smith's class. I did the same thing. It was my work in Kate's classroom that led to the widespread integration of technology into the classrooms at Lincoln.

There is no magic bullet for how to form a partnership, but my hope is that you complete the reading of this paper with a framework for establishing your own partnership. Respecting teacher knowledge and establishing a legitimate role for yourself are two general strategies for getting started. Working with a single teacher for an extended period of time and then expanding to the school level is another excellent strategy.

"The Lincoln experience helped me to contextualize my teaching of graduate technology integration classes. It gave me practical rather than theoretical experience in a school situation."

Summary

Over the four years of work with Lincoln, the school has benefited from technological expertise and grants. In that time, I benefited by having a readily available place for conducting my own research and helping my students to do theirs. It was an excellent place for students to learn about doing research and learn about the environment of school. The Lincoln experience helped me to contextualize my teaching of graduate technology integration classes. It gave me practical rather than theoretical experience in a school situation. On the negative side, it was very easy to get caught up in caring about the children and school and forget that your job is to share the results of your research with others. This paper attempts to disseminate some of the knowledge that I have gained from collaborating with graduate students, teachers, and middle school students. The results were unexpectedly productive.

References


Technology in an Inclusive Setting

Susan Bruner and Mary Lindig
Shepherd Middle School
Ottawa Elementary School District
Ottawa, Illinois

"Technology is a part of all students' lives; therefore, all students can learn basic technology skills when placed in an inclusive setting."

INTRODUCTION

Problem Focus
Rationale
Preliminary Concerns

LITERATURE REVIEW: Connections to Best Practice

A brief summary of each of the articles listed below is provided along with the ways in which each of the articles influenced the progress of the project described here.


Technology is underused in special education. CEC Today. July 1997. Vol. 4, No.1
METHODOLOGY

Time Line for The Project
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"Because we were looking for ways to include the students with disabilities in team activities and were trying

INTRODUCTION

Technology in an inclusive setting began as an idea to address some current changes facing us as instructors. This year we were placed on the same seventh grade team. We quickly realized a common goal of ours was including students with mental impairments in more team activities. Many of our team activities centered around technology based projects. However, until this point, students with mental impairments had only been included in field trips. Another challenge we faced was the fact that there was little training given to teachers of special education on the inclusion of the new
to learn the new technology, we decided to design a program that would meet both of these needs."

"Because special education students may require more time and repetition to learn these skills, computer usage should be frequent and consistent."

to teachers of special education on the inclusion of the new technology. Because we were looking for ways to include the students with disabilities in team activities and were trying to learn the new technology, we decided to design a program that would meet both of these needs.

As we looked at our schedules we found that the regular education homeroom class which was an extension of a regular language arts class period, would provide us with some students who could work as mentors to the students with mental impairments. Once we identified a group of mentors based upon volunteers, we identified some time in which the regular education students could mentor the students with mental impairments on the computers. The main idea behind these mentoring sessions was that the regular education students would take the knowledge and basic technology skills they had acquired and teach it to the students with mental impairments. We both felt strongly that all students can benefit from the use of technology. Technology is a part of all students' lives; therefore, all students can learn basic technology skills when placed in an inclusive setting.

Problem Focus

1) Few opportunities exist for interaction between general education students and special education students.

Shepherd Middle School has 600 students who are assigned to two 8th grade teams and two 7th grade teams. Students with mental impairments are placed in a self-contained classroom. However, the teacher of these students is a member of one of the seventh grade teams, Team 2. Up to this point, these special education students' interactions with general education students had been limited to lunch, one daily forty-minute enrichment period (art, industrial arts, music, home economics), an annual field trip, and extra-curricular activities, such as school dances.

2) Special education students have been given limited access to current technology.

Major technology upgrades were made during the 1996-1997 school year. Part of the plan included a new approach to using the computer labs. Prior to the upgrade, two computer labs had been used primarily for math and English classes, but with the arrival of new computers, the labs were changed to an eighth grade lab and a seventh grade lab. Computer time was then divided equally between team teachers. For example, Team 1 and 2, which are seventh grade teams, alternated weeks in the computer lab. It was up to the team to decide how individual teachers on that team
would use the lab for their team week. Every fifth week was allotted for enrichment classes. Although special education teachers were assigned to teams, no specific time was being allotted for their classes.

Special education students should have at least as much computer access as regular education students. They will benefit from the basic computer and Internet skills, keyboarding skills and skills taught through software. Because special education students may require more time and repetition to learn these skills, computer usage should be frequent and consistent. It should also be in an inclusive setting to allow students the learning strategy of modeling.

3) Teachers are unable to provide the individual assistance and training that are needed for the special education students to use technology successfully.

The students in the special education classroom have a wide range of impairments that range from mild to severe and include both mental and physical impairments. These impairments limit their abilities when using computers. Therefore, it is necessary to have individualized training and assistance. However, the teacher and support staff were unable to adequately and consistently provide this assistance.

4) Existing technology software needed to be adapted in order to meet the needs of special education students.

Although the special education students had prior experience with computers, the new technology included multimedia and Internet capabilities. Training with this technology had not been addressed formally with these students. Also, materials made available had not been age appropriate. Existing software needed to be adapted in order to meet the needs of all students. Technology that addresses the needs of students with a variety of disabilities is available. This software incorporates skills necessary for learning for this population. Not only does it focus on common goals such as daily living, vocational, motor, educational and social skills, it also encourages the use of computers. Computer skills are extremely important in today's world.
"Our goal was to implement new technology into the curriculum through activities that were meaningful and engaging to the learner."

Rationale

Our goal was to implement new technology into the curriculum through activities that were meaningful and engaging to the learner. Over the past year, teachers at Shepherd Middle School have received a new computer in each of their rooms. In addition, some teachers have been given mini-lab stations within their rooms. The introduction of new technology carried with it several new challenges. First, we were faced with the challenge of creating activities. This involved understanding the kinds of activities that are appropriate and useful. Second, as we introduced activities into the included curriculum, we needed to continually assess their impact upon learning. Finally, we wanted to incorporate special education students into technology programs.

Over the course of the next two years we developed a variety of activities to implement and assess. During the first year we focused on the development and adaptation of several specific activities for students with special needs. During the first year of the program, all mentoring took place in a lab setting. Regular education students were paired with special education students. Together they learned typing, basic computer and Internet skills. This allowed time for observation and data collection. It also gave other teachers an opportunity to see the program's progress. At the end of the first year, a summary of findings was be presented to the staff. The presentation was meant to ease staff concerns about inclusion. Some of these activities were already established in the regular education program, but this allowed special education students to use technology in more meaningful ways than were currently available.

After a year of laying groundwork, the second year of the program involved special education students participating in regular education classes and projects. This included classes of students with moderate mental and physical impairments and students with learning disabilities. The activities involved regular education students who mentored special education students. Through the continued use of mentoring and staff support, we established a successful inclusive program.
“Through the continued use of mentoring and staff support, we established a successful inclusive program.”

Preliminary Concerns

At the beginning of our project, we had the following questions and concerns:

1) Scheduling
   - When will we find time to plan activities?
   - How do we fit the program into existing class schedules?

2) Adequate computer lab time
   - Where will computer lab time come from if no specific time has been assigned to special education teachers?

