

MERIDIAN

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SCOPE:

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

MANUSCRIPTS:

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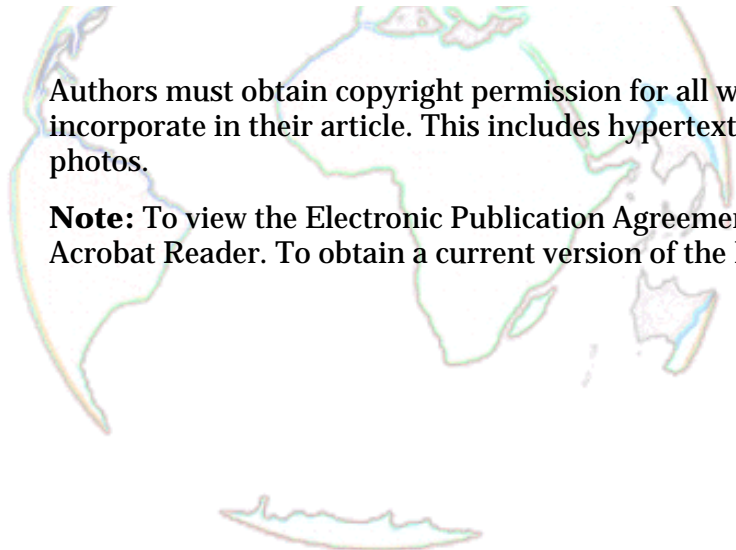
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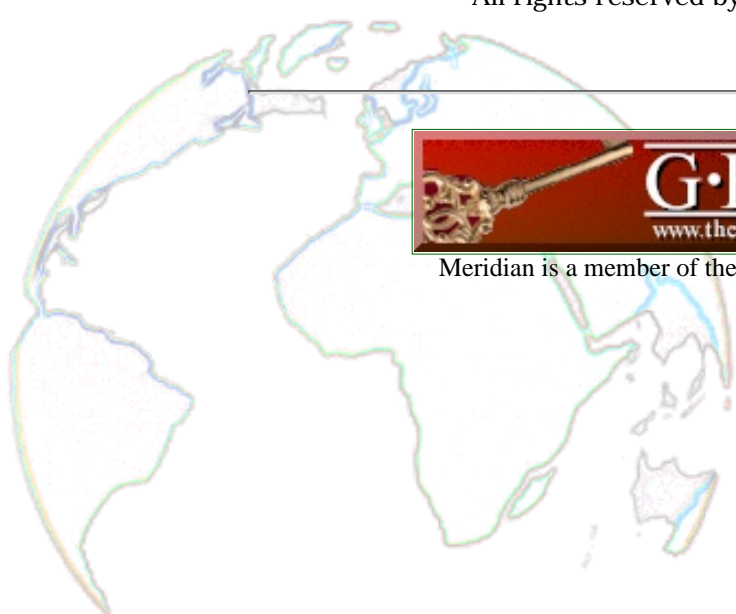
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Meridian is an electronic journal dedicated to research and practice of computer technology in middle school classrooms. It is published twice yearly by an interdisciplinary team of NC State graduate students representing a broad range of fields, from education to forestry. Located at

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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.

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"The underlying goal of this project is to grow beyond using the Internet merely to disseminate knowledge. Rather, we hope to use this as a forum to engage in the process of creating knowledge."

Editor's Note: Introduction to The Living Article

[Linda C. Greene](#)
[North Carolina State University](#)

A Living Article, as we hope to implement it, begins with the presentation of a strong and possibly controversial article related to the field of technology and adolescent education. The readers of the article are then asked to respond to what they have read in the manner of an open forum, using the resources of the Internet to collaborate with other readers. Our concept of a Living Article has evolved over the course of several years and through discussions with a rotating group of Meridian's Review Board members. The underlying goal of this project is to grow beyond using the Internet merely to disseminate knowledge. Rather, we hope to use this as a forum to engage in the process of creating knowledge. We want to expand the possibilities of academic collaboration to include the entire audience of Meridian. In so doing, we hope to create a new forum for academic discourse.

This Living Article is an experiment. As with any experiment, there are sure to be some glitches as we go along. There are bound to be some unforeseen problems. As we discover these problems, some of the information surrounding the Living Article may change. If you discover any such problems, we hope that you will make us aware of your discoveries and offer some potential solutions. Our hope is that this collaboration will inform not only the content of the article but the process of creating it as well.

The co-authors of this article are doctoral students in Counselor Education at NC State University who are also members of Meridian's Review Board. Since this project has been up for discussion for some time among the Meridian Board, we were unable to put this article through the same blind review process that is our usual policy for all Meridian articles. However, we have solicited feedback from our board members and faculty advisors prior to publication and we plan to document the process that we implement throughout the life of this project. We hope to make this documentation available to Meridian readers in a future issue.

Editor's Note:

The content of our first Living Article focuses on the use of technology as a tool for promoting healthy adolescent development. We have used examples of school violence (particularly the incident at Columbine High School) to highlight the need for promoting healthy development among students. We have then used the literature on adolescent development to outline the age-appropriate developmental tasks for middle school students. The major question posed by this article is "How can we use technology as a tool to promote the successful resolution of these adolescent developmental tasks?"

In answer to this question, we hope to receive responses in the form of anecdotal evidence, relevant research in this area, and commentary on the topic from various points of view. As we begin to compile these responses, they initially will be reviewed (to ensure that they are indeed responses to the article) and then posted intact in a manner similar to bulletin board type postings. They will later be edited into the article and cited using links to the entire response. In this way, the article will evolve. We plan to maintain all versions of the article in an archive (linked from the most current version of the article) so that the process itself can be examined.

We hope that you will find the information presented both useful and thought provoking. We also hope that you will share the thoughts that the article has provoked with us. We look forward to the collaboration.



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"With the current emphasis on accountability and measuring the success of our educational system in terms of scores on end-of-grade tests, how are we to account for the emotional and social well-being of the children entrusted to us?"

Using Technology as a Tool for Promoting Healthy Development in Middle School Students

Linda C. Greene and Charles F. Blackburn
North Carolina State University

NOTE: Be sure to read the [Introduction to the Living Article](#) before you continue.

"You say you want to bring about some kind of change in the schools. Start by putting a sign over the entrance of every school building that reads: "School May Be Harmful to Your Emotional and Social Well-Being. Enter at Your Own Risk. This School Does Not Assume Responsibility for Your Sense of Belonging or Your Sense of Place." (Quint, 1994, p. 10)

This commentary on our educational system by a young man who had dropped out of school was made in response to questions from a researcher investigating the needs of homeless students. His scathing assessment of the ways that schools routinely fail to meet the needs of students is disturbing. It is uncomfortable for those of us in education to hear such an indictment of our work. Unfortunately, if we are honest, we must recognize that there is some truth in this statement. Many of our schools have indeed become toxic environments for the souls of the students whom they purport to serve. With the current emphasis on accountability and measuring the success of our educational system in terms of scores on end-of-grade tests, how are we to account for the emotional and social well-being of the children entrusted to us?

There is no easy way to do this and there is certainly no way to quantify our success at developing emotionally stable, well-adjusted children. Unfortunately, too often it seems that the only time the public becomes aware that schools should be concerned with the emotional well-being of children is when something goes terribly wrong. Events such as the ones in Littleton, Colorado, Jonesboro, Arkansas, or Pearl, Mississippi, spark sudden public outrage that schools are not meeting the emotional needs of students. Simply hearing the names of these towns summons frightening images of teenagers gone wrong—teenagers who committed the most extreme forms of violence against their teachers and classmates in public schools. What went wrong? Why didn't anyone at the school do something to stop these boys before they killed? Why didn't someone at the school notice that something was wrong? Why did the teachers, counselors, and administrators fail to help these boys? How could they have let this happen? In the wake of tragedy, the public demands answers.

"Rather than focusing on what we don't want students to do, a more useful approach might be to focus on what we do want students to do."

Although more than a year has passed since the tragedy at Columbine High School, no simple answers to the questions surrounding that event have emerged. While it is easy to second guess the actions (or lack of action) of the school personnel in Littleton, none of us knows for sure how we would have behaved had we been in their shoes. Obviously, there were many small failures that paved the way for the tragedy that occurred the day that these boys finally exploded. We can speculate about the various points in these boys' lives that an intervention on the part of school personnel might have taken them off of the path that led to their deaths and the deaths of their classmates.

As a result of these incidents and the fear that they have inspired, numerous explanations and potential solutions have been offered. Proposed solutions have ranged from so-called "zero-tolerance" policies to posting the Ten Commandments in every public school classroom. Others, particularly as a result of the Columbine incident, have argued for banning video games or imposing other limits on students' access to technology. The fact that the students who committed the violence at Columbine were heavily involved in technology (playing video games, using the Internet, and making home videos) has been used by some as evidence that there is inherent danger when teenagers become interested in technology. Following this line of reasoning, the solution must lie in limiting or banning students' access to technology.

While these actions may in some cases ameliorate the symptoms, the root of these problems will likely remain intact. These solutions ignore the internal realities of the students who commit the violent acts that demand our attention. They also ignore the internal realities of the students whose actions may be just as troubling but do not demand our attention. Are there students in our schools who are just as troubled as the young men who killed their classmates and teachers but who direct their violence toward themselves rather than toward others? What about the students who are victimized every day by words rather than bullets? What are we doing to protect them? Are their wounds of less concern simply because they are less visible?

As we begin to explore these questions and attempt to generate possible solutions in answer to these concerns, perhaps a shift in focus would be helpful. Rather than focusing on what we don't want students to do, a more useful approach might be to focus on what we do want students to do. In other words, how do we expect students to behave? How do we expect them to think about things? How do we expect them to go about making decisions and setting priorities? If we are to begin to answer these questions, we need an understanding of adolescent development and the age-appropriate developmental tasks during the middle school years. The field of development includes a number of specializations. We have provided a very brief synopsis of some developmental theories, focusing primarily on the developmental tasks involved in enhancing problem-solving abilities, self-reflection, and the capacity to take another's point of view. We hope that this brief introduction to developmental theory will stimulate further thought and discussion.

Technology as a Tool

"Cognitive developmental theory proposes that changes in the quality of thought, understanding, and relating are fundamentally important in the growth and maturation of young adolescents."

Developing Opportunities for Increased Problem-Solving, Self-Reflection, and Role-Taking

As middle school students mature into adulthood, there are many drastic changes. While these budding adolescents change physically, there are also dramatic transformations in the ways they understand and relate to the world. These transformations of the cognitive processes are both quantitative and qualitative. Just as adolescents grow in stature, other quantitative changes become evident. For example, there is a vast expansion of vocabulary, knowledge of facts, and capacity to address more class material in a shorter amount of time. However, there are also qualitative changes in the ways these students construct and relate with the world around them. Many adolescents begin to demonstrate more complexity in problem-solving, role-taking, and self-reflection. Cognitive developmental theory proposes that changes in the quality of thought, understanding, and relating are fundamentally important in the growth and maturation of young adolescents.

This qualitative shift in understanding and relating to the world is reflected in the work of Piaget. In his stage theory of cognitive development, young adolescents begin to emerge from concrete operations and progress towards formal operations (Inhelder & Piaget, 1958). While many 10 year olds, using concrete operations, attempt to organize and understand the world around them through facts and descriptions, the more sophisticated adolescents begin to think abstractly and hypothetically. This qualitative change in the cognitive process to formal operations allows the adolescents to consider multiple strategies and probabilities, as well as enables them to practice a more complex form of role-taking and self-reflection.

