Addressing Women's Ways of Knowing to Improve the Technology Education Environment for All Students

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I often help my female friends to negotiate parts of the technical world. For one it may be going on a car buying expedition, for another it may be a computer installation, and for yet another it may be the replacement of rotten boards on a front porch. They know that I enjoy such expeditions and, I hope, that they actually believe that I can be helpful.

One recent Labor Day weekend I was engaged in helping a friend to replace the worn and damaged boards on her front porch. We worked the day away, pulling boards, removing rotten wood, and replacing it with solid wood. As we worked, I thought about how she probably had not been given much instruction in how to use tools and to construct with wood. Nonetheless, she was trying to do a simple household repair in order to save herself money. Her skills and tool selections were clear evidence of a lack of technical knowledge and her plans for the repair process, while adequate, needed some improvement. Probably, I thought, like my own school experiences, she did not have the opportunity to study "industrial arts" when she was going to school. Yet, I was concerned because young women today, given the opportunity to do so, are still not taking technology education courses in great numbers. Women and girls often perceive the subject of technology education as a male domain, especially after they have had a course in technology education (Hendley, Stables, Parkinson, & Tanner, 1996; Bame, Dugger, & deVries, 1993; Bame & Dugger, 1990).

Yet, women are technologists. Women are and have always been significant contributors to the making of the environment of which we are a part. Every woman has been a technological being, using and often inventing tools, materials, and processes in order to adapt and modify her world. Their contributions have been either focused on the traditional homemaking roles of females, or they have been diminished in the records of industrial and economic spheres (Wajcman, 1991). In addition to diminishing the role of women in technology and engineering, many technical occupations, including science, have a low representation of women. Are there differences between women and men which might influence their choice of study and which need to be addressed? Can technology educators begin to address the lack of participation

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of women and girls in technology education without understanding the potential for differences between men and women with regard to technology and to education? I want to explore these questions by discussing feminist theories of science and technology and of women's ways of knowing in order to bring cultural feminists' concerns to the attention of technology educators.

Feminist Theories

There is a rainbow of feminist theories which suit the ideological bent of women who espouse them. In an overview of feminism, Donovan (1994) described feminists as liberal; cultural; related to other theories such as Freudianism, Marxism, existentialism, etc.; radical; promoting a new feminist moral vision; and ecofeminists. Essentially, *liberal_feminists* have called attention to the inequality in society and have proposed remedies to that inequality. *Cultural feminists* have created a rationale for the differences in male and female cultures. *Feminists influenced by other philosophies* such as existentialism and postmodernism have interacted with those philosophies by both applying them to feminist ideas and principles and influencing the root philosophy with feminist ideas and principles. *Radical feminists* blame patriarchy as the cause of all societal problems and seek to supplant it with women's modes of thinking and acting. *Ecofeminists* incorporate several of the previously mentioned views into a theory of feminist values for the good of the environment. *Feminists of the new moral vision* integrate cultural feminism sans radical feminism in order to address inequity to create, for women and men, not just inclusion in a male dominated society, but a means of promoting the value of women's ways of thinking and acting. It is this category of feminist thought which underpins the discussion here.

Science, Technology, and Gender

Clearly, the dominant culture in Western society is the male culture, not by size but by influence. Evidence of this exists in the roles which women take on in relation to men, the valuing of traditional female roles in economic theory which historically has not factored in the contributions of women in the home (Fee, 1986; Rose, 1986; Donovan, 1994), the traditional use of language to prefer male pronouns to indicate all humans (Minnich, 1990), and the inability of politicians and citizens to successfully support an equal rights for women amendment to the Constitution. These and many other indications of the subjugation of the female in a hierarchy of value are explicitly evident in Greek philosophy, the bedrock of Western thought (Donovan, 1994; Minnich, 1990; Harding, 1986; Fox Keller, 1985). Essentially, women are relegated to second class status or invisibility in Western culture.

There are some who doubt the power of language and "ancient" philosophy, but Greek philosophical concepts persist in our culture through our use of language. About using the generic term "Man," Minnich (1990) provides a powerful illustration by using the rules of syllogistic logic that have been handed down from Greek philosophers.

