TRANSGRESSING THE TECHNOCRATIC CULTURE OF TECHNOLOGY EDUCATION:
Dominant and Other Stories of Teacher, Technology, Curricula, and Teaching

by
CHRISTOPHER BASTONE
B.Ed., The University of Victoria, 1974

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF ARTS
in
THE FACULTY OF GRADUATE STUDIES
Department of Curriculum Studies

We accept this thesis as conforming to the required standard

The University of British Columbia
April, 1995

© Christopher Bastone, 1995
In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of Curriculum Studies
The University of British Columbia
Vancouver, Canada

Date April 25, 1995.
ABSTRACT

This thesis is a study and transgression of the technocratic culture of technology education. The study problematizes technocratic ideology entrenched within the socialization of technology education teachers, common sense understandings of technology, technology education curricula, and industrial/technology education teaching practices. Knowledge is gained through life-history de/construction, socially critical examination of orthodox understandings of technology, technology education curricula, and classroom research in teaching social aspects of technology. Dominant and contrasting stories are revealed that describe and challenge the technocratic culture of technology education. The culture of technology education, from one teacher's perspective, is informed by the interpretative frames of industrial/technology educators, a technocratic consciousness within society, historical practices of industrial arts, and current political forces that shape technology education curricula. The author, as a classroom teacher, comes to a critical consciousness of personal and professional saturation in technocratic ideology. The story is told of the author's dislodgement from technocratic metanarratives and the growth of a heightened social consciousness of self, technology, curricula, and teaching. Such accounts infringe upon, or transgress, the near totalizing grip of technocratic consciousness within the culture of technology education. The study concludes that there is strong evidence of ingrained technocratic orientations within technology educators, common sense understanding of technology, curricular emphasis, and teaching practice and of the necessity to challenge such dominance. Possibilities are discussed for pedagogical practices that emphasize a critical, social, and cultural intelligence, rather than just a technical intelligence, in technology. While a technocratic culture for technology education may contribute to the goals of a technocracy, it is detrimental to the growth of an informed and critical democratic citizenry.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ABSTRACT</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES AND ILLUSTRATIONS</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGMENT</td>
<td>vi</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>vii</td>
</tr>
<tr>
<td>CHAPTER I INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Problems, Aims, and Questions</td>
<td>1</td>
</tr>
<tr>
<td>Terminology</td>
<td>3</td>
</tr>
<tr>
<td>Background</td>
<td>5</td>
</tr>
<tr>
<td>Methods of Research</td>
<td>6</td>
</tr>
<tr>
<td>Life-History Reflection</td>
<td>6</td>
</tr>
<tr>
<td>Socially Critical Reflection</td>
<td>8</td>
</tr>
<tr>
<td>Classroom Research</td>
<td>10</td>
</tr>
<tr>
<td>Assumptions of the Writer</td>
<td>11</td>
</tr>
<tr>
<td>Extent of Investigation</td>
<td>13</td>
</tr>
<tr>
<td>Significance</td>
<td>13</td>
</tr>
<tr>
<td>Organization of Thesis</td>
<td>15</td>
</tr>
<tr>
<td>CHAPTER II TEACHER: BEYOND DOMINANT MEN</td>
<td>18</td>
</tr>
<tr>
<td>Acknowledging Complexity: Multiple Men in the Man</td>
<td>21</td>
</tr>
<tr>
<td>Dominant Man 1.00: Technical Specialist Man</td>
<td>25</td>
</tr>
<tr>
<td>Dominant Man 1.10: Industrial Education Man</td>
<td>32</td>
</tr>
<tr>
<td>Undefined Man: Intuitive Inquirer/Socially Critical Man</td>
<td>34</td>
</tr>
<tr>
<td>The Dominance of a Technocratic Orientation</td>
<td>39</td>
</tr>
<tr>
<td>Destabilizing Dominant Men Within: Discovering Transformative Man</td>
<td>42</td>
</tr>
<tr>
<td>From Life-Narrator to Border-Crosser</td>
<td>47</td>
</tr>
<tr>
<td>CHAPTER III TECHNOLOGY: UNTHINKING MASTER NARRATIVES</td>
<td>49</td>
</tr>
<tr>
<td>Beyond the Technical: Social/Cultural Understandings of Technology</td>
<td>53</td>
</tr>
<tr>
<td>Technological Sleepwalking: Uncritical Acceptance of Dominant Narratives</td>
<td>60</td>
</tr>
<tr>
<td>The Master Tale of Technological Determinism</td>
<td>61</td>
</tr>
<tr>
<td>Deterministic Logic: Causes and Consequences</td>
<td>64</td>
</tr>
<tr>
<td>Optimism and Technophilia</td>
<td>67</td>
</tr>
<tr>
<td>Undervalued Accounts: Pessimism and Technophobia</td>
<td>71</td>
</tr>
<tr>
<td>Revealing Accounts: Technology as a Social Construction</td>
<td>76</td>
</tr>
<tr>
<td>Acknowledging and Valuing Complexity: Contextualism</td>
<td>80</td>
</tr>
<tr>
<td>Technocratic Metanarrative as Common Sense Reality</td>
<td>83</td>
</tr>
</tbody>
</table>
LIST OF FIGURES AND ILLUSTRATIONS