Selman and Schultz (1990), described a qualitative transformation in the way that children and young adolescents progress towards greater awareness of the perspectives of others. While younger children, through play and interaction, exhibit difficulty differentiating between their individual perspectives and those of their peers, developing adolescents begin to conceptualize the interpersonal relationship with more complexity and elaboration. Not only do the older children and adolescents begin to understand the perspectives of others, but they are required to reflect on their own perspectives and compare these to the views, thoughts, and feelings of those around them. Such a qualitative shift in meaning-making provides an opportunity for greater richness and perspective in interpersonal relationships.

"Such a qualitative shift in meaning-making provides an opportunity for greater richness and perspective in interpersonal relationships."

It has been theorized that the complexity of problem-solving and the depth of role-taking and reflection also have implications for moral decision-making. This has been a topic of considerable debate regarding theories of moral development. Kohlberg's cognitive developmental theory of moral development is one of the most widely researched and accepted theories in this domain. Based on his longitudinal research with preadolescent boys in the late 1950s and early 1960s, he theorized that individuals progress through six qualitatively distinct stages of moral reasoning in invariant sequence. As individuals increase in cognitive complexity and progress in moral judgment, there is a gradual movement from reasoning which focuses on authority-based concerns and self-interest to a more principled and moral level of reasoning which considers the rights and perspectives of others.

Inherent in the process of moral development is the notion that individuals begin to utilize and develop role-taking. Gielen (1991) explains, "Role-taking is fundamental to symbolic communication, social perspective-taking, and moral development since higher stages of moral development are based on more complex levels of role-taking" (p. 23). In review of the Kohlberg's (1981) stages of moral development, qualitative shifts in role-taking are reflected in the progression to higher stages. For example, in the first two stages of Kohlberg's model, the preconventional level of moral reasoning, individuals focus on avoidance of punishment and self-interest. Moving to more conventional levels of moral reasoning, the third and fourth stages, individuals shed an egocentric approach and place greater emphasis on what is right for the group. Here, more role-taking is incorporated as needs and order of the larger group are taken into consideration.

"Through carefully-structured activities and curriculum design, cognitive developmental tasks such as role-taking, complex problem-solving, and self-reflection can serve as important goals in the education of middle school students."

The consensus of research conducted on adolescent moral development indicates that most individuals begin to make the transition from preconventional to conventional levels of moral reasoning during early adolescence. It is during this time that young adolescents begin to utilize formal operations and demonstrate a greater capacity to take the perspectives of others. However, Kohlberg (1984) asserted that "at-risk" and delinquent youth have not necessarily progressed towards conventional levels of moral judgment. Research in the last two decades has supported this claim (Gregg, Gibbs, & Basinger, 1994; Arbuthnot & Gordon, 1988). These studies have reflected that the majority of juvenile delinquents function at a preconventional level of moral reasoning, primarily at the second stage.

Given that some individuals demonstrate lower levels of development, there has been considerable interest in the design and implementation of programs that stimulate and support moral development. One of the most popular means of sparking such development has been the use of moral discussion groups (Blatt & Kohlberg, 1975). Through the discussion of moral dilemmas, group members are challenged to consider the perspectives of others and consider new ways of thinking about the problem. As a result, they may experience a shift in the way

they make meaning of the dilemma. There are numerous studies that support this intervention as a means to foster moral development. (Rest & Thoma, 1986) Given that adolescents are exposed and challenged in qualitatively new ways, this may have particular relevance for incorporating of dilemmas in the classroom.

Teachers, parents, and school administrators play an important role in supporting the development of children and adolescents. Through carefully-structured activities and curriculum design, cognitive developmental tasks such as role-taking, complex problem-solving, and self-reflection can serve as important goals in the education of middle school students. Kohlberg and Mayer (1972) argue that the main goal of education is to support this increased cognitive development. Through stimulation and support of developmental tasks, students are given an opportunity to test new ways of knowing. Instead of focusing solely on norms and facts in the curriculum, an emphasis on how the young person constructs the world and relationships may serve as the foundation for educational objectives.

Technology-Based Interventions

A literature search focused on finding interventions that use technology as a tool for promoting adolescent development yielded only one program. SMART Talk (Bosworth, Espelage, & DuBay, 1998) uses a multimedia computer program consisting of six modules that incorporate games, simulations, and other forms of interactive technology. This program proposes to address the problem of school violence with modules focusing on anger management, conflict resolution, and perspective taking. While results from this pilot study appear promising, additional exploration of this area is needed.

What Next?

Now that we have a basic understanding of a few of the developmental tasks associated with adolescence, how do we use this knowledge to make our schools places that promote a healthy sense of emotional well-being among students? The SMART Talk program (Bosworth, et al., 1998) offers but one example of the innumerable possibilities for ways that educators might use technology to promote health adolescent development. Programs such as this one exploit adolescents' natural interest in technology in order to provide opportunities for engaging in activities that will promote the positive resolution of the developmental tasks associated with adolescence. What other types of programs might incorporate available technology to create experiences that will promote healthy growth and development for middle school students?

As you think about these questions (and others that may have been provoked by this writing), we encourage you to explore the links that have been provided in the sidebar. These links are offered as sources of additional information and possible alternative perspectives on some of the topics mentioned.

How to Respond to this Living Article

We encourage responses to any and all elements of this article. Our goal is to create a living document that will reflect numerous points of view that are based on personal opinion, experience, and anecdotal evidence, as well as rigorous educational research. Obviously, we are hoping to generate some answers to the questions that we have posed. However, that does not preclude the possibility that this article may generate additional questions. The exciting thing about this living document is that we really don't know where this will lead. That is up to you. We are anxiously waiting for your responses.

Responses may be sent in the body of an email message or as an attachment and should include your name and professional affiliation (work setting, title, etc.) as well as complete reference information for any material that you may cite in your response. Be sure to include any relevant Internet links so that we can include those as additional sources of information for our readers. If sending an attachment, please describe the type and version of software used to create the attachment and include contact information so that we may get in touch with you if there are any problems in reading the attachment. Send all responses to [Linda Greene](#) with the words "Living Article" in the subject line of the message.

[Piaget's Stage Theory of Development](http://web.psych.ualberta.ca/~mike/Pearl_Street/Dictionary/contents/P/piaget's_stages.html)

(http://web.psych.ualberta.ca/~mike/Pearl_Street/Dictionary/contents/P/piaget's_stages.html)

[Tutorial on Kohlberg's Theory of Moral Development](http://snycorva.cortland.edu/~ANDERSMD/KOHL/content.HTML)

(<http://snycorva.cortland.edu/~ANDERSMD/KOHL/content.HTML>)

[Kohlberg's Stages of Moral Development](http://www.awa.com/w2/erotic_computing/kohlberg.stages.html)

(http://www.awa.com/w2/erotic_computing/kohlberg.stages.html)

About the Authors

Linda C. Greene, currently serving as Co-Editor for **Meridian**, is a third-year doctoral student in the Department of Educational Research and Leadership and Counselor Education at North Carolina State University. She received her Masters Degree in Counselor Education with a concentration in school counseling from NC State following undergraduate work in Psychology at the University of North Carolina at Chapel Hill. She has worked as a school counselor at the middle school and elementary school levels. Her research interests include career development, spirituality, and expressive arts therapy. Her goal is to pursue a career in academics that will include research and writing in the area of curriculum development and school counseling.

Charlie Blackburn, a member of **Meridian's** Editorial Board, is a second-year doctoral student in Counselor Education at North Carolina State University. His research interests include developmental issues in counseling and intervention. A native of middle Tennessee, he graduated from high school in Lebanon, TN and then pursued his undergraduate degree at the University of North Carolina at Chapel Hill. He then returned to Tennessee to complete a Master's degree in Human Development Counseling at Vanderbilt University. Charlie has worked in a variety of settings to include psychiatric hospitals and wilderness programs. Most recently, he worked as a therapist with a focus on victim and perpetrator issues.

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". . . at a time when high-tech job opportunities are expanding, the literature indicates that many women are still socialized away from technology careers."

The Socialization of Females With Regard To A Technology-Related Career: Recommendations for Change

Lola B. Smith, Ph.D.

Fredericksburg, Virginia

Overview

Within the past few decades, after a hard fought agenda for women's rights, females have begun to make strides toward greater economic equity. Meanwhile, technology has become an increasingly important part of the modern economy, moving indispensably into the realms of science, business, and government, as well as the home itself. This greater use of technology implies that if women are going to continue moving toward increased economic strength, they will have to incorporate the use of technological skills as part of their power base (Brzowsky, 1998; Pazy, 1994; Spender, 1995; U.S. Bureau of Labor Statistics, 1997).

Yet, at a time when high-tech job opportunities are expanding, the literature indicates that many women are still socialized away from technology careers (Goodnow, 1998; Maney, 1996; NCES, 1992; Sadker & Sadker, 1994; Urschel, 1996). Many females do not see the computer culture as people-friendly, let alone female-friendly, and thus cannot see themselves flourishing in such an environment (Sanders, Koch & Urso, 1997). Only 16 percent of scientists, six percent of engineers and four percent of computer scientists in the United States are women (Poole, 1998). Furthermore, females hold less than 15 percent of professional jobs that require a college degree in mathematics, science, and/or technology (Goff, 1997; Hutchinson & Kung, 1994; McLean, 1996; U.S. Bureau of Labor Statistics, 1995).

On the other hand, it should be noted that since this study was originally conceived late in 1997, tremendous changes have occurred within the technology field. Many of these changes, such as an increase in the number of video games that include girls' play preferences, and the growing use of the Internet by many girls and women, have already begun to make mathematical, scientific, and technological (MST) climates more female friendly. Such changes promise continued progress for women in MST fields. However, since the number of women in high-tech fields continues to be relatively few, it is my contention, as well as that of many academic researchers and the popular press, that much work remains (Brzowsky, 1998; Davis, 1999; Goodnow, 1998; Lewin, 1998; Poole, 1998).

Therefore, the purpose of this research was to investigate experiences of women who have taken technological career paths, and who have also excelled in these fields, so as to identify factors that might have contributed to their excellence. It is hoped that a study of these women's lives will better inform practicing and preservice educators so that future generations of females might see all careers as open to them (Binns & Branch, 1995; Gay, 1995; Goodnow, 1998). It is hoped that such data may provide insight into teaching and learning methods that will help maintain and/or foster girls and women's interest in MST courses.

Methodology

The problem of gender-based differences in technology-related fields is a multidimensional problem with no one event operating in isolation. Such a complex issue called for process-oriented research which consisted of a qualitative, contextual, and developmental case study design (Merriam, 1988). Given the goals and purposes of this study, the overarching question that guided the research focused on asking, "What external and/or internal factors influenced, supported, and/or encouraged these women to become competent at a very high level in nontraditional, technologically related professions?" Sub-questions, which helped frame the semi-structured face-to-face Interview Protocol, were created to explore the participants' experiences within various spheres of their individual lives, such as academic, personal, and educational environments. The goal was to encourage participants' stories to emerge in natural descriptive narratives as they spoke of family life, experiences growing up, earliest recollections of MST encounters, and current concerns and interests in their MST professional environments. This case study approach allowed the researcher (myself, hereafter referred to in the first person) greater insight into the rich collection of abilities, attitudes, perceptions, and relationships these excelling women had/have with technology, and facilitated a holistic view of gender socialization factors that encourage and/or discourage women from participating in technological professions. The choice of a career path as the unit of analysis allowed for cross case study of women within various technology-related professions, at various stages within these careers (Huberman, 1993).