3) Method for selecting technology mentors
   - From which general education class will technology mentors be selected?
   - Should the students be selected or asked to volunteer?

4) Support of staff
   - Will teachers allow general education students release time to participate in the program?
   - Will general education teachers want special education students participating in whole team activities?
   - Will general education teachers be flexible with computer times?

5) Adaptation of software and projects
   - How do we provide technology experiences to special education students that are similar to those of their general education peers?
   - How do we adapt projects to be both inclusive and meaningful?

6) Time frame of implemented projects
   - How will we work within team scheduled projects?
   - Can special education students meet these predetermined expectations in the time allotted?
LITERATURE REVIEW: Connections to Best Practice


The article entitled Handywoman's Special (NEA Today, 1998) is inspiring to anyone hoping to learn or create a technologically rich environment for their students. Michele DePrille is a special education teacher at Midwestern Intermediate Unit in New Castle, Pennsylvania. When searching for software for her students with profound mental and physical disabilities, she was frustrated to find that there weren't any which were age appropriate. Most of the software she found was based on preschool level, yet preschool software, such as Sticky Bear and Big Bird certainly was of no interest to her junior high students.

While watching one of her students interact with a program, she noted that the program was created by using Hyperstudio. Michele then took matters into her own hands and created a program for her students. The program used a digital camera and Hyperstudio. Michele took pictures of her own students and then incorporated buttons which students could easily click on for responses. The program encouraged students to get to know each other visually and was stimulating to the students because they were able to see themselves. Michele went a step further by creating a Halloween program which allowed students to use their voices to be scary. Michele reported that learning to use Hyperstudio was easy. She had no manual or instructions, just some time playing with it.

The options for creating engaging technology are limitless as we begin using the resources in front of us. We have found similar results to Michele. When materials are adapted appropriately, all students can learn and be engaged successfully with technology.

An article published in CEC Today (1997) newsletter reaffirmed for us the need to address how technology is being used in special education. This article highlighted results of a study completed by Macro International, Inc. and the Office of Special Education Programs. Surprisingly many of the trends found in the results were similar to trends in regular education. Overall the study found that the use of technology in special education is not really extensive or intensive.

One of the first reasons this has occurred is due in part to the lack of consistent and sustained training and practice special education educators and aides have received in technology. Often they are only exposed to one-shot workshops, and there is little time given for how to practice and integrate the information gained at workshops. Secondly, access to computers seems to be preventing special educators from using computers. As we have found, students should have access to computers on a daily basis for at least thirty minutes a day. Like the adults who are struggling to learn and need consistent, sustained practice so do the students. However, often labs are full or schedules prevent consistent times. Furthermore, the older models seem to be given to the special education teachers as a way to appease them, however these models lack the capabilities of current models. Finally, special educators have problems finding appropriate software. In most cases age and level appropriate software has not been designed to meet the needs of older students functioning at lower levels. All of these factors contribute to reasons why technology is being underused in special education.

We both shared similar concerns when the technology arrived at Shepherd Middle School. By creating a technology mentor program and working together, Susan was able to learn more about the software we had available at Shepherd while at the same time brainstorming ways to integrate the software. The mentors assisted us in the training aspect of the software so that all students had an opportunity to use the technology. Time is still a major factor that has been a stumbling block. We have secured a forty-minute period one day per week and a separate 20-minute block of time on another day of the week. This allows students at least two days each week in the computer lab. Granted, this is still not enough, but it has been a step in the right direction.

"The mentors assisted us in the training aspect of the software so that all students had an opportunity to use the technology."
"Classrooms and teacher practices of today must continue to strive for a school climate that benefits all learners."


This article (Salisbury, Evans, & Palombara, 1997) supported the outcomes of our project in that we used a form of collaborative problem-solving (CPS). According to the article, "Collaborative problem-solving involves an interdependent relationship among two or more people to achieve a common goal." Based upon this study and its outcomes there were similar parallels to our project. Although CPS in this article was a formal process in which students were trained during several sessions, we clearly saw evidence in our informal use of collaboration.

In the article both teachers and students were trained over several sessions about CPS. In this case since the CPS centered around the issues of integrating students with mild to profound disabilities, CPS training sessions for both teachers and students included the following:

- The rationale for inclusive schooling practices.
- A working knowledge of what physical, social and instructional inclusion might look like.
- An overview of criteria used to screen potential solutions.
- Instruction in the 8-step CPS process.

The main ideas included in the CPS process are as follows:

- Identify the issue: "What's happening here?"
- Generate all possible solutions: "What can we do?"
- Screen solutions for feasibility: "What would really work?"
- Choose a solution to implement: "Take action"
- Evaluate the solution: "How did we do? Did we change things?"

The study conducted had issues that were similar to those we faced. The issues reported upon in the study varied from physical/social, social/emotional, academic, and staff-related issues. We have faced similar issues in setting up and monitoring our mentor program. The findings of this study were consistent with several of the outgrowths of our program. According to the study there were three major findings. First, the process of CPS eventually became routine to both teachers and students. Second, adults had to initiate the process of CPS. Finally, teaching staff felt CPS was an important strategy for promoting the physical, social, and instructional inclusion of students with disabilities in their classrooms. As the study continues to report, their findings had four important
implications which we have also seen as a result of our mentor project. First, the process can be used for solving physical, social, and instructional challenges of inclusion. Second, CPS process encourages creativity of staff and students for creating plausible solutions to real problems. Third, CPS is a part of the current teaching methods researched today. CPS involves teacher flexibility and shared decision making. Classrooms and teacher practices of today must continue to strive for a school climate that benefits all learners. CPS is consistent with these current methods. Finally, CPS is a great tool to encourage social, cognitive, and communication goals among students and staff.

Although we did not set out to use the formal CPS steps, we found ourselves and our students going through a similar process. From the moment we began the project, it was based upon collaborative efforts to solve the problem of integrating students with mental and physical impairments into several of our technology projects so they would also have the experience of using current technology tools. As we looked back, we realized that we went through the steps of CPS to create a successful technology mentor program. Furthermore, as a result of the modeling done by us, we have recognized our students going through steps of the CPS process as well as they completed the different technology projects. Both our project and the article defining steps in CPS have given us a vehicle to use in the future as we begin to integrate students into the classroom on a more regular basis.

Peck and Dorricott (1994) in research identified stages which technology has gone through while being introduced into schools over the last ten years. More importantly they have identified ten reasons why technology is a valuable tool for all students to use. Having completed our technology mentor project, we were able to identify with the stages the authors identified and we concur with the reasons for using technology.

According to John Naisbitt in Megatrends, new technology when introduced passes through three stages. In the first stage, the new technology follows a "line of least resistance into the ready market." In the second stage, users improve or replace older technologies with newer technologies. Finally, users discover new functions for the technology. Peck and Dorricott (1994), after studying these stages, came to the conclusion that schools in general are just beginning to enter the third stage. Unlike businesses that move through the stages quickly, schools seem to be moving slower through the stages of technological advancement. They identified several reasons why schools and many educators are stuck in the second stage. First, teachers have found that computers increased their workload rather than decrease it. On the other hand, educators who have moved into stage three are asking, "How can these new tools contribute to a more powerful educational experience?" According to Peck and Dorricott, "Educators at stage three understand that it is what the student does that counts" (p. 12). Educators who have moved to stage three have identified ten reasons to use technology. As we have progressed through the project, we have clearly seen the support for each of these ten reasons identified by Peck and Dorricot.