Figure 1. Multiple Men in the Man. ................................................................. 21
Figure 2. "Restricted and general meanings of technology" (Pacey, 1983). .......... 57
Figure 3. Determinist and contextualist "stories" of technology. ......................... 81
Figure 4. Interpretation of Giroux's (1992) "cultural script".................................. 92
Figure 5. "Masculinity = tools = products" T-shirts. ........................................ 130
ACKNOWLEDGMENT

I wish to thank a number of people who helped contribute to this thesis. First to thank are my mother Lorna, who encouraged me to enter teaching, and my father Arthur who encouraged me to remain in teaching and not enter chiropractic college. It is the unique influences of my parents, my mother’s keen sense of social justice and sensitivity to other’s welfare, combined with my father’s broad mastery of technique, that contribute to an integration of these two aspects in my approach to teaching technology. I wish to thank my thesis committee for their assistance. Dr. Jim Gaskell, as my thesis chair, provided wise counsel. Also, as a teacher of the social area of technology, Jim helped broaden my understanding of technology. Bill Logan has been much more than my host professor and the one who encouraged me to start my M.A. I thank Bill for his years of support, friendship, and wisdom. I also appreciated the perspectives, insight, and feedback from Dr. Linda Peterat.

This thesis involved much more than a technical examination of technology education. It involved questioning many of my taken-for-granted assumptions of viewing the world and a transformation from dominant technocratic ways of knowing. Such transformation was at times traumatic and I must thank all the critical helpers in my life who were there to listen, encourage, and support: Heather, Pat, Linda, Elizabeth, Noel, Mark, Lindsay, Paul, Jenny, David, and Judy. I also wish to thank the following professors for sharing their unpublished manuscripts: Drs. Steve Petrina, Ken Volk, and Karen Zuga. I also thank Dr. Graeme Chalmers, Linda Watson, and the British Columbia Teacher’s Federation for their help. The honesty, openness, and thoughtful ideas of my students at Windsor Secondary have always been the invigorating force keeping me in teaching. I appreciate what they have taught me.
DEDICATION

I dedicate this thesis with love, gratitude, and great respect to my parents,

Arthur and Lorna Bastone

I also wish to preserve the memory of three special teachers. Two of these teachers were members of my family who passed from this life during the writing of this thesis. My grandmother, Gladys Steele, (1893-1993) witnessed the unfolding of 20th century technology from the first motor cars, electric lights, and motion pictures. Although she was amused by the many technological developments she saw in her life, she did not equate it to “progress”. The techniques important to her were ones that included sewing, baking, playing the piano, prayer, and teaching Sunday School. Her technologies revolved around people, family, caring, and faith in God.

Carolyn Schwam (1942-1993), my cousin, was an elementary art educator. Her tendency to put people and their creative pursuits first, challenged her family and friends to rethink their priorities. As a dedicated artist, she took great joy in sharing her work. Technologies important to Carolyn were those which aided creative expression. In their own way, both Carolyn and Gladys, challenged the conventional wisdom of their day and were talented, courageous, and dedicated women.

Ron Seal was the Chair of the Division of Industrial Education at the University of British Columbia during my enrollment. I am grateful for Ron’s insistence of a required course in design taught by Roy Lewis. I believe the course provided male technical specialists with opportunities to experience interpretive frames other than technical ones.
CHAPTER I INTRODUCTION

This thesis is a study and transgression of technocratic ideology that informs the culture of industrial/technology education. Such ideology should be understood and transgressed in order to realize curricular claims that technology education involves the study of the social and cultural significance of technology. The cultural dimensions of technology education investigated in this thesis focus on a teacher, understandings of technology, curricula, and teaching.

Problems, Aims, and Questions

The problems addressed by this thesis are:

1. Many industrial/technology educators, by way of their socialization within the realm of male technical specialists and the profession of industrial/technology educators, understand technological activity in a technical rather than contextual sense.