> Consider the famous syllogism: 'Man is mortal. Socrates is a man. Therefore, Socrates is mortal.' Try it with a woman: 'Man is mortal. Alice is_____' what? A man? No one says that, not even philosophers. 'Man,' the supposedly generic term, does not allow us to say, 'Alice is a woman.' Then what are we to deduce? 'Therefore, Alice is_____ ____' what? …Reason flounders; the center holds, with Man in it, but it is an exclusive, not universal or neutral, center. Alice disappears through the looking glass. (Minnich, 1990, p. 39)

The use of language is powerful in shaping our thoughts (Wright, 1992), but Greek philosophy has shaped more than our thoughts through the use of language. It has shaped our actions.

Modern science is based in the rationalism and logical positivism inherited from our heritage of Greek philosophy (Longino, 1990; Arrington, 1989; Harding, 1986; Fox Keller, 1985; Bernstein, 1978). The rationale and argument which reinforced the duality of logic as science and emotion as nature and assigned gender characteristics to these concepts is found in Greek philosophy, especially the philosophy of Plato. According to a host of philosophers, both male and female, modern science is founded upon Plato's philosophy (Longino, 1990; Arrington, 1989; Harding, 1986; Bernstein, 1978), Fox Keller (1985) summarized this thinking.

> Modern science can thus be said to be following Plato's script, but without heeding his cautionary advice. In this script it appears inevitable that intercourse with physical nature evokes the domination and aggression appropriate to women and slaves. (p. 31)

Western science and technology have evolved based upon the concept of predicting and controlling nature, and nature has been assigned the female gender by Western philosophers.

Adding to the philosophy which has enabled the growth of Western science and technology was Bacon who furthered the arguments for power and domination of nature. Bacon helped to further separate the world into a duality, the mind as knower (masculine) and nature (feminine) as the knowable, a division into man as knower and subject and woman as knowable and object, placing man the subject and knower in control of women the object and knowable.

> Through science and art (that is, technology, or mechanical art), man can find the power to transform not so much the world as his relation to the world. The goal of science was, for Bacon, 'the restitution and reinvesting of man to the sovereignty and power …which he had in his first state of creation' [Robertson, 1905, p. 188]. (Fox Keller, 1985, p. 35)

In Western philosophy, through the language and metaphor, as well as through the history of practice, science and technology have become intertwined and linked to masculinity. Linked to science through the concept of applied science, technology assumes the masculine connotations given to science as an

activity of power and conquest over nature. As an activity in itself, technology is an attempt to control nature, becoming another example of where gender assignment is made to the subject as control. Reinforcement of gender characteristics is carried out in duality of technology and nature and the metaphor of technology as masculine dominating nature as feminine.

> Masculine here connotes, as it so often does, autonomy, separation, and distance. It connotes radical rejection of any commingling of subject and object, which are, it now appears, quite consistently identified as male and female. (Fox Keller, 1985, p. 79)

While Bacon provided stepping stones of ideas for the growth of Western philosophy of science, Descartes has been given the credit for reifying the masculinization of Western scientific and technological thought (Bordo, 1987; Harding, 1986). Philosophers tend to agree that Descartes provided the arguments and rationale for attributing masculinity to rational and logical thought in science and technology.

> The notion that the project of modern science crystallizes 'masculinist' modes of thinking has been a prominent theme in some recent writing: '[What] we encounter in Cartesian rationalism,' says Karl Stern, 'is the pure masculinization of thought.' The scientific model of knowing, says Sandra Harding, represents a 'super-masculinization of rational knowledge.' 'The specific consciousness we call scientific, Western and modern,' claims James Hillman, 'is the long sharpened tool of the masculine mind that has discarded parts of its own substance, calling it 'Eve,' 'female' and 'inferior.'' (Bordo, 1987, p. 249)

Descartes provided for the separation of subject and object in philosophy and in science and technology, separating thought and logic from nature. Separation and individuation are strong themes in Descartes work with separation and detachment as essential characteristics for the scientific and technological mind (Bordo, 1987; Fox Keller, 1985). According to Descartes, achieving this separation depends upon a "rebirth," one which sheds the mystical and illogical images of nature so predominant during the Middle Ages. This change to autonomous logic is needed in order to reconstruct knowledge, especially scientific and technological knowledge, and the mysticism of nature is cast as feminine in order to separate logical thought from nature.