1. Students learn and develop at different rates
2. Graduates must be proficient at accessing, evaluating, and communicating information.
3. Technology can foster an increase in the quantity and quality of students' thinking and writing.
4. Graduates must solve complex problems.
5. Technology can nurture artistic expression.
6. Technology creates opportunities for students to do
meaningful work.
7. All students need access to high level and high interest courses.
8. Students must feel comfortable with the tools of the Information Age.
9. Schools must increase their productivity and efficiency.
10. Technology accommodates students and their different learning rates.

This was observed during our project when the students were developing their basic knowledge of turning on the computer, logging in, and learning to use the mouse. We had ample time for students to develop these skills. Furthermore, they were able to create pieces based upon their level of functioning by using different functions of ClarisWorks. While using ClarisWorks, we also saw how students were allowed to express their artistic side. One student who is basically unable to control her hands enough to type, was able to express herself through the drawing mode of ClarisWorks and using the mouse. One of the most important outcomes of the project which is further supported by this article, is that students must feel comfortable with the tools of the Information Age. Because a student is impaired, he or she should not be restricted from learning and being exposed to a tool that he or she will continue to see in their environment. As a result of the Technology mentor project, we have moved into the third stage. We continually ask questions like, "How can these new tools contribute to a more powerful experience?"

Peck and Dorricott conclude their article with further support of technology for all students. "When educators allow students to interact with technologies in meaningful ways for significant periods of time, the growth that follows will encourage educators to try new things" (p. 14). This is probably one of the most significant outcomes of the uses of technology. We have both seen this first hand. We did not have the same amount of training. Therefore, after working together, we both learned how to do new things and how to apply them for all students. Moving through the stages that Naisbitt identified is similar to moving through stages in accepting the idea of inclusion. Teachers must come to the third stage and ask the question whether it be technology or inclusion practices, "How can these new tools contribute to a more powerful educational experience?" When educators move into this third stage, then we will be assured that a quality school climate has been created for all students.
“Empowering students through the use of technology meant that students had a new tool that helped them gain control over their learning.”


This article supported our goals and objectives as we started the technology mentor project. The article was written based upon a study conducted in a New Zealand school. Because the article was published back in 1995, this points to the fact that American schools are behind in their thought of how to make the best potential use of technology to benefit all students. A number of years later, we are only beginning to introduce this concept to our school that all students can benefit from the use of technology. The authors' results were similar to our conclusions. Ryba, Selby, and Nolan (1995) found that there were several ways that computers empower students with special needs. Empowering students through the use of technology meant that students had a new tool that helped them gain control over their learning. The authors found that the computer could first be used as a social development tool, a tool to enhance learning opportunities through multimedia programs, and the computer could be used to celebrate learning achievements.

Computers at one time were thought to isolate students. However, we have seen that technology creates excellent opportunities for students to work together. As a result of working together, interpersonal skills are developed. We have witnessed this through the technology mentor program. We have observed students learning how to interact appropriately with their mentor. We have observed a regular education student who was suspected of having severe ADD/ADHD able to focus upon helping his mentoree and actually develop strategies to help his mentoree complete the task. Working as a mentor for this student helped his focusing skills as well. We have also noticed a willingness from both the mentors and the mentorees to exchange greetings and appropriate social interactions in the hallways and in groups when on field trips outside of school. Technology lends itself to several cooperative learning strategies which enhance appropriate social development.

In the past most technology used with special needs students was restricted to drill and skill practices. Many of these were not even age appropriate. The authors found that teachers themselves were able to create several new and relevant learning opportunities through the use of multimedia programs. According to the authors, one such program combined a digitized picture and message from the student. In addition, students were able to create pictures and statements of things they liked. We have seen the same results through using ClarisWorks drawing, painting, word processing, and slide show features. Our students used ClarisWorks drawing and painting to fill in a map of the Canadian Provinces. This is the
same project which all seventh graders do on our team in the fall. Then students are exposed to word processing features by typing up basic recipes. Working with mentors, the students typed recipes which were used to make soup. The soup was then sold to teachers each Wednesday. All recipes were later put into a booklet using the sideshow feature. This allowed students to view and celebrate their final product.

Ryba, Selby, and Nolan (1995) also discovered that technology allows students to celebrate their learning achievements. The authors listed several great ideas on using technology to celebrate learning:

1. School or class announcement of individual student accomplishments.
2. Student demonstrations of software and hardware.
3. A multimedia club.

We have found that creating a sideshow to be displayed during the Latin American Festival was one of the best ways to celebrate our students’ achievements. All of the Team 2 students were involved in the study of Latin America. One of the projects during the study was to create a postcard from a country they had studied. With the assistance of mentors, students selected pictures from the internet and wrote a pretend postcard. The cards and pictures were all displayed at a booth the students created. Since much of the community attended this event, this was a very public way to celebrate their technological achievements.

As the authors consistently pointed out, there are many ways to empower students with special needs through the use of technology. "Recent advancements in technology means that almost all students can now access and use computers in personally meaningful ways that help them to communicate and learn" (p. 84). The most relevant point that the authors made and that we have witnessed has been that students who have experienced failure in the past just might find that working with computers is fun and that truly enhances the learning process!
METHODOLOGY

During the second year we began to implement and assess the programs developed during the first year. The implementation brought together staff members who had not had an opportunity to work together in the past. Shepherd has had very little prior interest in actively and successfully integrating special education students into the regular education classroom. Therefore, special education and regular education staff have had very little experience working together and very little knowledge of each other’s roles as teachers. We expected to develop some strategies to help staff appropriately include the special needs student in projects involving technology. Ultimately, we hoped to foster communication and understanding among staff and students populations.

Time Line For The Project

Fall/Winter 1996
Technology arrives in classrooms.
Attend technology and included curriculum workshops.

Spring/Summer 1997
Develop the plan and activities for Technology Mentoring Program.
Program will include these units:

- Initial Computer Training/Introduction to the Internet
- Canadian Unit
- Latin America Unit

September 1997
Begin implementation of Technology Mentoring Program.
Select mentor students based on volunteer participants.
Complete initial Computer Training Unit.
Assess success of the unit.

October-November 1997
Design Introduction to the Internet activities and Assessment tools.
December-January  97-98
Design Canadian Unit and assessment tools.

February-March 1998
Design Latin America Unit and assessment tools.

April-May 1998
Review designed units and assessments.

Summer 1998
Complete design units and review assessments.

Fall 1998
Implement Initial Computer Training Unit and Canadian Unit.

Winter 1998-99
Implement Latin American Unit and Introduction to the Internet.
Compile data and report findings.

January 1999
Prepare final Presentation.

February 1999
Conduct workshop for district personnel and teaching assistants.

Terminology Used in the Project

Adaptations: Adaptations refer to any adjustments that are made in order to enhance a person's ability to successfully participate in an activity. The adaptations can be temporary or permanent.

Age Appropriate: Activities, materials, or interactions that are expected for the chronological age of the student.

Collaboration: The interactions between the regular and special educators to enhance learning activities.

Inclusion: Students with disabilities are members of the same school community as peers. When appropriate they are included in the chronological age appropriate grade, class, and activities. Inclusion does not mean all instructional time is spent in general education classrooms.