2. Common sense understanding of technology sees it as value-neutral and context-free. Such understanding perpetuates narrow technical conceptions and simplifies social and cultural understanding.

3. The culture of technology education is entrenched in a technocratic ideology inherited from industrial arts. Such ideology is sustained by the technocratic influences of school culture, school reforms, and business and industry.

4. Contemporary technology education curricula, in theory, claim a social study of technology but, in practice, emphasize technical aspects.
5. Within the professional literature of technology education, there is little or no discussion of possibilities for curricula that help students examine underlying assumptions, beliefs, and values of technocratic culture.

6. There is little discussion in technology education of teacher's experiences, particularly, experiences of teachers who attempt to gain a social/cultural understanding of their work.

This thesis aims to:

1. increase understanding of the socialization processes experienced by male technical specialists and industrial/technology educators;
2. draw attention to the potential for industrial/technology education teachers, to dislodge themselves from technocratic frames of interpretation;
3. examine critically common sense accounts of technology;
4. research social, cultural, and contextual accounts of technology;
5. locate technology education within the technocratic milieu of schooling, school reforms, and business and industry;
6. trace the technocratic ideology of technology education to its origins in industrial arts and manual training;
7. stimulate discourse toward broad based and socially transformative technology education curricula;
8. suggest strategies for helping technology education students gain a cultural understanding of technology, their society, and themselves.

In reference to four cultural dimensions of technology education: industrial/technology education teacher, common sense understanding of technology, technology education curricula, and practices of teaching, the following critical questions are addressed:

1. How is entrenched technocratic ideology manifested?
2. What is problematic with entrenched technocratic ideology?
3. What possibilities exist for transgressing technocratic ideology?
Terminology

**Common Sense:** Ordinary understanding that leads to standardized, orthodox, or conventional views.

**Culture:** The accepted set of beliefs, practices, ideologies, and values of a social group.

**Ideology:** Ideology often refers to a belief system that legitimates power of one social class over another. However, ideology is used in this thesis in the sense that Bowers (1977) describes: "an interlocking set of beliefs and assumptions that make up the background or horizon against which the members of society make sense of their daily experience" (p. 35). It is assumed that ideology is socially constructed and shapes the interpretative frames used for understanding reality. Ideology holds particular meaning for teachers. Giroux (1988) describes ideology as

...a dynamic construct that refers to the ways in which meanings are produced, mediated, and embodied in knowledge forms, social practices, and cultural experiences. In this case, ideology is a set of doctrines as well as a medium through which teachers and educators make sense of their own experiences and those of the world in which they find themselves. ...an understanding of how ideology works presents teachers with a heuristic tool to examine how their own views about knowledge, human nature, values, and society are mediated through the 'common-sense' assumptions they use to structure classroom experiences. (p. 5)

Common sense assumptions "need to be evaluated critically by educators" (ibid, p. 5).

**Industrial/technology education:** The term combines the past identifier "industrial" and the more recent identifier "technology". Industrial arts is still in the early stages of change to technology education.
Technical: Technical refers to the tools, processes, products, and knowledge aspects of technological activity (as opposed to cultural, social, and organizational aspects).

Technique: Technique is a particular way of doing something. "The skills, methods, procedures, and processes that people perform in order to use tools" (Bush, 1983, p. 155). Also known as "technical means".

Technology (common sense/technical): "The organized systems of interactions that utilize tools and involve techniques for the performance of tasks and the accomplishment of objectives". (Bush, 1983, p. 155)

Technology (cultural/social):

Technology is a form of human cultural activity that applies the principles of science and mechanics to the solution of problems. It includes the resources, tools, processes, personnel, and systems developed to perform tasks and create immediate particular, and personal and/or competitive advantages in a given ecological, economic, and social context (Bush, cited in Bush, 1983, p. 164).

Technocratic: Traditional meanings of “technocratic” refer to governance by technical experts (Burris, 1993). In this thesis, a simpler meaning of technocratic is technical fixation or preoccupation with technique. Technical ways of seeing, knowing, and being are characteristics of a technocratic orientation.

Tenets of technocratic ideology are: measurability, componentiality, self-anonymization, reproducibility, problem-solving inventiveness, and mechanisticity (Bowers, 1977, p. 37).

Transgression: Transgression refers to the notion of infringement. To transgress the technocratic culture of is to infringe or challenge its dominant ideology.