"The goal was to encourage participants' stories to emerge in natural descriptive narratives as they spoke of family life, experiences growing up, earliest recollections of MST encounters, and current concerns and interests in their MST professional environments."

Purposeful sampling was used. "Purposeful sampling is based on the assumption that one wants to discover, understand, and gain insight; therefore one needs to select a sample from which one can learn the most" (Merriam, 1988, p. 48). As such, the 12 participants selected for this study were females who have excelled in technological environments. For purposes of this study, there were two categories of women, "guides" and "pathtakers." Guide participants were comprised of 4 college level teachers in computer science, instructional technology, and/or related technological fields that have attained a minimum rank of assistant professor; and 2 women in high-tech industries that have achieved managerial and/or artistic status within their company to the extent they affect the companies' economic competitiveness. Pathtakers included 6 graduate students within computer science, instructional technology, and/or related technological fields. The research settings included the respective places of business, research labs, and classrooms in which the participants work and/or study.

In-depth interviews were conducted and audiotaped. Observations and document analyses were also used. Field notes were taken to provide a detailed account of activities related to observations and interviews. A journal was employed to chronicle my thinking, feelings, experiences, and perceptions throughout the research process. Subsequently, sub-questions and the overarching question were answered by interweaving data, via a constant comparative method, that emerged from a variety of contexts within the participants' stories (Glaser & Strauss, 1967). Each participant was given a pseudonym. In the remaining portions of this paper, I will: (1) address sub-questions and the overarching question; (2) suggest recommendations for further improvement of gender equity within MST educational and work environments; and (3) suggest MST gender equity related issues that need further research.

The Sub-Questions

In general, the ten main sub-questions in the Interview Protocol attempted to provide an overview for the "who," "where," "when," "what," and "why" of the participants' lives. To lend greater clarity and give synthesis to this discussion, sub-questions that address aspects of the same issues will be grouped together. In the sub-questions discussion, I will focus on both the universality and uniqueness inherent in many of the participants' experiences.

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Sub-Questions One, Two, and Three

". . . many participants commented that exposure to a strong female technological role model played a significant part in their choosing MST career paths."



Sub-questions one, two, and three constitute different aspects of a single theme—why the participants were drawn to technology careers. Sub-question one asked, "What personal, cultural, and/or institutional factors provided a context for these women's developmental process?" and focused toward external factors. Sub-question two inquired, "Within what contexts did these women's attitudes, abilities and dispositions for using technology evolve?" and tended to elicit responses that veered toward internal factors. Finally, since the literature indicated a home environment has such an overarching influence in a child's life in terms of sexual stereotyping (French, 1990), as well as shaping the child's personality, abilities, and motivational attitudes (Eccles & Hoffman, 1984), sub-question three is included in this group. It asked, "What events in the home experiences, if any, reverberated into technological career choices?"

The data to determine why these participants were drawn to MST career paths emerged from responses to interview protocol questions such as: "Where did you learn the skills for this profession?" and "What were some of your earliest experiences with mathematics/science or technology?" The reasons were varied and often complex. However, the data indicated that many of these women were often initially influenced by either an encouraging male figure within their personal sphere, and/or by a teacher in the educational sphere.

By imitation and identification with this adult, whether a teacher-parent in informal settings, or a professional teacher in academic settings, the participant patterned her procedures or routines after the teacher's style. Sissy noted, "I remember my 2nd grade math teacher...which kinda strikes me, that being such an early grade. But her being such a good teacher led me eventually to the math degree...and influences the way I teach now." Such responses confirm research that indicated the tremendous part an appropriate role model or mentor can play in the influence of a child's career choice (Wright & Hounshell, 1981).

Like Sissy, many participants commented that exposure to a strong female technological role model played a significant part in their choosing MST career paths. Germaine noted, "When I saw this woman computer science teacher, I was overjoyed. I was hopeful. Because I realized the door was open and that I had been putting this limitation on myself." Such comments coincide with research which maintained that role models perceived as more similar are more likely to be imitated (Becker, 1985; Maccoby & Jacklin, 1974).

On the other hand, many participants were influenced by role models of a different gender. For example, eight women indicated they had substantial encouragement of technical/mechanical knowledge growth from fathers, male siblings, and male peers. Sophie commented, "My father was a process engineer. He was a tinker and he encouraged me to be a tinker." However, these participants' experiences do not coincide with research which indicated that many fathers do not expect daughters to do well in MST related areas (Mann, 1994; Nelson & Watson, 1991; Poole, 1998). In light of the excellence these women have been able to achieve in MST environments, this seems an important consideration.



While many participants had strong male influences, some of these same women also indicated they were drawn to MST careers because of their own innate interests and abilities. Rinky noted, "It was always a fascination with inventions. It was right from the start." However, in these cases, the child's interest was fostered by someone who recognized and supported her MST aptitudes. Such scenarios are reminiscent of educational philosophers who encourage the development of more student-centered curricula (Dewey, 1966; Rugg & Shumaker, 1998).

Others were drawn to MST careers for various reasons, such as Jo's psychological need for acceptance; "I went into computers to impress my parents, particularly my father." Some needed to put themselves through the rigors of such an experience to prove their intelligence to themselves. At least half were attracted to MST career paths because they found they could apply technology to other kinds of real world interests, such as teaching or proactive environmental objectives. Then, too, technology was often seen as empowering and liberating for themselves and for others, both personally and economically. Rinky commented, "It's the dawn of a new information age. Technology professions offer equal opportunities." Madison added, "Information is power. I think women are beginning to see that."

Sub-Question Four

"The data also indicated that some informal computer learning activities took place within a low-threat, high-challenge play type environment, and these experiences often led the participants to become risk-takers, going further and further into technological aspects."



Sub-question four asked, "What play experiences, if any, helped mold choices for participants to enter technological fields?" Responses indicated that for many participants the infusion of certain low-threat, high-challenge play activities into MST related classroom teaching methodologies, as well as in informal activities, often captured their interests, as well as motivated them to further pursue MST endeavors. For example, Judy grew up under the tutelage of a father who allowed her to play in his garage while he worked. "Play gave me opportunities to explore the properties and functions of many of the items (tools) without threat." Judy described learning to tinker and to build wooden trolleys, which she eventually sailed up and down the main street of town. She added, "A nonthreatening environment was absolutely essential to my creativity." Descriptions of similar activities by other participants reinforce research that maintained play is an activity which leads to other outcomes such as learning, and the process of unleashing an individual's creative potential (Pellegrini, 1995; Spolin, 1986).

The data also indicated that some informal computer learning activities took place within a low-threat, high-challenge play type environment, and these experiences often led the participants to become risk-takers, going further and further into technological aspects. For example, Sophie described being hired by the technical department of her college as a customer service representative because she was "nice." "But," she added,

They had a Prestel keyboard...and the keys represented different characters like x's, and slashes with a perpendicular line and things...and you could put those together to make pictures and animations. It was fun. I made things like a coffee cup with animated steam coming out of it. It made me feel like I had an aptitude for technical things. I was teaching myself. Later, they made me responsible for more and more (technical) things...gave me my first full time job.

For Sophie, as well as other participants, such experiences led to a major expansion in their cognitive growth. These encounters echo research which indicated that people are at their most "mindful," when they are at play, their senses are fully engaged, and their physical and mental powers at their highest (Csikszentmihalyi, 1990).

Other play activities that had a direct linkage to MST career path choices were found in tinkering activities and video game playing, especially problem solving, and puzzle oriented games. For example, Avery remarked that playing Mahjongg "sharpened my mind...looking at different options for things." However, the participants' attraction for puzzle type games, such as Tetris and Mahjongg, goes against research that depicts girls as not comfortable with video games which emphasize puzzles or involve visual and spatial tasks (Hi-D Girls, 1996). Again, this is a reminder that children are individuals, and their particular interests need to be addressed (Rieber, Smith & Noah, 1998).

Finally, in terms of play activities, the participants also indicated that other play venues such as team sports were especially helpful in learning attitudes or teaching them skills. These abilities included "how to be competitive," as well as "how to work cooperatively." The participants' comments parallel research that discusses team sports' complicated rules and strategies as learning avenues which prepare children for survival in work situations and social organizations (Lever, 1976; Mead, 1934).

Sub-Question Five

Sub-question five asked, "What educational experiences, if any, contributed to motivations for choosing technological careers?" As noted previously, teachers played a strong role in creating an environment that allowed the participants' interests in MST subjects to flourish. Likewise, learning situations that included low-threat, high-challenge play and cognitive activities were strong influences. For example, Judy described a grammar school class where the teacher helped students learn mathematical tables by encouraging them to make up rhymes and to sing them together as a class. She added, "It was a neat experience that was absolutely enchanting."

Hands-on applications and reality-based assignments were also high motivation factors. Germaine, for example, had an absolute passion for music. She remarked, "When I started to get hands-on experience using a Musical Instrument Digital Interface (MIDI), I began to understand how the computer behaved, and I think that encouraged me to go on and learn some more." This desire for real world contexts and hands-on applications echoes many feminist educators' perspective of women's preferred learning styles. Such styles are characterized by the necessity of personal connection (Gilligan, 1982; Walkerdine, 1984). For example, Chodorow (1978) and Keller (1983) indicated that women need to establish a relationship between themselves and the object they are studying.

Finally, the academic computer environment itself, with a combination of science, technology, and software, emerged as a strong influence for why some participants choose MST career paths. For these women, the intellectual challenge of critical and abstract thinking within these environments was key. Rinky remarked, "You tend to abstract things to make things general so that they can be used to understand the relationships." Such comments illustrate constructivist theories that describe "learning as occurring through interactions with one's environment or culture" (Rieber, 1992, p.94).

Nonetheless, the attraction toward critical thinking on the part of some participants, and these women's avowed need to work in environments that encourage such thinking, reminds us of the necessity to avoid overgeneralizations—such as "males only" having a preference for controlled abstraction (Kenway & Modra, 1992). On the other hand, the degree to which many of these same women also employed reflective thinking parallels feminist theories that suggest women's predominant way of knowing is derived from a need to balance both subjective and objective strategies (Belenky et al., 1986).

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". . . whether MST interests emerged early on or later in life, many responses indicated the strong impact that role models or mentors played in the participants' lives."



Sub-Question Six

Sub-question six asked, "Under what circumstances did these women become producers and consumers of new technologies?" In terms of the emergence of technological interests, there are two major categories: (1) the participants' being emotionally and mentally ready; and (2) a change in the participant's perspective concerning the use of technology. For some participants "being ready" simply meant letting their innate abilities and interests come to the fore. For three women, their overall technology career paths have a more linear shape that evolved in gradual, orderly revelation, with a few digressions here and there. These women were labeled "Type A's" (More Linear Career Paths). For others, labeled "Type B's" (Event Change Career Paths), there was a need to become mentally prepared to take on the discipline necessary to master technologically-related knowledge. With regard to the seven Type B's, their career paths appear to have resulted from an unpredictable event from an outside source that triggered a sudden change in the participant's perspective of computer-related possibilities. A third group of women, labeled "Type C" (Multiple Beginning Career Paths), incorporated aspects from each emergence pattern. The two Type C's made career choices that were not defined in terms of any single technology initiation event because the typical sequence for this career path style appears to be fueled by a need on the part of the participant to continually invent and reinvent themselves as they undergo explorations of multiple facets of their own personality and abilities. Each of the two Type C participants was a Guide and tended to incorporate parts of former occupations.