Mental Impairment: Any student placed in a special education program due to significant cognitive delays.

Mentor: Student who provides guidance, friendship, and a positive social behavior model to chronologically-aged peers.
**Minimal Assistance**: Assistance given only when the student is not capable of completing the task independently.

**Procedures Used For Collecting Information**

**Expected Outcomes**
Strategies will be successful in helping staff appropriately include the students with disabilities in projects involving technology. Communication will facilitate and strengthen understanding among staff and student populations.

**Criteria for the Success of the Project**

The regular education students will participate as technology mentors.

Students will:

- act as a guide to foster independence with technology
- gain knowledge on people with a variety of disabilities
- increase computer knowledge
- communicate appropriately with special education students

Teachers and Teaching Assistants will apply strategies to include students with disabilities.

**Procedures Used For Analyzing Information**

**Pre-Technology Skills Survey**: In the fall of 1998, special education students and technology mentors will be given a short survey to determine current skills.

**Video recording of students in the mentoring program**: Once every four weeks students will be video taped to monitor progress.

**Student journals**: Once every week all students will be asked to write about experiences in the technology mentoring program.

**Electronic Portfolios**: Because all students have an individual file on the school's networked system, they will save a project from one of the three included units:

- Basic computer skills
- Painting and drawing - Canada Map (Appendix #1)
- Word processing - Recipes (Appendix #2)
Basic Internet - Postcard (Appendix #3)

Post-Technology Skills Survey: In January 1999 special education students and technology mentors will be given a short survey to determine newly acquired skills.

Staff Pre/Post Survey: In the fall of 1998, involved teachers and teaching assistants will be given a short survey to assess current attitudes regarding inclusion. In the spring of 1999, involved teachers and teaching assistants will be given the same survey to measure any changes in attitudes.

Performance Levels

We expect that the performance levels will show a significant increase in the areas assessed.

Pre-Technology Skills Survey
Students will respond to five questions regarding current technology skills. (Appendix #4)

Video Recording
During Technology Mentor sessions, students will demonstrate an increase in positive peer interactions. (Appendix #5)

Student Journals
All students will respond in writing about one experience each week during the technology mentoring session.

Electronic Portfolio
All students will select their best included technology project for their electronic portfolio.

Post-Technology Skills Survey
Using the same questions as on the pre-survey, regular education students will be able to demonstrate five new skills.

Staff Pre/Post-Inclusion Survey
Using the same questions from the pre-survey, teachers and teaching assistants will report on the progress of the program's development. (Appendix #6)
“By the completion of the project, most students were able to report their involvement in Internet research, design and presentation of a slide show, as well as use of more sophisticated tools, such as painting and drawing in ClarisWorks.”

**FINDINGS: Data Results**

**Student Basic Skills Pre/Post Survey** (Appendix #4): In the eight areas surveyed, all peer mentors reported an increase of at least 90% from the pre-survey. These results were calculated based upon the comparison of students’ responses to the same questions given both in the pre-survey and the post-survey. No questions were changed. We looked specifically at the responses to question #8, “In what other technology related activities have you participated?” When we compared the pre and post-surveys, we found that there had been an increase in the number of activities. When averaged and compared, the results represented an increase of 90%. For example, most of the peer mentors reported on their pre-surveys that they had been involved in word processing activities only. By the completion of the project, most students were able to report their involvement in Internet research, design and presentation of a slide show, as well as use of more sophisticated tools, such as painting and drawing in ClarisWorks.

**Video Observations** (Appendix #5): On five different occasions for a period of ten minutes at each taping session, portions of the technology mentor program were recorded: These sessions occurred on the first day of the mentor program, one month into the mentor program, two months into the mentor program, three months into the mentor program, four months into the mentor program, and on the final day of the mentor program. Prior to video taping, we established a checklist of behaviors that we hoped students would demonstrate. Our checklist included the following behaviors:

- All students engage in appropriate conversations.
- Regular education students guide special education students using minimal assistance.
- Special education students appropriately accept minimal assistance from Regular education students.
- Regular education students use verbal reinforcements.

As we viewed each taped session, we simply marked either a plus or a minus for each behavior. Following the completion of each taped session, we reviewed the tape and evaluated the observed behaviors. Throughout the technology mentor program, portions of sessions were videotaped.

Of the five behaviors observed, improvements occurred with each evaluation. Initially students were exhibiting assessed behaviors.
with approximately 40% accuracy. Over a three month period of mentoring sessions, these results increased to between 90 and 100% in all areas. The special education students also showed an increase in their basic skills. We found that 80% of the students were able to perform all basic skills which were not present at the time of the pre-survey.

**Technology and Inclusion Staff Survey** *(Appendix #6)*: Several themes were present in the pre/post surveys. Observations made by several staff members included the following:

- an increase in classroom interaction
- a change in the type of activities from skill and drill to engaging activities creating products
- an increase in positive social interactions
- development of pride, leadership and confidence for both regular and special education students
- an increase of special education student involvement on the team

**Student Response Journals**: Initially we had planned students would either orally or in writing reflect upon mentoring experiences. However, due to time constraints it was impossible to accomplish this consistently. Although we have journal entries and oral responses, the inconsistency invalidated the use of this method as an assessment tool.
SUMMARY AND CONCLUSIONS

We were extremely thrilled with the results of our project. Several positive outcomes developed as a result of the Technology Mentoring Program. Because we came to this project with different backgrounds and experiences, we each had individual personal successes. To adequately express our discoveries, we have written individual reflections.

Mary's Comments

When Susan and I first started this project, I have to admit I was apprehensive about how the inclusive setting was going to work. I had little experience with special needs students. On the other hand, I was bothered by the fact that some students were not getting equal exposure to our new technology. I was also bothered that special educators in our district were not receiving adequate training to incorporate the technology with their students. Since I had been working as a technology consultant, I saw this as an opportunity to include Susan in our technology experiences.

After having completed the project, several positive outcomes developed. Students and teachers were both able to develop technology skills further. When I compared the pre- and post-surveys from the students it was evident that there was a 90% improvement in the basic skills area of technology for the mentors. This proves the old adage once again that one truly learns something when they have to teach it to others. Susan and I were able to pilot an entirely new technology project that will be incorporated into the Latin American Theme unit next year. By designing the electronic postcard activity, we were able to experiment with the benefits of using word processing to complete the task. Up to this point, all students on our team designed them by hand. We found that using the word processing helped mentorees express their ideas for everyone to read clearly. Also, mentorees were given the experience of visual travel to the countries about which they had read with Mrs. Bruner by going onto the internet to select a picture. Most importantly, was the growth that occurred within myself and the mentors as we worked with our technology mentorees. After working with Susan, I was able to learn how to adapt the activities to fit the needs of the students. More importantly, as I watched on the videotape, I saw
my body language change throughout the project. At first, like the
student mentors, I was very uncomfortable and did not know what
to expect from the mentorees. At this point I now interact directly
with the students by placing a reassuring hand on their shoulder
and telling them "Good Work." I have even learned what they are
capable of doing. I have found that we have developed
relationships. The most touching moment was during the Latin
American Festival when Tina brought her mother up to me to
introduce us. Now many of the students greet me in the hallway
and have a conversation with me as well. I have seen the
relationship between the mentors and mentorees grow as well
throughout the year. I was most happy to observe Don, a
technology mentor, who has ADD and had several negative
experiences at the beginning of the school year become completely
focused when he worked with Diana. Social relationships have
also developed among the mentors and mentorees. As Amy, a
mentor, wrote in her journal entry, "I danced with John several
times at the Halloween dance. He even says hello to me when he
sees me in the cafeteria." The number of positive outcomes that
have developed as a result of the project have surpassed our initial
goals and expectations.
Susan's Comments

Although Mary and I agree on the highlights of our project, the importance of these accomplishments differ to us individually. I feel that the incorporation of computer skills into the special education program is an immeasurable success. These students can benefit greatly from the use of technology. The peer mentor program has allowed my students access to a computer lab that some teachers deemed “unnecessary for the special education students.” The peers have also solved the great special education debate of “How are we going to reach all of these kids when they need one-on-one assistance?” Through the progress of the program, I know the peer mentors learned many new skills as well.