Background

This thesis is the story of an industrial/technology education teacher's search to improve practice through explorations into personal and public worlds. The study began as a curricular argument for technology education that advocated, in addition to traditional technical content, the inclusion of a critical social and cultural understanding of technology. As I researched meanings of technology from social constructivist standpoints, the partiality of my traditional frames of reference, as an industrial education teacher and male technical specialist, were increasingly revealed. I came to a deeper understanding of my own socially constructed subjectiveness and a heightened awareness of dominant social conditioners in my life. I gained a deeper sense of the social purposes of education in general, and industrial/technology education in particular. What started as an argument for the inclusion of a particular form of curriculum content, has enlarged into the story of how I dislodged from technocratic interpretive frames and crossed borders into other locations, perspectives, narratives, and tales of understanding self, teaching, technology, and curricula. The thesis describes four journeys that, taken together, situate my traditional interpretive frames as an industrial/technology education teacher within the larger contexts of schooling and society. The persistent theme, repeated in each story of teacher, technology, curricula, and teaching, involves coming to a heightened understanding of the partiality of dominant technocratic narrative and subsequent discovery of other stories.

---

1 According to Gough (1993) narrative “is a generic term covering the sequenced structuring of the culturally significant textual materials (words, metaphors, images, symbols, etc) and the textual practices we use to make sense of our world. From a poststructuralist perspective, subjectivity is constituted through discourses and formulated ... through narrative” (p.1).
and ways of knowing. All stories, my own and the retelling of others' tales, are told through the subjective frames of the storyteller.

Methods of Research

The research methods used in this thesis reflect my desire to derive knowledge through multiple interpretative frames. Methods selected reflect my intentional desire to utilize ways of knowing apart from the dominant positivist research paradigm of technology education (Zuga, 1995). To transgress the technocratic research culture of technology education I utilize life-history reflection, social critique, and classroom research.

Life-History Reflection

This thesis begins with an autobiographic account of particular experiences in my life as a teacher. Jackson (1990) points out that critical life-history work can play a useful part in redefining what counts as valid knowledge in public and private life. Life-history reflection is increasingly recognized as a valid form of knowing and provides significant insight into teacher's lives and practice (Goodson, 1990). For example, my life-history reflection reveals my socialization into frames of reference orientated to male technical specialist/industrial education ways of knowing the world. Cochran-Smith and Lytle (cited in Sparks-Langer and Colton, 1991) state that:

...what is missing from the knowledge base of teaching ... are the voices of the teachers themselves, the questions teachers ask, the ways teachers use writing and intentional talk in their work lives, and the interpretive frames teachers use to understand and improve their own classroom practice. (p. 41) [emphasis added]

Graham (1991) suggests that "writing autobiographically engages a conception of knowledge as a function of reflective self-consciousness and of the active construction and reconstruction of personal experience ...autobiography can be conceptualized as narrative undertaking" (p. 9).
As an industrial/technology and mathematics teacher immersed in cultures of technical thought and activity, the use of narrative is my deliberate acknowledgment of ways of knowing apart from those oriented in a technical/scientific/technocratic worldview and belief system. Burris (1993) explains that:

...scientific knowledge and instrumental reason have displaced narrative as the most fundamental way of knowing....While narrative discourse accepts science as one of many varieties of narrative cultures, science does not reciprocate with similar tolerance. (p. 47, 48)

Bowers (1977) explains that among professionals, including educators, a technocratic ideology has led to a devaluing of inner experience. "Discussions about inner experience are tactfully put down as dealing with a non-reality because it is neither observable nor measurable" (ibid, p. 39). A tenet of technocratic ideology is self anonymization (ibid) in which the reality of an individual's phenomenological experience is denied. It is difficult for a technocratic consciousness to interpret and value a subjective-phenomenological experience. Zuga (1995) indicates that most technology education curriculum research is done in the positivist paradigm and adds that:

Most frequently, the focus of this kind of research is about the beliefs of state supervisors and teacher educators, with just a handful of studies focused on teachers' beliefs and fewer studies on students' beliefs. These research practices illustrate either a hierarchical view with respect to the value of those people who are involved with technology education or a selection of research populations based upon convenience... (p. 19) [emphasis added]

Within the field of technology education curriculum research, driven by a positivistic and instrumental view of curriculum, narrative inquiry is sadly lacking. A teacher's voice, story, and experience adds a unique perspective to technology education discourse. Research into the phenomenological experience and interpretive frames of

---

2 Phenomenology is an educational philosophy that emphasizes the importance of an individual's self-directed discovery of their environment or phenomena in their life.
an industrial/technology education teacher broadens the research culture of technology education.