> Situating this masculine birth—or more precisely, *re*-birth—within the context of the cultural separation anxieties described earlier, it appears not only as an intellectual orientation but as a mode of denial as well, a reaction formation to the loss of 'being-one-with-the-world' brought about by the disintegration of the organic, centered cosmos of the Middle Ages and Renaissance. The Cartesian reconstruction of the world is a defiant gesture of independence from the female cosmos—a gesture that is at the same time compensation for a profound loss. (Bordo, 1987, p. 259)

Philosophers of all schools have given credit to Bacon and Descartes for creating the ideological framework for the growth of Western science. Much of the way in which science and technology are conducted today is a result of these fundamental ideas which shaped the procedures of science. Yet, as with any human endeavor, the influence of Bacon and Descartes has not been permanent, as the conduct of science continues to evolve. Many philosophers, especially those of the Frankfurt school (Gebhardt, 1987; Fee, 1986) have and are contributing to the reunification of the subject and the object in order to both develop new ways of conducting science and technology and to explain the reality of what is happening as science is conducted and technology is created (Bernstein, 1978). A continual revolution of scientific thinking as described by Kuhn (1970) is taking place. To this revolution, feminists have much to contribute to the dispelling of the Cartesian duality in philosophy and science, and eventually, in daily life (Donovan, 1994, Fox Keller, 1985). Feminist theories can influence how educators conduct education in general and how technology educators specifically conduct their classes in order to be inclusive.

Women's Ways of Knowing

The current discussion of women's ways of knowing in feminist literature represents a severe critique of liberal feminism. Essentially, the position of a number of current feminists is that women, constituted as the other, do function in different ways than men and that their ways of knowing have much to offer in the reconstruction of theory. Using the discussion of cultural differences, contemporary feminists are trying to create an alternate theory and scientific methodology based upon the differences of women. The purpose of this is not to destroy science, but to continue the evolution of science (Fox Keller, 1985; Fee, 1986; Rose, 1986).

Two thrusts are evident in women's literature about science: discussing the masculine bias as outlined above and arguing for a different, feminist influence in science. The framework of ideas for a more inclusive form of science include:

> One in which no rigid boundary separates the subject of knowledge (the knower) and the natural object of that knowledge; where the subject/object split is not used to legitimize the domination of nature. Where nature itself is conceptualized as active rather than passive, a dynamic and complex totality requiring human cooperation and understanding rather than a dead mechanism, requiring only manipulation and control…the scientist is not seen as an impersonal authority standing outside and above nature and human concerns, but simply a person whose thoughts and feelings, logical capacities, and intuitions are all relevant and involved in the process of discovery. (Fee, 1986, p. 47)

This form of science is not considered to be the exclusive domain of women, but of both sexes. The purpose of such science is to enable scientists to continue to progress, revising faulty interpretations and theories which rested on the assumption of masculine power and domination (Bleir, 1986).

Harding (1987) characterizes such a science as having new empirical and theoretical resources of women's experiences, new purposes for social science as women, and new subject matter for inquiry by locating the researcher in the same critical plane as the overt subject matter. Essentially, this kind of science is being developed in many areas. One of the most famous illustrations of this change in the view of science has been detailed by Fox Keller (1986) in her biography of Barbara McClintock. As a Nobel Laureate for her pioneering work in the plant genetics, McClintock's approach to her study involved a more contextual research process by observing the growing of corn in fields, the natural environment; holding back on hypotheses and imposition of answers; and valuing the exceptions. Another area of research which has benefited from feminist conceptions of theory and paying attention to women's ways of knowing has been the work of primatologists as outlined by Reed (1978), Haraway (1986; 1989), and Hrdy (1986) and as given notoriety by the work of Dian Fossey with mountain gorillas. Fossey and other women have been able to reinterpret, explain, and develop more accurate primate theory by rejecting masculine theories of domination and control in primate societies and by observing, closely, the actual interactions and social behaviors of primates.