The development of the projects in which my students became involved was excellent. With two teachers collaborating, the projects became much more innovative. I hope that the results of our project encourage more sharing of ideas and curriculum between regular and special educators. It is very satisfying for my students to see their projects admired by others and also to be a part of a team-wide activity.

Mary felt that the growth between the regular education students and the special education students was the greatest project accomplishment. I agree that the growth in friendships is immeasurable. The benefits for both populations are many. But, I have been lucky enough to see this type of bond between the students through the school's Peer Partner Program. This program allows for similar relationships to be built.

I felt the most important aspect of our program was the successful incorporation of the students into the regular education curriculum. Although my students have had interactions with the regular education peers for the six years the peer partner program has been in existence, other teachers and staff have not seen the results. Many have questioned the special education students’ academic and social abilities. Some have admitted their apprehension and requested not to work with the students. I think the Latin America project helped to break down some of those barriers. Teachers saw my students interacting appropriately with the student population. They were able to see projects they completed independently and with the help of their peer mentors. I feel that some of the hesitation that has been in the school for the past six years I have been teaching is being replaced with an eagerness to see these students involved. This is a goal I have strived for continually and certainly adds to the success of our project.
**Recommendations for the Future**

After concluding the initial phase of the project, we have several changes we would make as we implement the project in the future. First, in establishing mentors and partners, we think a rotating partner schedule would be most effective. We observed some mentors becoming frustrated following long intervals with the same partners. In the case of Diana and Don, Diana required a lot of physical support in order to complete technology tasks. Therefore, Don became uninterested in working with her and eventually requested a new partner. A rotating partner schedule will expand positive peer interactions.

Another concern was the original time allotment chosen for the mentoring sessions. We allowed ourselves only 25 minutes during a weekly homeroom period. These time constraints did not allow for location change, introduction of activity, or adequate time for production. During the project we found more success by arranging an additional 40-minute weekly study period for mentoring. In the future this amount of time will be allocated. This time will occur during Prime Time, a 40-minute study hall. Consequently, mentors will volunteer during this time.

A final issue was the number of projects we targeted for implementation this year. Initially we identified four major technology based projects. Because of schedule changes, time constraints, computer lab problems and lack of technology experience on the part of students and instructors, we had to eliminate some projects initially planned.

**Specific Project Changes to Implement:**

**Basic Technology Skills** (logging in, using the mouse)

- For mouse practice use puzzle function
- Request mouse practice be installed on all computers
- Create checklist of basic skills for mentors to use as a guide

**Canada Map** (drawing and painting in Claris Works)

- Plan at least four to five mentor sessions
- Put map into puzzle function as an introduction and geography lesson
**Recipes** (basic word processing in Claris Works)

- Use of all upper case letters to save time and confusion
- Plan at least four to five mentor sessions

**Postcard** (drawing, word processing, and basic internet usage)

- Review parts of a letter including how to address
- I.D. cards with names and addresses to alleviate any communication concerns
- Pre-writing activities completed in classroom before attempting computer postcard

**Latin American Booths**

- Latin American projects will be integrated (special education and regular education students in the same groups)

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**About the Authors**

**Mary Lindig** has taught seventh grade for the past eleven years. During her career, she has presented workshops at her school, Shepherd Middle School as well as internationally in Guatemala. She completed her Masters from Aurora University in June of 1999. Although technology has become one of her hobbies, Mary also loves to read- any kind of book, camp, travel, swim, snorkel, and play with her new baby daughter who arrived this past July.

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**REFERENCES**


ON LINE RESOURCES FOR INTEGRATING TECHNOLOGY INTO THE CLASSROOM

Best Information on the Net
http://vweb.sau.edu/bestinfo/Disable2/disindex.htm

Equal Access to Software and Information
http://www.rit.edu/~easi/

National Center to Improve Practice in Special Education Through Technology, Media, and Materials
http://www2.edc.org/NCIP/

Special Ed Resources on the Internet
http://www.nhgs.tec.va.us/SpecialEd/sped_resources.html

ADDITIONAL RESOURCES CONSULTED


Resources Recommended by Dr. Robi Kronberg


Cooperative Learning and Strategies for Inclusion: Celebrating Diversity in the Classroom. By Joanne Putnam. Available from Paul Brookes Publishing Co. 1-800-
Cooperative Teacher: Rebuilding the Schoolhouse for All Students. By Jeanne Bauwens and Jack Hourcade. Available from Pro-Ed Publishing Co., 8700 Shoal Creek Boulevard Austin, TX 78757.


Inclusion: 450 Strategies for Success. Available from Peytral Publications, P.O. Box 1162, Minnetonka, MN 55345. (612) 949-8707.


Appendix #1: Canada Map
Appendix #2: Recipe Card

BASIC WORD PROCESSING IN CLARIS WORKS

Soup

Ingredients
4 16oz pkgs frozen Broccoli
5 cups water
1/2 bundle Celery
1 large Onion (Chopped)
5 Tbs. Margarine
5 Tbs. Flour
6 Cups Chicken broth
1 1/2 t. Salt
1 t. Pepper
6oz. Velvet a Cheese
7 Chicken bullion cubes
1/3 box Corn Starch
Seasoning Salt to taste
1 1/2 Cups Whipping Cream

Directions
1. Heat Water to boiling.
2. Add broccoli, Celery and Onion.
3. Cover to boil about 10 min. or until broccoli is tender.
4. Place broccoli in blender.
5. Melt margarine in pan.
7. Cook, Stirring Constantly until smooth and bubbly.
8. Remove from heat.
9. Stir broth into flour mixture.
10. Heat to boiling for 1 minute-continue to stir.
11. Stir in broccoli mixture, Salt and Pepper.
12. Heat to broil.
14. Cook until hot, but not boiling.

return to Technology in an Inclusive Setting (Methodology)

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ISSN 1097—9778
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Appendix #3: Postcard

Dear Mom and Dad,

I am visiting Brazil one of the important thing in foods are coffee, I saw all of the beaches. Thats pretty much it. THANKYOU!!!!!