Nonetheless, whether MST interests emerged early on or later in life, many responses indicated the strong impact that role models or mentors played in the participants' lives. These mentors offered the scaffolding so necessary for many children, especially girls, to take risks (Bandura, 1986; Mann, 1994; Vygotsky, 1978), and therefore must not be underestimated. Germaine commented,

I think it's always helpful if you've got someone actively believing in you because you pick up so much on the feelings (of that person). I found myself doing things that I would never be able to do because (they) gave me the support to do it and the opportunity to do it.

On a somewhat different note, it should be pointed out that while each of these 12 women have all excelled as producers and consumers of new technologies, some seemed more content than others. This feeling of contentment appeared in many ways to have resulted from a "good technological match" between their personal and professional interests. For example, Judy stated that she had "authentic reasons" for doing her technologically-related work and could barely contain her enthusiasm to search for new technological frontiers. On the other hand, Marie is an example of someone who experienced work as a schism, on a daily basis, between her "artistic self" and a "mathematical, logical self." Because Marie's professional duties only involved the later components, she was dissatisfied and appeared to be on the threshold of abandoning her current job. Such situations remind educators that interest in MST subjects is in many ways related to the will of the student to be engaged in such activities (Rugg & Shumaker, 1998). Thus, it is imperative for educators to discover and include the student's own interests as part of the MST curriculum.

Sub-Questions Seven and Eight

". . . it is not surprising that many of the respondents enjoyed cooperative and collaborative aspects of their MST work environments."

Sub-question seven inquired, "What perspectives associated with 'women's ways of knowing,' if any, brought these women to technology?" Sub-question eight asked, "What ideas and values do these women bring to technology?" These sub-questions are grouped together because they tend to either directly, or indirectly, affect the responses to the other question. The phrase "women's ways of knowing" implies a gender-related, but not gender-specific, tendency to relate to the world through contextual preferences, to offer empathy, to tolerate ambiguity, as well as to make connections via intuitive, cooperative, interactive, and holistic ways of learning (Belenky et al., 1986; Gilligan, 1982; Kenway & Modra, 1992).

Given this definition, sub-questions seven and eight addressed the qualities these participants identified in technological professions that were also part of their "core" value system as women. In terms of these women's values, all 12 were drawn toward innovation and technological change via paths that, to one degree or another, sprang from motivations which included the traditional role of being nurturers, caregivers and caretakers. Judy succinctly stated, "This (work) is changing people's lives, it's enhancing their lives. That's where I get the buzz." Judy's idealistic efforts reflect those of the other participants who saw technology as a bridge between their knowledge and other people.



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Such comments reinforce research which indicated that women value relationships with others as central to their lives (Rosser, 1989). In this regard, many of the participants have tried to incorporate more socially redeeming values into their highly competitive technological worlds, such as work objectives that create mutually beneficial solutions to socially significant problems. Therefore, it is not surprising that many of the respondents enjoyed cooperative and collaborative aspects of their MST work environments. Jo noted, "You build one thing and somebody else builds something else. It's a team thing because all these parts have to fit together. I really like that."

Sub-Question Nine

Sub-question nine examined issues such as, "What encouragement and support can these women contribute to other women's technological participation?" The data indicated they have earned their way, finding technical solutions in problem solving situations. As such, they feel they have legitimate power in their professional lives. Sophie commented, "I've struggled to get where I am...gone through the competitive hoops. I take pride in my work...have the expertise to back up the title." Therefore, many understand they can serve as conduits for better understanding of women's roles in MST environments. As role models, these women show how self-esteem can be built on the self-knowledge which comes from learning from mistakes, taking advantage of changing perspectives, and taking control over their own lives.

In terms of being risk-takers themselves, these women advocate a need for girls and women to become question-askers, to take part in discussions, and to voice their opinions. Many of the participants, especially guides, talk of "giving back" to other women, of moving into a "mentoring" phase rather than an "individual achievement" phase. For example, Judy spoke of her efforts in teaching technology skills to mature women students. She noted, "The work that I'm doing is giving them the chance to move out of the entrapment where they've been."

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"These experiences also call for continued attention to girls' vulnerable middle school years, and for educators to find methods to encourage girls' MST studies during this crucial time."



Sub-Question Ten

Sub-question ten inquires, "What obstacles did/do these women face in their technology-related career paths?" The responses indicated that some participants had to surmount many impediments. Socioeconomic difficulties, struggles with depression, or low self-esteem proved to be barriers for many of them. Eleven of the twelve participants indicated a drop in self-esteem during their adolescent years. These experiences parallel developmental research, which indicated that during girls' middle school years, many experience depression including suicidal ideation (Gilligan, 1990; Kantrowitz & Kalb, 1998; Mann, 1994). These experiences also call for continued attention to girls' vulnerable middle school years, and for educators to find methods to encourage girls' MST studies during this crucial time.

In terms of restraints, bias was a formidable opponent. All participants dealt with at least one occurrence. Some incidences were blatant and overt, such as Jo's loss (in the 1970's) of a full mathematics scholarship to college when the funding committee realized she was a woman. Jo noted, "It was awful. But what was really awful was that my parents were embarrassed that since I was a girl I shouldn't be doing this." On the other hand, most participants discussed the more pervasive subtle gender bias found in today's MST environments. Rachel noted, "In graduate school our instructors would often refer to the men by the last name...like Resnick thinks...whereas with the women it was...Rachel thinks. The ideas of men were already classified as having authority." Such descriptions of overt and subtle bias reiterate gender equity literature that indicated female students have a significantly broader spectrum of problems in MST environments than do their male counterparts, and that simplistic remedies will be ineffective in closing this gap (Canada & Brusca, 1991; Fennema, 1993; Hesse-Biber & Gilbert, 1994). On an incident-by-incident basis, micro inequities may frequently appear to be negligible. Some participants even prefaced certain remarks by noting that some experiences might not be "significant." However, I found that incidences of subtle bias were all too often a part of the collective experience on an ongoing basis, and need to be addressed.

Finally, a plurality of these women have experienced, or are currently experiencing, conflict in terms of family and career choices. This is typified by Marie, who remarked,

I'm in a profession that completely feeds on knowing what the latest and greatest is...yet my opportunities for those are limited. (As a single parent) I don't have a lot of outside learning time. And I'm not willing to sacrifice my parenting responsibilities. So I find myself in a position of always being behind.

This section looked at the ten sub-questions individually. Next, the overarching question and sub-questions in the aggregate will be discussed. In forming this overview, links are made to previous research. In addition, consideration of new findings will be incorporated.

". . . fathers, male peers, or siblings were especially important as role model/mentors in tinkering environments."

Overarching Question & Discussion

In the investigation of internal and/or external factors that aided the participants' success in technological environments, or hindered their progress, the following representative topics from the literature can be linked to specific data from this study.

1. Role models and mentors are important motivators (Bandura, 1986).
2. Same-sex role models are important to counteract stereotypes (Cobble, 1980; Maccoby & Jacklin, 1974).
3. Collaborative, cooperative learning environments work well for female students (Rosser, 1989).
4. Scaffolding is important to encourage risk-taking (Vygotsky, 1978).
5. Reality based assignments work well for female students (Hesse-Biber & Gilbert, 1994; Rosser, 1989).
6. Video game playing aids in developing technology skills (Provenzo, Jr., 1992). Play activities are often effective learning environments (Pellegrini, 1995).
7. The perseverance in mastering a challenge depends on whether the activity is perceived as personally satisfying (Cope & Kalantzis, 1990; Leper, 1985; Keller & Suzuki, 1988).
8. Quiet reflection aids in cognitive growth (Dewey, 1938).

In addition to the above, other themes emerged that offer slightly different explanations for why these participants excelled in MST environments. For example, each had either (1) a strong constructive and creative impulse to make things; and/or (2) a cognitive impulse to find out "how things work." In this regard, fathers, male peers, or siblings were especially important as role model/mentors in tinkering environments. When one looks at tinkering activities and the way these experiences aided the participants' MST knowledge growth, one cannot underestimate the power of a child's (especially a girl) playing with gadgets and gizmos. Sissy remarked, "I took physics classes because I could play with all those machines...making things happen."

". . . any successful remedy for the 'technological gender gap' will require a supportive climate from business communities, families, and schools in developing guidelines for effective collaborative planning."



Likewise, the infusion of play elements into more traditional MST learning environments emerged as an especially strong motivating factor, in terms of giving the participants freedom to find their own way. Similarly, question-asking and risk-taking were traits the participants shared. These characteristics appeared to have a strong impact on their ability to succeed in MST fields. Finally, many of these participants had inherent critical thinking and reflective skills in their MST toolkits.

While findings from this study, in connection with previous research, offer new approaches for improving gender equity in MST environments, it is first necessary to understand that such an undertaking is both complex and dynamic. Although it is generally agreed that educational venues are the most effective way to assure equal opportunities via legal and social mechanisms, it is also agreed that schools are part of a larger societal unit (Spring, 1998). Therefore, many social, political, and economic agendas come into play when trying to narrow down solutions for improving any particular concern. Obviously, any successful remedy for the "technological gender gap" will require a supportive climate from business communities, families, and schools in developing guidelines for effective collaborative planning (Rogers, 1965; Rogers, 1971; Sarason, 1982, 1993; Schrum, 1991).

However, since teachers, school leaders, students, parents, or community members may have different conceptions of equity, this makes the goal of achieving such an objective even more problematic (Spring, 1998). For example, one of the current barriers to further implementation of programs concerned with the improvement of girls' school experiences is found among parents and educators who are afraid that boys are being shortchanged. This perspective is partially grounded in the rising number of women, as compared to men, enrolling in liberal arts colleges, as well as the current dilemma of a large high school drop out rate for boys (Lewin, 1998). Such conditions have fostered a backlash against girls' equity issues and ignited concerns over the many emotional and academic problems that boys face in today's educational and societal climate (Kantrowitz & Kalb, 1998; Ravitch, 1994).

While it is noted these boys' issues are important, it should be pointed out that the same 1998 U.S. Department of Education report that cited the greater enrollment of females in liberal arts schools also indicated that at most engineering and technical schools, men are still in the majority (Lewin, 1998). Therefore, a continued need for vigilance exists on the part of gender equity researchers in terms of helping girls' academic pursuits in MST subjects. However, this researcher also upholds the viewpoint that the pursuit of a MST career must not be pushed as the only valid option for a girl. For example, Sara pointed out,

". . . each person in a girl's circle of family, teachers, friends, and community members can begin from early childhood to help her understand that women have had, and do have, a place in MST professions."

I think one trap that women fall into is doing what's expected...as opposed to what's right for them...it's a matter of being able to embrace your own self and not just work in meeting everyone else's expectations. So, I think forcing women into technical fields if they are not comfortable is as bad as keeping them out.

With that in mind, I believe that true MST gender equity can be accomplished only by: (1) reducing and eliminating biases and stereotypes that manifest double standards between male and female children, while (2) treating each child as an individual with respect for who she or he is. To that end, I will next focus on recommendations to achieve this goal.