While women's participation has been changing the way in which science is conceptualized and conducted as illustrated by the previous examples, a specific area of behavioral science, psychology, is also being questioned and revised with a concern for eliminating the inherent gender bias in Western science. This revision is directly related to differences in women's ways of thinking and knowing.

Most important to this discussion has been the reinterpretation of moral development offered by Belenky, McVicker Clinchy, Rule Goldberger, and Mattuck Tarrule (1986) in psychology. Because of a growing interest in women and of science based upon women's lives, Belenky et al. (1986) took a new approach to the theoretical work of Kohlberg on moral development and repeated the research of Perry (1970) in order to investigate the moral development of women.

Perry's original work focused on the moral thinking of Harvard undergraduates who were at the time a predominantly male population. Perry's influential work describes "how students' conceptions of the nature and origins of knowledge evolve and how their understanding of themselves as knowers changes over time" (Belenky et al., 1986, p. 9). Perry traced a series of student perspectives which he called positions and categorized them as: position one, *basic duality*, where views are in opposition as in dichotomies of right/wrong, black/white, etc.; positions two through four, *multiplicity: pre-legitimate, subordinate, correlate or relativism subordinate,* where there is an incorporation and acceptance of other points of view and a realization that authorities may not have the "the right" answer leading to a growing dependency upon a personal interpretation; position five, *relativism: correlate, competing, or diffuse,* where an analytical view of knowledge is developed and perceived as a way of knowing without commitment; and finally, positions seven through nine, *commitment foreseen, orientation in implications of commitment, or developing commitments*, where the contextual nature of knowledge is accepted and

commitment as a necessity for action is accepted (Perry, 1970; Belenky et al., 1986).

Belenky et al. revised Perry's research to incorporate a population of women and included in that population not only college students, but also women from various ages and occupations. Their research results were similar, yet different in that there were particular differences in the way in which women experienced knowing. Their perspectives were: *silence*, a condition in which women did not speak out; *received knowledge*, listening to the voices of others; *subjective knowledge*, listening to the inner voice and a quest for one's own identity; *procedural knowledge*, looking for reason and becoming aware of separate and connected knowledge; and *constructed knowledge*, integrating the voices of all with respect to context.

Perry's theories have been influential in psychology and in education, especially higher education, as faculty look toward helping students to grow intellectually. Belenky et al. (1986) offer an interesting and viable addition to Perry's (1970) theories as educators begin to adopt the cultural feminist argument that there are differences in the way in which women experience and, therefore, think about the world. Certainly, women as silent receivers of knowledge, rather than constructing their own knowledge, is an important factor in the education of women. These positions are not represented in Perry's (1970) theories, and while the next few positions identified by Belenky et al. (1986) are similar to Perry's (1970) positions, the final position of constructed knowledge which involves paying close attention to context, wanting to know and to represent the knowledge of others in order to inform thinking, is not as well represented either in Perry's (1970) theories or in the traditional conceptualizations of science.

If women do think and learn differently than men, then we need to address those differences in education, especially in the context of technology education where there is a severe lack of women. It could be that technology educators have not examined the philosophy and psychology of women's thinking in order to learn how to be more inclusive of women in both technology education and creating technology.

Technology Education and Women's Ways of Knowing

By the lack of numbers, it appears as though women are avoiding the study of technology education (Welty, 1996). Young girls view it as a male subject (Hendley, Stables, Parkinson, & Tanner, 1996; Bame, Dugger, & deVries, 1993; Bame & Dugger, 1990). Some of this effect is due to a history of exclusion and stereotyping with respect to course of study, yet we do not seem to be changing the traditional separation of girls into home economics and boys into technology education (Wellesley College Center for Research on Women, 1995; Deem, 1978). For those few technology educators who are concerned about this problem, the discussion has centered on the "chilly" classroom effect known to exist in subjects not traditionally studied by many women (Resnick Sandler, 1982) and the "add women and stir" method of resolving the problem. Unfortunately, "add women and stir" has not been known to be a successful cure

in other subjects (Minnich, 1990). It appears as though the problem is much deeper than socializing girls and women into the existing hierarchy. Perhaps, we need to rethink the hierarchy and technology education content and practice.