MOM AND DAD SMITH
123 MAIN STREET
ANYTOWN, USA 12345

return to Technology in an Inclusive Setting (Methodology)
Appendix #4

STUDENT TECHNOLOGY BASIC SKILLS PRE/POST SURVEY

1. Can you log onto the computers in the Shepherd computer lab independently?

2. Do you know how to start the computer from a shut down mode?

3. Do you know how to return your screen to the student list?

4. Do you know how to use a mouse independently?

5. Do you know how to select a new program independently on the computers in the computer lab at Shepherd?

6. Can you create and print a basic ClarisWorks document?

7. Can you do a basic internet search independently?

8. In what other technology related activities have you participated?
Appendix #5

VIDEO OBSERVATION CHECKLIST

<table>
<thead>
<tr>
<th>Present</th>
<th>Not Present</th>
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1. All students engage in appropriate conversations.
2. Reg ed students guide special ed students using minimal assistance.
3. Special ed students appropriately accept minimal assistance from Reg ed students.
4. All students exhibit appropriate body language.
5. Reg ed students use verbal reinforcements.

return to Technology in an Inclusive Setting (Methodology)

return to Technology in an Inclusive Setting (Findings)
Appendix #6

TECHNOLOGY AND INCLUSION STAFF SURVEY

1. Describe present interactions between regular ed and special education students.

2. How has technology been used with special education students in your classroom?

3. What technology skills are useful for special education students?

4. How do you feel about regular education students mentoring special education students in technology?

5. How can special education students be included into units which include technology.

Basic Computer/Internet Skills

Latin America Unit

return to Technology in an Inclusive Setting (Methodology)

return to Technology in an Inclusive Setting (Findings)
A Reprint of
"How do I learn how to do
Action Research?"

Introduction

by Jack Whitehead

Department of Education, University of Bath, Bath, UK

Do you find yourself asking questions such as "How do I do this better?" and "How do I help you improve your learning?"

The invitation to introduce the chapter "How do I learn how to do Action Research?" has provided me with the opportunity to reflect further on my learning about action research since I contributed to the 1992 book on Creating a Good Social Order Through Action Research with Jean McNiff and Moira Laidlaw. It has also highlighted the transformation in the communication of ideas brought about by computer technologies and the Internet.

If you find yourself in your classrooms asking questions such as "How do I do this better?" and "How do I help you to improve your learning?" I think you will recognize the value of the action planning processes described in this chapter. I think you might also feel a growing sense of confidence and security in embracing the experience of "I" as a living contradiction. The idea that "I" as a living contradiction is to be embraced and acknowledged as having great motivating power to change and improve our practice has stood the test of time and practice in our action research community in Bath, England. Another idea that continues to inspire teacher-researchers is that all individuals can create their own living educational theory in the descriptions and explanations they produce for their own learning as they ask, research, and answer questions of the kind "How do I improve my practice?"
"...all individuals can create their own living educational theory in the descriptions and explanations they produce...."

Perhaps the most important qualities to think about and feel in doing your action research are the values that inspire your commitment to your own and your students' learning. Jean McNiff writes passionately about these values in terms of the generative power of action research within our community.

Computers and the Internet have transformed the power of action researchers to communicate with each other in ways which we did not imagine in 1992. You can now view the results of teachers' action research on the web at http://www.actionresearch.net/.

Beginning action researchers might like to start with Moira Laidlaw's guide in the initial teacher education section. If you want to see the results of Master's and Ph.D. programs, you can download these from the Living Theory section. I am thinking particularly of the following:

- How can I create my own living educational theory as I offer you an account of my educational development? (Laidlaw, 1996).
- How do I as a Teacher-Researcher contribute to the development of a living educational theory through an exploration of my values in my professional practice? (Holley, 1997).
- How do I come to know my spirituality, as I create my own living educational theory? (Cunningham, 1999)

For those of you who are interested in the work of Donald Schoen on Reflective Practice and in developing an "epistemology of practice" to enhance professionalism in teaching, I would recommend Kevin Eames's thesis. Some of you may be interested in helping to support school-based teacher-researcher groups or school-university partnerships. The theses of Moyra Evans and Kevin Eames in the Living Theory section specifically address such issues. Finally, some of you may be interested in following the development of ideas on action research and living educational theories in the American Educational Research Association.

The Writings section of the action research homepage contains a set of papers delivered at a symposium at AERA 1999 that explain how teacher-researchers are creating a new discipline of education from their inquiries into their classroom practices with their students.
I do hope that the reprint of our chapter will help to stimulate your own action inquiries. I also hope that it will encourage you to share your own living theories as we learn how to collaborate more effectively across international boundaries in the process of enhancing teacher professionalism.

**Reprint:** "How do I learn how to do Action Research?"

Copies of *Creating a Good Social Order Through Action Research* can be obtained from Jean McNiff. Please send requests to 3 Wills Road, Branksome, Poole, Dorset BH12 1NQ, UK.

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Chapter Three

How do I learn how to do Action Research?

Jean I think this is where this form of thought - our group - has a particularly strong contribution to make. I think the really powerful contribution lies not in the offering of this way of thinking as an orthodoxy. Some people could look at it like that - that we are requiring people to adopt this form of thinking. The power of this form is that it really is emancipatory, because of itself it lets people exercise their power of freedom to question the form, and in that I think it is unique. This is where the idea of the 'good order' of the form lies for me, in that it is not a coercive form.

Jack That is the difference I feel between what we’re doing and what I experience in my dealings with other people in other parts of the country. At that conference I was telling you about, I felt that I was going back into the coercive form. Now, I think that the generative form, because it has got that break in the sense that it cannot rest upon what I, for example, say, is particularly powerful. We might agree that I’ve originated one idea about educational theory being constituted by the descriptions and explanations that you and I produce for our own practice. That is, I think, an original thought, but it is a liberating one in the sense that I can’t impose on others to create a form of practice that is not grounded in their own intentionality.

Jean You see, this is the same problem that Gorbachev had. You enable other people to exercise their own freedom such that they can exercise that freedom against you. This is the old paradox of freedom, of liberating people, and you take on that responsibility when you enter the game.

This chapter is in two parts: first, what advice the literature offers in terms of how to do action research; second, advice on how to use the advice that the literature offers. I want to point out how the literature recommends that action research may be used as a form of critique, and then I want to encourage you to apply your own critique to those recommendations. I am endorsing my own view that action research is an approach that helps people to question. (My argument may be carried through to advise you to critique the fact that I am advising you in the first place. For that, however, we have to enter into personal dialogue, which is not immediately possible in the distance mode that printed documents impose. However, when we meet in person, or communicate directly, we may discuss just the issues I am raising here.)

1. GUIDANCE IN THE LITERATURE

The guidance in the literature on how to do action research does vary, and the specific methodology you choose will depend on which approach you find most appropriate to your way of thinking and your own situation. The literature offers us basically two approaches—the one developed at the University of East Anglia, and the other developed at the University of Bath. Both these efforts have been developed within the field of education.

Both initiatives share the same rationale—to put the practitioner at the centre of the research enterprise—and the same intent—to redefine educational theory whereby the reality of teachers’ practices embody educational theory. My own view is that the two types also incorporate hidden agendas which are reflections of their originators’ view of the power relations between teachers and teacher educators; but this is to anticipate.
It would be useful here briefly to trace the origins of action research as we know it, and to see how it has gained as a credible approach to professional development. This will be a brief review, for I have already covered this ground in detail (McNiff, 1988). I will then go on to show the difference between the approaches, how they may be applied, and point to the sort of practical advice they offer.