Overarching Recommendations

These suggestions encompass four overarching arenas for reducing and eliminating the technological gender gap: (1) parents and educators' role; (2) parental role; (3) educators' role; and (4) role of the greater society. The categories of "parental role" and "educators' role" are subsets, as well as extensions of the inclusive category "parents and educators." Therefore, general recommendations for parents and educators will be found under the first category, and will not be repeated under the individual categories. In each of the two-subset categories, more specific recommendations will be added. The term "educator" refers to both teachers and administrative members. Recommendations for the "greater society" will be addressed separately. In total, these

four areas form an interwoven web, "an organically-related system of relationships" (Tyack, 1974, p. 15) (see Figure 6.1). Within this web, the human element is paramount. Based on participants' responses, one-on-one interactions often appeared to be a necessity for progress. In this regard, each person in a girl's circle of family, teachers, friends, and community members can begin from early childhood to help her understand that women have had, and do have, a place in MST professions. Likewise, women and girls can take the initiative to be proactive, to form study teams and ask questions, to set goals, to participate in a variety of activities, to seek out video games and software designed for girls' play and learning preferences, as well as to investigate cyberspace sites that are female-oriented. These recommendations and suggestions are offered as gateways that might lead to a change in society's sensitivities, as well as avenues for the extension of our knowledge so that all students can receive the benefits of a sound and fair education.

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"These recommendations and suggestions are offered as gateways that might lead to a change in society's sensitivities, as well as avenues for the extension of our knowledge so that all students can receive the benefits of a sound and fair education."

Recommendations for Parents and Educators

Based on the participants' responses, as well as supporting literature, it is clear that parents and teachers often exert a strong influence on a girl's choice of either choosing a MST career path or not. Therefore, it seems that parents, in general, need to have greater participation in the life of the school on a regular basis. While this is already the norm for some, in other cases the school needs to become more proactive in seeking parents as partners in the MST education process (Tyack, 1974). Obviously, when parents are involved, they will have a higher chance of affecting policies that influence their children. The following categories emerged from the study as macro level improvement areas for parents and teachers in reduction of the MST gender gap.

Fostering Interest and Awareness

In fostering girls' awareness of, and interest in, potential MST careers, an overall need exists to change the negative perception of MST professionals as cold, non-nurturing people (Mann, 1994; Sadker & Sadker, 1994). Professional careers such as being a scientist, engineer, mathematician, or technician must be promoted so that girls see them as relative to their lives. In this effort, girls need role models (Becker, 1985; Jackson, Mewborn, & Wieseman, 1997). Parents and educators need to empower girls with appropriate information to help them make informed choices. In addition, it is necessary that parents and teachers begin MST skills development in girls' early years, followed by more intense efforts in middle school. In high school and college, girls must be motivated to take advanced level MST courses. To accomplish these tasks, here are some general recommendations parents and teachers might consider:

1. Increase girls' exposure to historical role models by presentations of media depictions of female MST protagonists. For example, the video *Minerva's Machine* includes women's roles in the creation of the computer culture.
2. Enlist the help of girls in a collaborative search for age-appropriate media to foster interest in MST areas, as well as enlist the help of a media librarian.
3. Help girls find real-life role models with whom to converse. In such encounters, the social and nurturing aspects of their jobs, such as how they help other people, might be emphasized along with the technological aspects.
4. Help girls have direct exposure to MST work environments by taking advantage of such campaigns as "Take Your Daughter To Work Day."

5. Foster females' interest in MST subjects and careers by encouraging them to interact with age-appropriate software, web sites, or listservs that focus on MST careers for women. For example, Internet career networking sites such as International Webgrrls offer a forum to exchange job and business leads, as well as to teach and mentor (Downey, 1997).

Recommendations for parents. In terms of increasing girls' awareness of, and interest in, MST arenas, parents might incorporate the following suggestions:

1. Help children experience activities or hobbies they do not normally do by purchasing more gender-specific toys for either gender.
2. Set personal examples by utilizing MST contexts within the home, i.e., working on a computer if there is access to one. If there is no home computer, parents might encourage daughters to accompany them to an alternative site, such as the library. Mothers, especially, might elect to do (or learn to do) more technical tasks.
3. Find out if there is a representative number of girls in the computer classes at the high school. If not, then parents might identify what can be done to increase participation.
4. Parents who work in MST environments might volunteer to be available as guides for on-site work visits.
5. Parents, especially women, who have experience in MST environments, might volunteer to serve as mentors, or guest speakers, to assist with hands-on activities, to provide field trips.

Recommendations for educators. In terms of increasing girls' awareness of, and interest in, MST arenas, educators might:

1. Include technological training for classroom teachers so they may be better MST role models by incorporating the use of technology into their classroom strategies.
2. Show relevance of MST to everyday life, by introduction of age appropriate discussions concerning ethical, cultural, and societal issues that surround MST fields.
3. Engage the use of web sites, listservs, software, or other media, that focus on age appropriate gender issues within a sociological or cultural context.
4. Encourage females' consideration of MST occupations by sponsoring career fairs that include discussions with working MST professionals.
5. Support the inclusion of current age-appropriate MST career information in the school media center, especially software packages that explore career opportunities.
6. Encourage and support the establishment of age appropriate MST mentoring programs.
7. Model classroom enthusiasm for teaching MST subject matter.

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"In cases where participants had difficult relationships (or no relationship) with their own mothers, there was an especially strong need for interactions with other women role models."



Fostering Self-Esteem in Girls

As evidenced by the participants' stories, one can see that words wound and that a subtle biased gesture can change a child's life. Therefore, parents and teachers need to become aware that what they say, how they say it, the language they use, what they do not say, what and how they teach, and even what they do not teach, can all have a significant effect on the potential success or failure of a child. Therefore, parents and teachers need to renew efforts to assist girls with their transition to adolescence, and to address strategies for girls' self-empowerment beyond these developmental crisis years. As indicated by the participants' responses, girls' self-esteem can be enhanced by being exposed to "real" women talking about real issues. In cases where participants had difficult relationships (or no relationship) with their own mothers, there was an especially strong need for interactions with other women role models.

On another note, the participants' ability to ask questions in class, or after class in one-on-one situations with an adult teacher or parent played an important part in helping many of them develop self-esteem which aided in their achieving excellence in MST environments. Thus, it appears important to develop the questioning skills of girls and young women if they are to succeed in MST environments—to help them find their voices. However, the participants' responses also indicated that getting some students to ask questions is a subtle, delicate business. Therefore, it would appear that efforts in cognitive questioning strategies must also include the fostering of risk-taking tactics. Parents and educators might use the following suggestions for fostering self-esteem in girls and young women:

1. If representative portrayals of women's accomplishments are not included in curriculum materials, they might object to textbook committees or the local school board. They might even take a proactive stance by volunteering to serve on such a committee.
2. Have discussions with students/children concerning the inclusion or absence of women in various media presentations within MST contexts. If there is lack of representation, adults and children might join forces in finding ways to promote awareness of the situation, and then, in turn, to change it.
3. Enroll in seminars and workshops that focus on the improvement of communication skills, such as listening abilities.

4. Use new communication skills to create "safe" dialogue environments that allow girls to voice their own opinions, ideals, and even fears.
5. Encourage girls' further question asking by taking time to answer questions that they do ask, as fully as possible. In instances where an answer may be unknown to the adult, a collaborative search for the correct information might be instigated.
6. Reflect on their own lives, in terms of being a role model, especially if involved with MST occupations, and share life experiences with girls.
7. Encourage risk-taking in a safe environment by helping students push through fear and frustration in small increments.

Recommendations for parents. In focusing on methods for parents to help increase girls' self esteem, they might:

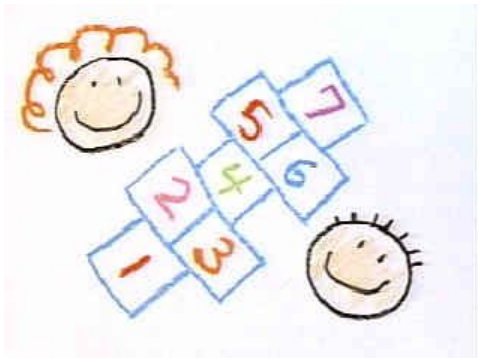
1. Set up "free" or unstructured periods of time to spend with daughters (and sons) where there is an opportunity for children to ask questions or just to talk. In terms of "what it means to be a woman," mothers might share memories of their own experiences growing up. (Although many parents already do this, it is useful to heighten awareness of the need for unstructured "sharing" intervals.)
2. Support a daughter's concerns of perceived school gender bias by, first, encouraging her to speak directly to the teacher concerning the incident. Then, if the girl is too uneasy to do this alone, go with her to discuss the matter with the teacher.
3. Talk to teachers and let them know concerns about gender bias in the classroom (Harper, 1996). Maybe there is value in visiting classes, either individually, or with other parents. These visits could include watching the proceedings to see if there is an equitable use of equipment or other resources, or to see if everyone has an equitable chance to speak. (See if teachers find ways to encourage quiet, shy students, whether they are boys or girls, to contribute to class. Observe if teachers find ways to help overly boisterous students, boys and girls, learn to listen to and respect their peers. In other words, find out if teachers respond to each student as an individual, providing whatever type of support each individual needs.)
4. Encourage low-threat, high-challenge play conditions that offer appropriate risk-taking environments.
5. Encourage a daughter to gain further proficiency on the computer by letting her demonstrate new skills that she learned in school. Let her teach them to you.

Recommendations for educators. This section will focus on ways for educators to foster self-esteem in girls.

1. Pre-service and in-service teachers might participate in professional development experiences designed to support the reexamination of beliefs, expectations, and cultural sensitivities. Hirsch (1998) noted, "Nothing truly effective in the way of large scale policy change through federal, state, or local mechanisms can be accomplished until there is a change in mind by the ...two and a half million teachers" (p. 147).
2. Teachers might have a program for parents and community members on gender bias.
3. If stereotypes are encountered in materials, teachers might have discussions with their students on ways to overcome such stereotypes. Teachers might supplement existing curriculum materials with other books, web sites, and handouts.
4. Educators might explore utilization of classroom strategies that allow participation that is more equitable for both boys and girls by identifying and developing the abilities of all students.
5. Teachers might invite women who are in non-MST roles, in addition to technological role models as guest speakers. For example, a mother who has raised six kids, who talks about what women can do (as women), could be invited as a guest "story teller."
6. If it is not already a part of the school administration, educators might help establish counseling services. If a school can only afford one counselor, perhaps some kind of "share" policy might be established with a neighboring school so that girls, as well as boys, might have access to a counselor of the same gender. This would be especially important during girls' adolescent period when they often become especially shy in talking about sensitive topics (Mann, 1994).
7. Middle school teachers especially might encourage adolescent girls to form study groups so these girls can have a social network of peer support. Such a strategy might give girls the necessary encouragement that would allow them to speak out, and maybe even risk an incorrect answer (Mann, 1994). Educators might help students network by arranging for times and rooms where groups could meet.
8. To further encourage risk-taking, teachers might infuse lesson plans with appropriate cooperative, low-threat, high-challenge play conditions such as role playing, or staged debates. These may be followed by open class discussions that help students learn to listen to each other. A mathematics class or a science class might include designing and building some structure, such as a dollhouse, with working lights and/or music.

The Socialization of Females

". . . question-asking skills among the participants appeared to be a gateway for them, as did the utilization of low-threat, high-challenge, play environments, such as computer games."