The descriptions of women's ways of knowing have multiple meanings for technology educators. Some of the ideas help to cast doubt on and dispel the dominance of masculine thinking in science and technology. The arguments could lead to reconceptualizing science and technology as we now know it, incorporating a larger concern for context and environment and a diminishing concern for control and domination. As the school subject representing the study of technology, technology education has been a male controlled subject matter defined by males (Welty, 1996). Technology educators could revise their view of the role and purpose of technology, especially as they approach the study of technology in the classroom. Another way that this information could influence technology educators is the way in which they construct activities for children in classrooms. If women are to be attracted to a study of technology, both the value and purpose of technology and the way in which it is taught must be changed.

Several women in other educational fields have tried to provide direction in order to help teachers to implement feminist ideals in their pedagogy. Certainly, these ideas are not new and they are advocated by male educators seeking to improve the practice of education in general. The ideas focus on creating a critical pedagogy. Goals, based upon feminist theory include restructuring the subject matter (Welty, 1995, 1996; hooks, 1994; Miller, 1993; Minnich, 1990; Langland and Gore, 1981), revising language (Minnich, 1990; Rosser, 1986), creating a humane classroom (Miller, 1993; Weiler, 1988; Rosser, 1986), and integrating cognitive and affective learning (Welty, 1995, 1996; Rosser, 1986). These goals relate to the issues of revising the subject matter and recognizing women's ways of thinking and acting mentioned above, and, they go far beyond a simplistic add women and stir.

Restructuring the Subject Matter: A Revised and Critical View of Technology

Feminists as well as many men are suggesting alternatives to the traditional masculine models of power and domination for the reconstruction of technology (Wajcman, 1991; Franklin, 1990). In a series of lectures, Franklin described the current state of technology as a system and as practice linked to culture. She defined technology as prescriptive and depending upon compliance, leading to isolation, control, and planning to maximize efficiency. These thoughts are echoed by a number of women who have studied the interaction of women and technology (Wajcman, 1991; Kramarae, 1988; Davies, 1988; deLaurentis, 1987). Franklin (1990) noted the feminist critique of technology and its intent to revise, not destroy science and technology. As an engineer, herself, she does not seek to destroy technology as we know it, but to redefine technology. While noting that the technologies, advocates for change, and means to change exist, Franklin (1990) called for a conserver society in which technological decisions are made with humility by taking into account nature and people first. In order to do this she recommends that we listen to ecofeminists and cultural feminists and learn to communicate with each other in order to examine the costs and benefits of our technological choices to society. The purpose of this would be to

develop technologies which are appropriate in scale and application. Finally, she suggests that, "We must protest until there is *change* in the structures and practices of the real world of technology, for only then can we hope to survive as a global community" (Franklin, 1990, p. 130).

More technology educators could begin to address the subject of technology education with a critical view focusing on the role of technology as a system and as practice in which there are choices about our future course of action. This approach to teaching about technology has been implemented in what I have previously called a social reconstruction curriculum design (Zuga, 1992) and it is being implemented by some of those who are advocating design and technology education as problem centered situated learning. It is not, however, inherent in the problem solving process in that many technology education problems are designed to be the antithesis of these ideas and advocate competition and efficiency first. Implementing a social reconstruction curriculum design in technology education encourages thoughtful critique of the status quo and existing practice with respect to technology.

Feminist theorists have created an interpretation of technology as a largely masculine enterprise, relying upon domination and control of the environment. Ecofeminists have critiqued patriarchy as being largely responsible for technological abuses of nature and suggest alternatives driven by feminist ideals for addressing environmental concerns (Donovan, 1994). Technology educators interested in studying the environment and discussing the nature of technology in our society can incorporate the feminist critique, as well as critiques based upon race and class, of technology into the curriculum of technology education (Welty, 1995, 1996).