**A brief history of the evolution of action research.**

Action research was a term created by, among others, Kurt Lewin (1946), a social psychologist working in America. He offered a basic action plan for the improvement of practice through observation, a reconnaissance of any problems, a proposed solution to the problems, an implementation of the proposed solution, an evaluation to see if the solution was effective, and a subsequent modification of practice. This constituted an action-reflection cycle, which could then be applied repeatedly by the practitioner to move the situation closer towards the desired outcome.

Action research had been going for some time in Britain before it was given the name ‘action research’, in the sense that, during the massive curriculum-change process that was under way in the 1960s and 1970s with a move towards comprehensive education, teachers began to question the ethos of a mainly academic curriculum that was geared towards the success for brighter children in public examinations at the age of 15/16 (Elliot, 1991). This led to substantial school-based reform. The curriculum reform movement generated new conceptions of teaching and learning, and evaluation began to become an exercise of discussing and justifying personal practice with colleagues, rather than looking to the judgement of an external observer.

In the 1970s, the movement was given focus and direction by the establishment of the Humanities Curriculum Project under the direction of Lawrence Stenhouse of the University of East Anglia. This project stressed the need for the practical wisdom of teachers to be at the heart of pedagogic practices; and gave prominence to the concept of ‘teacher as researcher’ (Stenhouse, 1975), a concept which has since been a central tenet in the action research enterprise.

Stenhouse gathered round him a band of academics who have since gone their separate ways, but who all shared a common sense of purpose in promoting the idea of professional development being grounded in practical learning (Rudduck, 1991). Some of these people articulated and formalised the principles of action research (as it came to us from Lewin) as a system that could reflect, in a theoretical form, the practical actions of teachers as they tackled problematic issues.

At the same time, Jack Whitehead at the University of Bath was working with groups of teachers in Local Education Authorities, supporting them as they tried to find the right questions that would help them to make sense of their problematic practice, questions of the kind, ‘How do I improve this process of education here?’
The benefit that this movement has brought to teachers is that, in principle, they are empowered to be in control of their own practice, and freed from the theory-driven model that imposes ideal standards towards which they must aim. Both schools of thought have translated this fundamental value into practicalities, in the sense that there are published schemes available to help teachers work through their practice with a view to improving it. The form of these action planners, however, is quite different, and I think this is a very important point. I think the way in which the planners are devised reflect the intentions of their authors, and that this is symptomatic of the wider issue of what counts as valid knowledge.

Let me take a brief look at the types of action plan available in the literature and the accompanying advice. One type of action plan offers clear guidance in the form of action steps: the sort of behaviour to adopt. The other type offers clear guidance in the form of questions to ask: the sort of attitude to adopt. All published forms of action planner follow the basic action-reflection sequence of ‘observe—reflect—plan—act—evaluation—modify’, this sequence to be repeated as the need of the individual practitioner impels.

**Structured approaches**

The best known plans of this kind are found in Kemmis and McTaggart (1982), ‘The Action Research Planner’, and Elliott (1981, 1991), which offer a step-by-step guide. They offer procedural guidelines for teachers and administrators interested in improvement and change in their schools. They provide a way of thinking systematically about what happens in schools or classrooms, implementing action where improvements are thought to be possible, and monitoring and evaluating the effects of the action with a view to continuing the improvement.

I have presented and critiqued the plans elsewhere (McNiff, 1988) on the grounds that this behavioural orientation is not intrinsically educational and does not necessarily lead to enhanced understanding. As a teacher-educator, I do not think I help my colleagues to develop their practical wisdom by telling them what to do, requiring that they model my pedagogical behaviour, or offering answers, drawn from my own experience, which I require them to apply to theirs (though I am happy to share the insights I have drawn from my own research). Rather, I encourage them to think with their own minds about their own situation, and to speak with their own voices about how they can improve it. I cushion them against the risk involved when their critical thinking makes them see things in a new, uncomfortable light, the sense of alienation when old assumptions are critiqued and rejected (Brookfield, 1987); but I do not cushion them against their experience of their own experience.

In order to work this way, I choose a strategy of asking opportunistic questions, supposing that the answers to the questions will be embodied in the transformations that practice undergoes. My procedure of questioning itself involves arranging for my clients to ask their own questions.

**Dialectical approaches**

(a) The work of Jack Whitehead

The second kind of action plan available incorporates this kind of questioning mentality. Jack Whitehead has developed a question-oriented approach that is now widely used in programmes of professional development.
He begins with his own action plan:

1. I identify a problem when some of my educational values are denied in my practice;
2. I imagine a solution to the problem;
3. I act in the direction of the solution;
4. I evaluate the solution;
5. I modify my ideas and my practice in the light of the evaluation.

(Whitehead, 1985, 1989a & b)

This action plan does not aim to offer substantive answers, but indicates a pathway along which certain gates may be opened to allow access to many new scenarios. The plan has been tried, tested and adapted by many practitioners (for example, Eames, 1990; Larter, 1989). It has also been incorporated into aspects of award-bearing courses of the University of Bath, in terms of a set of questions that can act as the basis for an individual’s action enquiry:

1. What is your concern?
2. Why are you concerned?
3. What do you think you could do about it?
4. What kind of ‘evidence’ could you collect to help you make some judgement about what is happening?
5. How would you collect such ‘evidence’?
6. How would you check that your judgement about what has happened is reasonably fair and accurate?

The plan, and variations of it, is being used extensively in programmes of teacher education (for example, Avon LEA, 1990). As noted above, most work here has been done in mainstream education, and Whitehead has focused his enquiry on the educational nature of educational enquiry. The implication here is that the form of the plan itself is highly generalisable to the all-embracing concept of professional development (see also Chapter 4). We need to start with the notion, as Whitehead does, of what constitutes the ‘good order’ of a particular community of professionals; how they see the constitution, acquisition and use of the ‘good order’ as embodying the evolution of their society; and, through their personal and professional knowledge, how they attempt to make explicit for themselves the values that they hold implicitly within the notion of the ‘good order’.

Because this book is part of the project to disseminate the ideas that have been developed at the University of Bath, it is worthwhile giving here a brief outline of the main features of Jack Whitehead’s thought (for a fuller exposition, see McNiff, 1992, Chapter 3).

Whitehead places the individual enquirer at the centre of human enquiry. We need to acknowledge the living ‘I’ as the epistemic centre, he maintains, otherwise educational researchers are in danger of producing propositional theories which do not directly relate to educational practice. We need to acknowledge the force of the individual consciousness in interpersonal relationships in order to understand the nature of our commitments, and to work towards establishing the good order of a rational society.

I must also acknowledge myself as a living contradiction, says Whitehead. When I say that I believe in something, and then I do the opposite, I exist as a living contradiction. When I say I should not steal, and then I do, I am not living up to my own beliefs. I think we would all recognise this experience.

As an educator, I hold a number of educational values. Within my practical, everyday workplace situation, the potential which is embodied in those values is often denied. Educational enquiry, for Whitehead, is a way in which this negation may be overcome, with the
practical intent of enabling me to live out my educational values in my practice and realise my full potential.

It is worth noting here that the idea of realising and living out my educational values in my practice does not mean the imposition of my values on you. It means that each one of us recognises the quintessential integrity of our living ‘I’s’, and, through airing and sharing our values, we make explicit a sense of vision that we may come to the position where we may develop a common sense of purpose and strategic Action (Habermas, 1981) to improve the quality of education for ourselves and for the people in our care. In this sense, action research works towards the best interest of the other, and its methodology is dialogue (see Chapter 4).