Fostering Cognitive Growth in Girls

The participants acknowledged the many paths they traveled to MST careers, yet all indicated they were able to excel in MST environments partially due to their high degree of (1) critical thinking, (2) reflective thinking, and/or (3) problem-solving abilities and skills. Therefore, parents and educators may strive to find ways to help girls (as well as boys) engage more fully in these practices. For example, hooks (1998) (she prefers to sign her name with lowercase letters) commented, "Without the capacity to think critically about ourselves, and our lives, none of us would be able to move forward, to change, to grow" (p. 230).

In terms of methods to foster cognitive growth, question-asking skills among the participants appeared to be a gateway for them, as did the utilization of low-threat, high-challenge, play environments, such as computer games. These participants' responses concurred with cognitive psychologists and educators who maintained that effective instruction focuses on the active involvement of students in their own learning, with opportunities for interactions which engage the child's natural curiosity (Dewey, 1938; ISTE, 1998; McCombs, 1993). Similarly, engaging in team sports and team activities encourages problem solving in a social context, which according to the literature and the participants, help prepare children with organizational skills and competitive/cooperative survival skills in work situations (Lever, 1976; Piaget, 1962).

Finally, some participants, as well as the literature, indicated a need for schools to actively seek integrated curricula. Sizer (1984), for example, described curricula that leave even the ablest and most devoted students in a swamp of intellectual confusion by the "jumble of subjects, none either thoroughly defined or related well to any other" (p. x). Specifically, with regard to MST subjects, the challenge is to develop curricula within contexts that have an appeal to learners of varying interests and aptitudes. To aid in cognitive growth among girls and young women, I recommend the following methods that parents and teachers might use:

1. Provide experiences, such as tinkering activities that lend a sense of wonder about the inner workings of machinery, tools, cars, computers, and household appliances. Interest might be fostered by an adult working side by side with the child.
2. Enhance higher-order thinking skills involved in problem solving by asking the student(s) to articulate what they are trying to do, why they are doing it, and why it is important.

3. Provide scaffolding support via books, computer software, and web sites. For example, [Operation Smart Girls, Inc.](http://www.feminist.com/girlsinc.htm) (<http://www.feminist.com/girlsinc.htm>), is a site where girls are involved in hands-on experiences, building and talking things apart, questioning and predicting, and developing an understanding of what scientists do.
4. Encourage cooperative game playing in MST environments since cooperative learning situations appear to have positive effects for all children (Johnson & Johnson, 1989), and play environments appear to foster learning (Pellegrini, 1995). For example, the use of software, such as *The Oregon Trail*, encourages pairs, as well as trios or quartets of students working together to share strategic decisions for the journey west. Cooperative technical play is an especially important consideration for children who may miss out on the parallel track of social learning by sitting in front of a computer for hours (Greenwald, 1998).
5. Encourage single-sex, as well as coed cooperative computer game playing sessions. Some research indicated that girls are at a disadvantage in mixed-sex computer groups (Underwood, Jindhal, & Underwood, 1994). In providing software, a full array of selections should be made available, especially games with girls' play preferences and learning styles, such as the CD-ROM *Girl Talk*, where girls (both individually, and in groups of up to four) are challenged to cooperate, use logic, reveal secrets, and solve puzzles (Davis, 1999).
6. Actively sponsor integrated curricula approaches in terms of the "widening of the areas of shared concerns" (Dewey, 1998, p. 34). For example, many girls fear mathematics yet might love music. In an integrated curricula, the connection between these two subject areas (i.e., an eighth note, a quarter note, etc.) might be orchestrated into the course work in such a way the student can use the love of music to better understand mathematics, and to eventually transcend her fear.

Recommendations for parents. This section will focus on methods to increase the cognitive growth of girls. Parents might:

1. Sit with their daughters while they do homework, and encourage them to verbalize their thought processes. This fosters critical thinking.
2. Encourage girls to become involved in team sports, or to engage in similar team-oriented activities. Parents might foster this involvement by engaging in family sports activities.
3. Encourage family cooperative software and board game playing. For example, in *SimSafari*, the parent(s) might help the child create a safari-park business, while balancing budgets, prey, and predators (Stauffacher, 1998).
4. Volunteer to act as sponsors for after-school or weekend sport and team activities.



Recommendations for educators. This section will focus on cognitive growth methods that educators might employ.

1. Introduce MST content by gateways that support the student's personal pursuits or interests. For example, use software that incorporates graphics instruction to entice girls who might be fearful of technology—yet love art.
2. Infuse brief intervals of quiet reflection time, especially after hands-on activities, or play learning experiences, into classroom strategies. Dewey (1938) noted such reflections mix observation and memory.
3. In terms of integrated curricula at the university level, educators might mainstream computer programming into an area where women are highly enrolled, such as women's studies, as well as encourage female students to enroll in a computer programming course by offering such a course within a context that emphasizes both threads of knowledge (Smith, Del Rey & Everett, 1997).
4. Educators might foster the inclusion of students in both formal and informal team sports and/or activities. In terms of MST, environmental and computer clubs could be sponsored.

Recommendations for the Greater Society

To facilitate the community's understanding of MST gender inequities, educational, political, and business leaders need to organize and participate in roundtable discussion forums at the local, state, and federal levels. In turn, these members of the greater society might develop funding and policy strategies for the encouragement of women's greater participation in MST fields. Financial support is necessary to carry out reform such as awareness training, curricula development. The question, of course, is "Do we as a society care enough about our daughters, sisters, and wives to take the necessary action to bring about gender equity in MST environments?"

Summary of Recommendations

These recommendations for parents, educators, and the greater society call for the fostering of girls' cognitive growth in MST subject matters, via teaching and learning methods that focus on strengthening their self-esteem, as well as increasing their interest in, and awareness of, technical skills. In this effort, it is necessary for the community to form a partnership with the schools and the parents (see Figure 6.1). Next, we will look at future research that might advance the creation of greater MST gender equity.

Future Research

As evidenced from this study, the problem of reducing the MST gender gap is complicated. Longitudinal studies are recommended to provide a deeper perspective of specific factors that influence women's choice(s) in taking or not taking a MST career path. There is a need for extensive tracking of students' exposure to various teaching methods suggested in these recommendations in order to provide quantitative and qualitative data on their effectiveness. There is a need to collect data on parental intervention techniques to determine which ones, if any, build a sense of trust, motivation, and cognitive curiosity in girls. There is also a need to determine effectiveness of particular methods, such as improved parental communication techniques in terms of promoting girls' questioning, or in helping girls verbalize cognitive thought processes.

Further research is necessary to determine how to effectively strengthen teacher competencies in MST content and gender equity pedagogy, so that a cadre of professionals can serve as resources and lead reform efforts. In brief, research in this area needs to look at the following: (1) What do teachers need to know in terms of improving MST gender equity? (2) When do they need to learn it? In addition, a need exists to develop teaching activities that incorporate and integrate recommendations from this study. Then, formative evaluations of these learning activities need to be conducted.

In focusing on recommendations for curriculum reform, such as integrated curricula, it is necessary to determine the status of integrative and transformational curricula approaches occurring in schools and colleges across the U.S. Research needs to investigate if such approaches are more effective gateways for women to enter MST careers. Since the literature indicated a need to increase both the number of women participating in MST, as well as a need for corporations to retain experienced women (Goff, 1997), it seems logical to determine what MST corporation programs, if any, are already in place that focus on the recruitment and retention of women. There is the necessity to investigate corporation forums which address problems that often fall disproportionately within women's concerns. The goals here are to decide whether these programs have been useful, are worth continuing, and if so, what changes are needed.



Summary

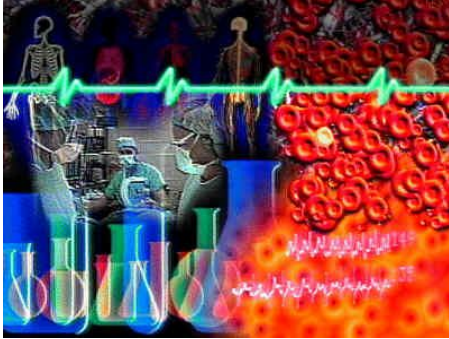
This study sought to investigate the experiences of 12 women who have taken career paths into traditionally male dominated MST areas, and who have excelled in their respective fields. The study began with a single overarching question, "What internal and/or external factors aided the participants' success in technological environments or hindered their progress?" The study was facilitated by a qualitative design that included in-depth interviews. These dialogues allowed me to form a holistic view of gender socialization factors that encouraged or discouraged these women's participation in technology-related professions.

The overarching conclusions of the study reinforced prior research, which indicated that role models, scaffolding, and collaborative, hands-on, reality-based assignments facilitate girls' interest in MST. New findings revealed that fathers, male peers, or male siblings played a strong part in motivating the participants to engage in tinkering activities, and provided scaffolding. Other findings indicated that girls need to be encouraged to ask questions and to take risks, even if they are only moderate ones. From the data, it appeared the infusion of play activities in MST environments also needs to be encouraged.

Finally, on a personal note, this study made a substantial impact on the researcher, herself. In these women's voices, I found echoes of my own thoughts. Most importantly, I became more attentive to my own part in being a role model for my students, and the need to provide scaffolding for them. The teacher/researcher was reminded over and over of the astonishing complexity of the learning process, and of the great variability among individuals.

The Socialization of Females

About the Author



[Lola B. Smith](#) has earned a Ph.D. from The University of Georgia in Instructional Technology, M.A. from The New School For Social Research in Media and Film, and B.A. from The University of North Carolina at Greensboro in Drama and Speech. Lola's professional life has included work as an actress, screenwriter, songwriter, and singer, as well as being both a high school English teacher and a university instructional technology and foundations of education instructor.

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ELECTRONIC NETWORKS IN SCIENCE EDUCATION

A Literature Review

[Rita Hagevik](#)

[North Carolina State University](#)

"Electronic networks are emerging as a possible way to create highly interactive environments in which information can flow in many directions."
"

ABSTRACT

Electronic networks in science are emerging as a new way to create highly interactive environments in which information can flow in many ways. In addition it has been found that teachers and students develop new instructional strategies and classroom organization when participating in telecommunication projects. A wide variety of telecommunication projects are explained including tele-apprenticeships, problem solving, and scientific investigations. Research is reviewed and indications are that electronic networks are one way to enhance science learning and teach students how to effectively communicate in a technology-based society.

Technology and its role in education are emerging as an important topic for the next century. The National Science Education Standards (NSES, 1996) state that the major goal of science education is to produce students that are scientifically literate and technologically informed. Many literary scholars are predicting a paradigm shift as students become linked to the world beyond the classroom (Dillan & Gabbard, 1998). However, there remains a tremendous need for a richer understanding of the learning process and how it relates to technology education. The use of technology as a means of information creation and the potential for learning **with** technology and not just **from** it need to be considered (Dillan & Gabbard, 1998).