Using feminist, racial, and class theory and critique would give voice to the concerns of not only women, but also other underrepresented groups in the content of what is taught as technology education. Comparing all of these critiques to the ongoing critique and discussion of technology would allow students to contrast thinking about technology in order to look for similarities and differences. More important, the critical discussion of technology and the way in which we, as a society, choose to implement technology, especially as a society in which gender, race, and class structures create inequities in power, would give students insight into how to subvert prescriptive technologies in favor of developing redemptive technologies. Addressing the critiques of technology would benefit all students by helping them to understand that technology is a debatable practice with both positive and negative consequences for the environment and different groups of people. Teaching about the critiques of technology and their corresponding philosophical rationales would add depth and rigor (hooks, 1994; Kalia, 1991; Weiler, 1988) to the study of technology.

Revising Language: Paying Closer Attention to Explanation and Context

According to Belenky et al. (1986) women generally need to understand the context of an idea and to have a thorough explanation. This is a way in which technology teachers can revise language which goes far beyond the concern for gender, race, and class biased language in the classroom. The initial and

superficial remedy for a chilly classroom is to revise one's vocabulary to be inclusive, but actions must be revised, also. Adequate explanation and contextual description is an important way to improve instruction for a number of students.

While judging at a 4-H woodworking event one summer, a young girl told me that her technology teacher never helped her to learn about how to do things. She said, "He doesn't explain things well. I never get anything out of him and I follow him around all the time asking." I am sure that her teacher thinks he has adequately explained the processes to her. I suspect that she has a much higher need for human interaction than her teacher realizes. Some students will need to have a higher degree of explanation and contact with the teacher. Many of these students may be women who are exhibiting the characteristics of women's ways of thinking. However, all students would benefit from more attention to explanation and context from any teacher.

This idea can also be related to the way in which we each approach putting together a new item that has "some assembly required." Some of us need to read the directions and some of us just dive into the box, pulling out parts and putting them together. Some of us have a high need for explanation, others, do not. Using language involves providing adequate explanation and contextual information for students.

There is another aspect of using limited explanation that relates to power and control. Keeping information to oneself, through brief or omitted explanation, allows teachers to maintain a position of privilege as "expert" and keeper of the knowledge (Lewis and Simon, 1991). All students would benefit from more detailed explanation and knowledge sharing. Students, themselves, should be encouraged to share their own knowledge and expertise. Technology teachers need to rethink their use of language in the classroom to eliminate not only sexist, racist, and classicist language, but also to include adequate explanation rather than terse comments. Moreover, technology teachers need to include women and all students in the educational discourse, providing them with a voice in order to strengthen students' involvement and understanding of the subject matter (Lewis and Simon, 1991).

Creating a Humane Classroom: Recognizing Women's Ways of Knowing and Acting

In addition to the concerns presented above with respect to revising language, technology educators need to observe and think about how women use technology. Women as technology users often co-opt the technology as originally designed and utilize it to further their values, particularly their need to communicate (Wajcman, 1991; Kramarae, 1988). From the telephone to e-mail, as women have encountered communication technologies they have been quick to utilize them to maintain contact with other people, displaying characteristic women's ways of knowing such as having a need for context and explanation. Women as a group have also approached the use of computers, especially computer games, with some differences (Collis, 1991). Not as many girls as boys are as entertained by the "shoot 'em up" games, yet they do engage in the "building up" games and use the creative tool software. In recent research about

gender differences with respect to technology, Welty (1996) found that women identified communication and medical technologies more frequently than men. Technology educators need to understand that women's values will enter into their valuing and use of technology and that women will find ways of using the technology for their own priorities, just as any one should.