(b) The work of Jean McNiff

My own work is interlinked with that of Jack Whitehead, and equally focuses on the need for educators to enable practitioners to develop as critical thinkers. I am particularly interested in trying to characterise the nature of the cognitive forms that enable us to build theories about how understanding is facilitated. I have called this enterprise:

The generative order of educational knowledge

Imagine that you are a magician of infinite power. Imagine that, at a word, you could put into effect a process whereby every thing in the world started changing of its own accord into a different kind of thing, that was recognisably the same original thing, but that became more mature with each step in the process of change. Seeds started turning into plants, raindrops formed oceans, students became professors, one-man bands metamorphosed into orchestras.

The power that you have unleashed is called generative power (see also Chapter 6). The processes that it begins are called transformational processes. Imagine that each thing in the world contains its own blueprint of what it could be—a sunflower seed turns into a sunflower, left to its own devices—but no thing will actually fulfil its own potential unless the generative power is available. The transformational processes at work in the world are grounded in the power of generativity. The number systems of the world are really meaningless unless I start using them to calculate, and I can perform an infinite number of calculations. The rules of language are meaningless unless I use them to create new language.

Now imagine that you want to teach other magicians how to use their power of generative creativity. Your own generative power has to work actively within you, otherwise you deny your own potential as a magician of infinite power. You show them the secret of setting the power in motion, and, by inevitable implication, they return the compliment, showing you the secret of their power. This is truly a magic circle whereby the power within you itself transforms your own community into a better, more fully-realised version of itself.

Now, transfer the analogy to the real you, in relationship with others. Consider how your individual life is transformed into a better version of itself, provided you are part of a community, each of whom acts in the other’s best interest. This sort of community may be encouraged by each of you because you want to improve your own community, and spread the word into the wider world to show that it can be done and that you have done it by working together. You know how you have done it by working together, and you share the knowledge.

These are the elements within my own project. I take the idea of generative power as the basic unity of energy whereby each thing may transform itself endlessly in the process of its own realisation of potential. In terms of the educational enterprise, I see the development of educational knowledge as being the process of an individual’s ever-
expanding consciousness, which is encouraged by the parallel processes of other expanding consciousnesses with which I am in conversation. The development of our individual and collective understanding helps us to promote the evolution of our own society, each acting in the other’s best interest. The generative power at work in me has the potential to transform the world, but only through the will of others who are equally aware of their own potential.

2. ACTION RESEARCH AS CRITIQUE

The idea of critique has been articulated intermittently throughout this text. I want to focus now on critique as a living element in a living theory—that is, to help you, the living reader, to develop your own power of rational thought so as to see other people’s theories (and that includes this book, as it constitutes my present best thinking) for what they are: the product of thought that thinkers are offering as a resource to help colleagues develop their thought.

The idea of critique

Take the well-known example of Orwell’s ‘Animal Farm’. Mr. Jones ran Manor Farm in a brutal manner and oppressed the animals severely. Finally, the animals overthrew Jones, and set up their own government, maintained by the pigs, who then set out to strengthen their image of the ruling intellectual class. Over time, the pigs transformed the embryonic democracy that had been the spur to the revolution into a dictatorship where they oppressed the other animals severely.

This is the same process that could possibly happen in an ideology critique (the activity of questioning an ideological system that is already well established). A set of ideas (SI), incorporating a view of the human condition, is judged to be the ‘right’ way. Certain radicals disagree, and discredit and reject the set of ideas (SI), and propose instead an alternative set of ideas (ASI). (ASI) becomes accepted as the norm, and, over time, its transitional character as a possible temporary alternative transforms into that of a fixed permanent way. The alternative that was offered with a sense of diffidence and caution is now reified (fixed), and abstracted from the consciousness of the radicals who created it, to exist as an impersonal system that assumes control over the society of which the radicals are a part.

Imagine now that a second group of activists propose yet another set of alternative ideas (ASAI), and instigate a revolution to discredit (ASI), and instal (ASAI) in its place. How do they check that (ASAI) will not go the same way to reification as (SI) and (ASI)? Where is the fail-safe mechanism that stops the process plunging into degeneration?

There are a number of ways of dealing with the problem, mainly:

1. The empiric-objectivist way, where a society agrees on norms and standards which are then used to test the truth claims within a given set of assumptions. This is the way of, for example, the logical positivists who held that truth conditions rest in verification: I can say something is true if I demonstrate through factual evidence the verification of its internal truth.

2. The relativist way, where a society agrees that its constituent members are entitled to establish their own truth relative to their particular circumstances and contexts. This truth is then put to the test of a factual analysis of the contexts which the claim to truth allegedly reflects.

3. The dialogical-dialectical way, where a society agrees the right of each of its constituent members to make his or her own truth claim. Members justify their claim by demonstrating their ‘version of truth’ through the way that they live—that is, they attempt actively to live out their values. They offer their way of life, as an embodiment of their truth claim, to be validated by the community of
which they are a part. This validation is through the process of dialogue.

The objectivist and the relativist ways are susceptible to reification. The dialogical way resists reification, because its substantive categories of concern (what people agree—the truth claims of its members) are in a process of constant transformation; and its forms of cognition (how people agree—the agreed process for reaching agreement) is also inherently transformational. To expand: freedom of thought by definition must be free, in the content of the thought produced, in the forms of thinking employed, and in the right of the individual thinker to exercise his or her own freedom of thought. Dialogical communities must by definition be grounded in dialogue—that is, the process of reaching intersubjective agreement through rational argument with the practical intent of human betterment.

The idea of critique rests here. It does not rest in the imposition of one form on another, or in the rejection of one form in favour of another. Then the process of critique itself becomes a reified structure. The idea of critique rests in the openness of individuals who nurture the quality of openness throughout their society, and their agreement not to violate the integrity of the other through selfish moves towards closure.

These ideas enter into the consistent theme that, in order to enlarge upon our own ability to decide how best to develop our own professionalism, we need to develop our critical faculties, and to turn that faculty back on itself in order to understand our own practical intent in deciding to use this critical form. We need not only to construct our theories of professional development, but also then systematically to deconstruct them, with a view to reconstructing our actions as a reflection of the values that have underpinned the process of critical reflection, through critical dialogue.

In conclusion, let me say that action research is a way of using personal understanding to look at personal understanding. It is a way to question norms and taken-for-granted, but, in order to use it in this way, we have to turn action research back on itself and use it to justify our very use of it. We have to hold up to the mirror our decision to use action research, and use one reflected decision to justify the other.

In effect, for a research programme to be called educational, in the sense that I, the practitioner, may develop my own story as I go along, I need to develop insights into the process of developing insights, to be aware of my own process of awareness. I need to use my action enquiry to explore the process of action enquiry.

This, in my opinion, is the ultimate power of action research. As noted above, to try to reduce the idea of action research and present it as a method is to deny its very epistemological base, the pushing back of the frontiers of knowledge. It is not that action research offers a critique; it is that the idea of action research offers a critique. For it is in following through my sense of vision that I am able to develop that I actually do develop. Grasping the idea of action research helps me to appreciate that all doors are potentially open, and that I have the key that will open them.
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