Electronic networks are emerging as a possible way to create highly interactive environments in which information can flow in many directions. These networks create “microworlds” of highly motivational learning contexts for teachers and students. Students and teachers are motivated to collaborate on projects in different locations and share their results with a wider audience (Levin & Thurston, 1996). Students become motivated and excited when they receive immediate feedback about their work. For example, students can collaborate on projects such as the AT&T learning network (Riel, 1990) in which teachers joined students and others to search for information and explore a variety of topics. These classes developed new instructional strategies and classroom organization in order to be able to effectively telecommunicate with each other. Teachers and students worked in teams to solve real problems, share cultural perspectives and learn from one another. They collected data, conducted interviews and surveys, and analyzed the data to draw conclusions that are significant to the adult world (Riel, 1990). The AT&T Learning Network involved university researchers, students, teachers, and pre-service teachers who communicated electronically and collaborated on a variety of subjects such as a study of career choices and how they changed across generations, comparisons of news coverage of world events, a study of how the water cycle operates in different places and techniques for dealing with water shortages, comparisons of food prices and import/export policies, and comparisons of TV watching patterns (p. 165). Schools worked closely with site coordinators to organize the schedules of the projects. This concept has also been applied to the Long Distance Learning Network (LDLN) and has connected hundreds of teachers from the US, Canada, Holland, France, Germany and Australia into networking units of 6-10 classrooms with specific goals and curriculum-based tasks to be complete. The design and development of the LDLN and the AT&T Network show that successful telecommunication networks can provide a type of communication tool that offers a way to help reduce the isolation of teachers and students in classrooms (Riel, 1990). Telecommunication networks often can be effective in breaking down boundaries between academic subjects and students can become critics of each other’s work (Brienne & Goldman, 1989). Electronic networks, therefore, break down barriers and the remoteness that exists in schools and encourage teamwork and collaborative inquiry (Levin and Thurston, 1996).

[AT&T Learning Network](http://www.att.com/learningnetwork/)

(<http://www.att.com/learningnetwork/>)

". . . careful organization and planning as well as continual evaluation of electronic networks have been found by researchers to be key to their success."

Electronic networks do require support, training, equipment, and time for setup. The integration of all partners as collaborators in an educational community of practice are key to its success (Ruopp, Pfister, Drayton, & Gal, 1993). Careful planning is required if the electronic communication is going to be an effective form of group interaction. Questions about the group structure need to be answered such as:

- What is the group size?
- What are the common interests of the group members?
- What are their prior experiences?
- Is there a clear group goal that includes a timeline of beginning and ending dates?
- Is there an end product?
- How will the communication take place?
- Will messages be sent individually or collaboratively?

Ruopp, et al. (1993) found that addressing these initial questions supports and strengthens the connections among the teachers and their community of practice, which included students and university researchers. In addition, they found that it was critical for someone to take responsibility for facilitating the interactions. Riel and Levin (1990) found that successful student networking projects were managed by a network coordinator and were "planned for success." In the Riel and Levin study, participants were organized into work groups that had cooperative tasks with response obligations. The network coordinator not only facilitated interactions but also evaluated the classroom interactions. Interactions were assessed using the criteria of organization of group, organization of task, response opportunities, response obligations, and evaluation of the exchanges. The study found that successful networks were those that were organized into groups rather than one to one communication, had a timeline and end product for each task, worked on the project at school, had a short response time (at least every 2 weeks) and had a coordinator that continually evaluated the success of the network. Therefore, careful organization and planning as well as continual evaluation of electronic networks have been found by researchers to be key to their success.

There are many examples of successful electronic science networks. In the LabNet project, students calculated the Earth's circumference using Eratosthenes' method. Data were collected by measuring to the nearest centimeter the shadow cast by a meter stick at high noon (Ruopp et al., 1993). Students shared this data, along with their precise latitude and longitude location, with each other. Other LabNet projects include designing a paper-and-tape structure that slows the descent of a ping-pong or golf ball or building model cars to strict performance specifications. The LabNet project verified that any science problem could be approached using a larger community of learners as long as factors vary naturally from location to location.

Electronic Networks

"Networks make it possible to create highly interactive groups of students and teachers that otherwise would be isolated from each other."

Electronic networks also initiate the formation of tele-apprenticeships, as students work jointly to tackle problems with other students, teachers, adults, and scientists. An example of this type of project is one in which students shared information and collaborated on how the problem of water shortage could be solved in their communities (Levin, Riel, Miyake, & Cohen, 1987). Local data gathering, data sharing, and a comparison of other's approaches to one's own problem were all a part of the project. Results showed that students benefited by working with other people grappling with an authentic, complex problem and that in this context, they learned a great deal about water. Levin (1987) concluded, from this study, that these types of "tele-apprenticeships" should become the dominant form of instruction in education because students acquired science concepts in an instructional setting that provide dynamic support for the acquisition of problem solving skills (Levin et al., 1987, p. 258).

Other examples of collaborative electronic environmental projects include posting rainfall pH across the US, analyzing ground water samples, ranking environmental problems in your area, and tracking migratory birds (Valauskas, 1993). The STEPS Physics program focused on collaborative projects such as acid rain, collaborative physics problems and computer-based lab experiments (Lehman, J., Campbell, Halla, & Lehman, C., 1992). An example of an elementary program, the Earth Lab Project, included a "Think Tank Trivia", pre-lab hypothesis, science logs, and data gathering and sharing (Brienne & Goldman, 1990). Students investigated topics such as hurricanes and how weather affects people's lives, plate tectonics and other Earth Science topics. Brienne and Goldman (1990) found that electronic communication provided students with numerous opportunities to communicate about science and students were exposed to many new opinions. The Technical Educational Research Center (TERC; <http://www.terc.edu>) has developed many telecommunication projects including Feederwatch by Cornell University (<http://www.birdsource.org>) and KidsNet by National Geographic (<http://www.kidsnet.org>). Other successful ongoing science telecommunication projects include GLOBE (<http://www.globe.gov>), the KanCRN Collaborative Research Network (<http://www.kancrn.org>), and EstuaryLIVE (<http://www.ncnerr.org>).

[Technical Educational Research Center](#)

[Feederwatch](#)

[KidsNet](#)

[GLOBE](#)

[KanCRN Collaborative Research Network](#)

[EstuaryLIVE](#)

Electronic networks have the potential to offer students and teachers the opportunity for authentic learning. These networks encourage teamwork, collaborative inquiry, and facilitate instruction (Levin & Thurston, 1996). Riel (1990) found that teachers shift classroom instruction from whole group instruction to small group investigations or team projects when using electronic networks. Networks make it possible to create highly interactive groups of students and teachers that otherwise would be isolated from each other.

For some additional information on electronic networks, explore these links:

[Use of Electronic Networks in Educational Settings](http://www.ed.uiuc.edu/people/taku/unpublished.html)

(<http://www.ed.uiuc.edu/people/taku/unpublished.html>)

[Teaching Teleapprenticeships](http://lrs.ed.uiuc.edu/TTA/Papers/TTAS.html)

(<http://lrs.ed.uiuc.edu/TTA/Papers/TTAS.html>)

[Cooperative Learning Through Telecommunications](http://www-cscl95.indiana.edu/cscl95/outlook/14_Riel.html)

(http://www-cscl95.indiana.edu/cscl95/outlook/14_Riel.html)

[Educational Electronic Networks: A review of research and development](http://www.ed.uiuc.edu/projects/tta/papers/Levin-Thurston-96.html)

(<http://www.ed.uiuc.edu/projects/tta/papers/Levin-Thurston-96.html>)

Therefore, research indicates that electronic networks are one possible way to enhance science learning and effectively teach students to be scientifically and technologically informed. Yet, at the same time, it is clear that network-based activities are not always appropriate. The challenge to education on the electronic frontier is to identify the techniques that are most efficient and effective (Levin et al., 1989).

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Rita Hagevik received a BS in Biology from Meredith College and an MS in Science Education from North Carolina State University, Teacher Certification in grades K-12, with a specialization in science. Additional certifications include Academically Gifted, National Mentorship training, and North Carolina Environmental Educator. Currently, she is working at North Carolina State University as a Coach 2 Coach Teacher in which she is a liaison between the University and schools. She is also a Ph.D. student in Science Education and Forestry at NC State University. Rita worked for Wake County Public Schools for 9 years and has taught 2nd grade, 6th grade, and 8th grade. She has sponsored many students in national and state competitions and has had six national Duracell contest winners and numerous state science fair and science academy winners. Rita is a national trainer for Foundational Approaches in Science Teaching (FAST III), in critical thinking for the National Center for Teaching Thinking, in Clinical Supervision and Mentoring, and for ESRI in Geographic Information Systems.

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International Application of the Web in an Italian School Reform Case



Gian Carlo Visani

Scuola Media Statale Alfredo Oriani

Casola Valsenio

Italy

Translated from Italian to English by **Marsha Alibrandi**
with assistance from Alta Vista's translation website
<http://babelfish.altavista.digital.com/translate.dyn>

"The Internet has also come to be a great source of information, a world-wide library, and promises to become a great resource for interactive lessons for students."

Introduzione

I computer (dai Commodore 64, Commodore 128, i primi PC, Amiga, ai PC Pentium attuali) sono usati nella mia scuola da molti anni. Dapprima erano utilizzati per il linguaggio Basic, per il Logo, per la videoscrittura, per la realizzazione di giornali scolastici, ora già da qualche anno soprattutto per i progetti internazionali in Internet. L'«utilizzo di Internet è iniziato con la costruzione di una pagina Web della scuola, che all'inizio era semplicemente una vetrina della realtà scolastica e di quella ambientale.

La svolta è iniziata quando ho iniziato un rapporto attraverso la posta elettronica con Caroline McCullen, responsabile di MidLink Magazine, su cui avevo letto un articolo su una rivista italiana. Con Caroline è iniziato un dialogo frequente che ha permesso la realizzazione di pagine Web e la collaborazione tra studenti Americani ed Italiani.

Sono seguite altre esperienze: "Virtual Classroom", in collaborazione con una scuola dell'Oregon e una scuola del Giappone, il progetto Europeo Comenius con scuole in Germania, in Olanda e in Scozia, i progetti "Monumental Idea", "Poesia in rete", un progetto sulla sicurezza nella scuola e a casa, lo studio di ambienti in Alaska ed in Italia tramite i messaggi di posta elettronica. Internet viene anche utilizzato come una grande fonte di informazioni, una biblioteca mondiale, e stiamo progettando lezioni interattive per gli studenti.



"I believe that the ultimate value of the project has been the collaboration between students on common topics."

Introduction

Computers have been used in my school for many years (from Commodore 64, Commodore 128, the first PC, Amiga, to the current PC Pentium). At first we were using programming languages from Basic to Logo to videoscripting for relating to scholastic journals, and now for some years, for international projects using the Internet. Our early utilization of the Internet was initially for the construction of the school web page displaying a picture of the school and its environment.

The extended web page began with my collaboration through electronic mail with Caroline McCullen, editor of MidLink Magazine about which I had read an Italian review. With Caroline a frequent dialogue began that has led to the development of extended Web pages and collaboration between American and Italian students.

From these followed other online experiences: "Virtual Classroom", in collaboration with one school from Oregon and one from Japan, the European project Comenius with schools in Germany, Holland and Scotland, the "Monumental Idea" project, the "Poetry Network," a project on security in school and at home, and an atmospheric study in Alaska and Italy through Email. The Internet has also come to be a great source of information, a world-wide library, and promises to become a great resource for interactive lessons for students.

Gli studenti utilizzano Internet circa tre - quattro volte durante la settimana per i progetti e per le ricerche. Alcuni, che frequentano la classe prima, ricevono delle informazioni sull'«utilizzo del computer e dei software ed eseguono esercizi opportuni.