Using design briefs as cooperative activities is a good way to initiate change based in feminist theories (Scott and McCollum, 1993). When technology teachers create activities such as design briefs for students, some knowledge and empathy with women's ways of knowing and acting could help them to create design briefs that might be of interest to girls and women. Not everyone wants to design a machine tool. Some women do, yes, but others may be more interested in designing a device to aid a handicap, a decorative item, toy, or other object that would require the same knowledge and skills as designing and making a machine tool. What seems to be valid and appealing to teachers may not always be appealing and valid to students, both females and males.

The ideal would be to identify the concept, processes, and skills, which need to be taught and cast them into a design brief which would allow each student to interpret the solution as she or he sees fit. A good example of this kind of activity is discussed in research on problem solving by McCormick, Murphy, Henessey, and Davidson (1996) where in a technology class students were to devise moisture sensors and to provide an application for them. One of the students in the class created a fake stocking to hang on a clothesline in order to sound an alarm when it rained. This application is unique to the student and not something that would be suggested by most technology teachers.

Integrating Cognitive and Affective Learning: Discussing Values Related to Technology

Based upon the discussion of the inherent masculine values in the creation and conduct of science and technology as presented by several feminist theorists, it is difficult to deny that values are not a part of the curriculum. It is from the feminist discussion that we can see that the denial of values, the separation of subject and object, leads us to reproducing default values of masculinity which influences science, technology, and the curriculum. In any human endeavor, values are inescapable. Teachers need to begin to address and to incorporate values in their curriculum through study of various value positions, discussion and critique of values, and value laden activities in order to avoid hegemony, the unconscious reproduction of values.

Technology education is often approached as a series of processes and techniques that are taught in isolation of the affective values which accompanies all human activity. There are many technology educators who are trying to revise the curriculum of the field in order to include a broader knowledge base and the values associated with technology, particularly the technological systems (DeVore, 1980; Snyder & Hales, 1981). More specifically, a number of technology educators are recommending the study of technology education from a social reconstruction perspective (Zuga, 1992; Gilberti, 1996). Social reconstruction curriculum confronts the value question by making the improvement of

society, a value-laden activity, a fundamental principle of curriculum selection and organization. Technology educators need to continue to blend the cognitive and affective aspects of technology education in order to improve technology education for all children. Adopting a social reconstruction curriculum design is one way to do this.

In addition to addressing the values inherent in technology (Scott and McCollum, 1993) to begin creating a participative, inquiry driven classroom, Miller (1993) suggests:

> Situated narratives of educational experience and inquiry, expressed in multiple versions and forms, offer ways into examinations of such complex intersections and constructions of both identities and curriculum. Current versions of such studies point to work in autobiography, including dialogue journals, life histories of students and teachers, descriptions and analyses of situated pedagogies and curricular practices, 'teacher and student lore,' and 'teachers' personal practical knowledge.' Autobiographical work within reconceptualized versions of curriculum particularly emphasizes the multiple constructions and reading of ones' and others' stories. (p. 51)

Technology teachers need to experiment with unique ways of permitting students to express their values with respect to technology in non-threatening ways through a combination of learning activities. As mentioned above, journals and other forms of writing can permit students to confront and to write about values without having to speak in public.

Summary

Teaching technology education in order to incorporate women's ways of knowing and experiencing is not a revolutionary educational idea. It involves recognizing that subject matter structures need to be changed as humans continually recreate the disciplines upon which they are based; that human behavior evolves and is changing to meet the needs of everyone; that educators need to be in the vanguard of change by creating classrooms in which all students can learn; and that in order to address the needs of all students, teachers must use teaching styles which address those disparate needs. It is educators' roles in society, as facilitators of the educational growth of children, to keep up with societal change and to incorporate those ideas and attitudes into their classrooms.

In thinking about concrete examples of how technology educators might do these things in order to transform their own practice, one has to start from a base of knowledge. We need not be afraid of the idea of feminism. There are excellent ideas in feminist texts and those ideas are not in contradiction with what we all want in our lives. Technology educators need to study feminist texts related to science and technology and to rethink their own philosophies and views of technology. Then, these ideas will begin to be incorporated into their curriculum and their teaching practice through a change in their behavior.

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