Progetti

Ogni progetto viene discusso prima con i ragazzi, che fanno delle proposte e si dividono i compiti, quindi compongono un vero e proprio gruppo di lavoro, ad esempio una redazione. Esempi diversi sono il progetto europeo "NIDS" all'interno del progetto Comenius, "Monumental Idea" e "Poesia in rete".



[Contact the Author](#)

[Comenius Project](#)

(<http://www.en.eun.org/news/comenius-en.html>)

[MidLink Magazine](#)

(<http://www.cs.ucf.edu/~MidLink/>)

[Monu-MENTAL](#)

(<http://www.ncsu.edu/midlink/feb00/poe.exch.menu.htm>)

[International Poetry Exchange](#)

(<http://www.ncsu.edu/midlink/feb00/poe.exch.menu.htm>)

[Teleconference Between Scuola Media and MEGA](#)

(<http://www.ncsu.edu/mega/training/Software/software.html>)



Fasi del progetto Comenius:

pianificazione dell'attività (realizzazione di un giornale telematico) da parte degli insegnanti, scambio di e-mail tra gli studenti, presentazione di sé e del proprio ambiente, realizzazione di un sito in Olanda, visita di studio in Germania ed in Olanda finanziata dalla CEE per la programmazione dell'attività, realizzazione comune di pagine Internet, visita di studio in Italia, programmazione comune di attività didattiche.

I progetti "Monumental Idea" e "Poesia in rete" sono nati in collaborazione con il MEGA e con MidLink Magazine. Essi prevedono la presentazione di importanti monumenti e di aspetti culturali, la riflessione sulle culture, l'espressione dei propri pensieri e sentimenti tramite la poesia. Credo che il passaggio ulteriore sia la collaborazione tra gli studenti su temi comuni.

Internet è abbastanza integrato nelle classi che hanno attività anche nel pomeriggio, gli studenti partecipano attivamente ai progetti e sanno costruire pagine in Internet; stanno iniziando ad utilizzare Internet per ricerche studio. È necessario a questo proposito una guida opportuna da parte degli insegnanti, altrimenti è facile che gli studenti si perdano nella grande rete.

Programmi per il futuro

Stiamo predisponendo link ad alcuni siti interessanti per la scuola; il passo seguente è la realizzazione in rete di lezioni. Su quest'ultimo punto è molto importante la collaborazione degli insegnanti anche in ambito internazionale.

Our students use the Internet approximately three - four times during the week for projects and searches. Some, who get to class first, get additional instructions in hardware and software, taking the opportunity to execute other exercises.

Projects

Every project is first discussed with students, then they propose how to divide the tasks, and therefore compose a proper work group, for example, a peer editing group. Other examples are European project "NIDS," Project Comenius, "Monumental Idea" and the "Poetry network."

Phases of the Comenius project (an electronic journal) included planning activities, teaching, exchanging email between the students, on-site and virtual presentations situated in Holland, studio visits in Germany and Holland financed by the EEC for programming activities, collaborative development of Internet pages, and a studio visit in Italy for common development of instructional activities.

The "Monumental Idea" and "Poetry Network" projects were born out of collaboration with MEGA and MidLink Magazine. These review the cultural aspects and importance of historic monuments and their reflections of culture expressed in students' own thoughts and feelings through poetry. I believe that the ultimate value of the project has been the collaboration between students on common topics.

The Internet is integrated enough into classes that in the afternoon, the students participate actively on projects, construct web pages, they are initiating Internet use for research and study. It's necessary for the teacher to guide instruction, otherwise it's easy for students to get lost in the great network.

Future Projects

We are planning to link to some interesting school sites; the following step is to develop a network of lessons. This final point is most important in developing collaborative instruction and international initiatives.



Nelle scuole italiane la situazione è molto diversificata: da scuole che non hanno compiuto per ora alcuna esperienza in Internet, ad altre che hanno sviluppato diversi progetti, lezioni in ambiti locale, nazionale ed internazionale.

Io penso che l'uso del computer possa promuovere la crescita degli alunni, perché li abitua all'autonomia, alla necessità della programmazione per ottenere dei risultati, al confronto con gli altri e con i risultati ottenuti in modo da poter programmare le iniziative future, al collegamento immediato con le fonti di informazione per superare le proprie carenze culturali. Tutto ciò promuove la crescita umana e sociale degli studenti.

Riforma di programma di studi e tecnologia in Italia

Insegno italiano, storia, geografia, multimedia nella scuola media di Casola Valsenio, un paese che si trova in una valle verde dell'Appennino settentrionale in Italia. Insegno già da molti anni, in precedenza ho insegnato per cinque anni in una università di Brescia e ho lavorato per tre anni in una casa editrice. Sono sposato e ho un figlio di 14 anni, Davide.

La scuola dove insegno è piccola ed è frequentata da studenti dagli 11 ai 14 anni, provenienti dalla scuola elementare. In Italia i bambini iniziano a frequentare la scuola materna quando hanno tre anni, a sei anni frequentano la scuola elementare, che dura 5 anni, quindi frequentano la scuola media inferiore per 3 anni e la scuola media superiore per 5 anni. Quindi frequentano circa 16 anni di scuola prima di iscriversi all'università. In questo periodo si sta discutendo il progetto di unificare la scuola media inferiore e quella superiore, come avviene in molti paesi europei, aumentando di un anno la scuola elementare e facendo iniziare due anni prima la scuola media superiore.

Italian schools are quite diverse in terms of technology integration. They range from schools that haven't completed even an hour of experience on the Internet, to those that have developed various projects, lessons and local, national and international initiatives.

I think that student use of computers will promote student development because it accustoms them automatically to use various programs in order to obtain results, to compare them with other findings, and with findings obtained in even more powerful ways in future initiatives connecting immediately with information sources that exceed their own cultural limitations. All of those things that promote human and social growth in students.

Curriculum Reform and Technology in Italy

I teach Italian, history, geography and multimedia in the Casola Valsenio school, set in a green valley of the northern Appennines in Italy. I have already taught for several years. Previously I taught for five years in a university of Brescia and have worked for three years in a publishing house. I am married and I have a son of 14 years, David.

The school where I teach is small and is attended by students from 11 to 14 years, coming from the elementary school. In Italy the children begin to attend the maternal school when they are three; at six years old they attend the elementary school for 5 years, therefore they attend the inferior medium school for 3 years and the advanced medium school for 5 years. Therefore they attend approximately 16 years of school before enrolling in the university. Currently a unification plan is being discussed in which the inferior medium school and the advanced one, would be unified as in many European countries, increasing the elementary school by one year and starting the advanced medium school two years earlier.

"It is quite significant how much educational and instructional autonomy is granted to the schools, who can program projects or interventions to meet educational and social needs that impact the atmosphere in which we work."



Struttura Della Scuola

E' molto significativa l'autonomia educativa e didattica concessa alle scuole, le quali possono programmare progetti o interventi collegati alle necessità educative e sociali dell'ambiente in cui opera. Scrivo l'elenco delle materie svolte nella mia scuola nell'anno scolastico 1998/99. Materie curricolari (l'orario è settimanale): Italiano, storia, educazione civica, geografia (11 ore), religione (1 ora), matematica (4 ore), scienze (2 ore), inglese (3 ore), francese (3 ore), ed. artistica (2 ore), ed. tecnica (2 ore), ed. musicale (2 ore), ed. fisica (2 ore). Altre sono progetti e materie facoltative: multimedia, Internet, linguaggio Logo, informatica, progetti internazionali su Internet, teatro, lingua latina, logica, orienteering, attività sportive, laboratorio scientifico, laboratorio tecnico, attività di recupero e approfondimento. Per tutti gli alunni si svolgono attività finalizzate all'educazione della persona: ed. sessuale, ed. sanitaria, ed. alimentare, orientamento, incontri con associazioni sociali, assistenziali, educative.



Riorganizzazione delle risorse

Gli alunni frequentano la scuola 36 ore settimanali: 5 ore tutti i giorni al mattino, 3 ore il pomeriggio il lunedì e il venerdì. A disposizione degli alunni c'è la mensa. La scuola dove insegno è statale (quasi tutte le scuole in Italia sono statali); di conseguenza i genitori svolgono varie attività e hanno normali aspettative per i figli, che scelgono ogni tipo di scuola superiore: licei, istituti tecnici, istituti professionali, scuole professionali. La maggior parte degli alunni sceglie scuole tecniche e professionali, quelli che hanno ottenuto risultati migliori scelgono i licei classico, scientifico, socio - psico - pedagogico, linguistico. E' in atto in Italia una

Structure Of the School

It is quite significant how much educational and instructional autonomy is granted to the schools, who can program projects or interventions to meet educational and social needs that impact the atmosphere in which we work. I wrote and developed the curriculum and materials carried out in my school in scholastic year 1998/99. The curriculum includes (the schedule is weekly): Italian, history, education civics, geography (11 hours), religion (1 hour), mathematics (4 hours), sciences (2 hours), English (3 hours), French (3 hours), and arts (2 hours), technical education (2 hours), music (2 hours), and physics (2 hours). In addition, there are projects and electives: multimedia, Internet, Logo language, computer science, international Internet projects, theatre, Latin, logic, orienteering, sport activities, science labs, technical labs, remedial and enrichment activities. For all students there is personal health: sexual, sanitary, nutrition, and guidance with orientations to social, vocational, charitable services and educational associations.

Reorganization of the Resources

The pupils attend the school 36 hours weekly: 5 hours each morning, 3 hours each afternoon Monday and Friday. There are monthly reports on each student. The school where I teach is a state school (nearly all the schools in Italy are state schools); consequently the parents carry out several activities and have normal expectations for their children, and can choose from every type of advanced school: technical grammar schools, institutes, professional institutes, professional schools. Most students choose technical and professional schools, while others prefer classical grammars schools, scientific, partnership-pedagogical schools,

riforma per cui scompariranno la scuola elementare (5 anni), la scuola media (3 anni) e al loro posto ci sarà la scuola primaria (7 anni), quindi la scuola secondaria (5 anni), quindi gli alunni potranno iscriversi all'Università.

Riflessioni

Ci sono aspetti positivi nella riforma: gli studenti termineranno la scuola a 18 anni, invece che a 19 come avviene ora, quindi potranno un anno prima o accedere al mondo del lavoro o iscriversi all'Università. L'obbligo della frequenza della scuola è prorogato a 15 anni, invece che a 14 come avviene ora; quindi sarà obbligatorio frequentare 1 anno di scuola materna, 7 anni di scuola elementare, 2 anni di scuola superiore. Scompariranno inoltre i corsi di formazione professionale, che ora sono frequentati da ragazzi che si trovano in difficoltà a frequentare un normale corso di studi. Qualcuno si chiede se è giusto costringere tali ragazzi a frequentare 2 anni di scuola superiore, invece che imparare un mestiere.

language schools. There is a movement in Italy a reform in which the elementary schools (5 years), the medium schools (3 years) would disappear and in their place will be the primary school (7 years), secondary school (5 years) when the students would enroll in the University.

Reflections

There are positive aspects to the reform: students will finish their schooling by age 18, instead of 19. Therefore they would have an extra year to work or to enroll in the University. Compulsory attendance would extend to 15 years, instead of 14; therefore it will be obligatory to attend 1 year of maternal school, 7 years of elementary school, 2 years of advanced school. The course on personal and professional training would disappear, which would impact those who find difficulty with the normal curriculum. Some question the fairness of forcing such students to attend 2 years of advanced school, and then learn a trade.

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