Initially, I felt that life-history reflection would be seen as a self-indulgent, narcissistic, navel gazing pursuit. A rational voice, relentlessly logical, used in my previous papers and life-worlds, spoke from the supposedly detached third person. Several factors pricked my conscience that it was hypocritical for me to talk solely, or to posture, in a rational, objective voice. As this thesis developed I became increasingly determined to provide other forms of knowing alongside that of a critical commentary and classroom research. Increasingly, as I reflected on my life-history, it became clear that I must reveal personal worlds through narrative writing. I did not want, however, my life-history work to become a "male memoir" account that would give the impression of objectivity, emotional detachment, and distance. A story of pretense, in a voice that offered the illusion of a unified, objective self, could not describe my experience. In particular, I wished to draw attention to multiple ways of knowing and the complexity of my socialization. Such narration, I felt would provide a sense of my different subjectivities and the tensions that exist between them. As a hitch-hiker's tale of inner and outer spaces, I deliberately switch voices between that of critical comment and my newly acquired voice of life-history narration. Through the process of life-history reflection I am increasingly sensitive to the subjectiveness of all discourse and narration.

Socially Critical Reflection

As opposed to "technical reflection" where "teachers as technicians" reflect on the best means to an end, teachers who critically reflect:

...begin to clarify their own beliefs about the purposes of education and to critically examine teaching methods and materials to look for the hidden lessons about equity and power that might lie therein....a reaction against an antiseptic, value-free, purely rational view of teaching and learning. (Sparks-Langer and Colton, 1991, p. 40) [emphasis added]
Insights into technology education culture are provided through socially critical reflection in all four cultural dimensions examined: my social shaping as a teacher, my teaching experience, common sense understandings of technology, and the world of technology education curricula. Socially critical reflection draws attention to the socially laden\(^3\) nature of curriculum with the intent of making more perspicuous issues of subjectivity. Tripp (1990) believes that:

> If teaching is a profession, it is not enough merely to keep improving the technical expertise of teachers... Teachers need to be more than excellent technicians to be genuinely professional. They need to have some understanding, influence over, and responsibility for the social conditions and outcomes of education. (p. 165) [emphasis added]

Since education is not a socially neutral undertaking, teachers need to investigate the social effects of their work. This thesis is a story of such involvement.

As a teacher, a socially critical stance is a form of resistance to becoming a professional technician. Teachers are in danger of becoming merely deliverers of curriculum (BCTF, 1995b). Giroux (1988) points out how educational reforms have had the effect of discounting teachers as socially transformative intellectuals:

> Unlike many past educational reform movements, the present call for educational change presents both a threat and a challenge to public school teachers that appears unprecedented... The threat comes in the form of a series of educational reforms that display little confidence in the ability of public school teachers to provide intellectual and moral leadership for our nation’s youth... Where teachers do enter the debate, they are the object of educational reforms that reduce them to the status of high-level technicians carrying out dictates and objectives decided by experts far removed from the everyday realities of classroom life. The message appears to be that teachers do not count when it comes to critically examining the nature and process of educational reform. (p. 121)

Education seems increasingly vulnerable to the whims of politicians and administrators and the desires of special interest groups. Teachers, as socially reflective public intellectuals, must play a central role in efforts to reform the school system. Teachers

---

\(^3\) Curriculum is never socially neutral. Embedded within all curricula are beliefs, world views, and particular forms of thought (Miller and Seller, 1990).
cannot engage in this role if they assume the role of the technician. There is a need to
defend "teachers as transformative intellectuals who combine scholarly reflection and
practice in the service of educating students to be thoughtful, active citizens" (ibid, p. 122).
Social critique provides important insight into the perspective of teachers and the
complexities of teaching. Through social criticism I show how predominant practice in
technology education is rooted in a technocratic world view and culture. Moreover, I
illustrate how it is possible to appreciate other cultures of understanding, not from a
distanced, detached standpoint, but from a heightened awareness of one's socially
constructed frames of reference. This thesis draws attention to one teacher's social
understanding of teacher, technology, curricula, and teaching.

Classroom Research

A third research method used in this thesis involves "classroom research" (Hopkins, 1985, p. 40) of teaching. Prior to undertaking classroom research for this
thesis, the writer researched various "action research" models and philosophies. Many
models of action research employ a sequential plan for undertaking research. Action
research models that employ a step-by-step sequence (Kemmis and McTaggart, 1982)
are incredibly similar to step-by-step models used for solving problems in design and
technology often referred to as the "technological method". Sequential models may help
provide overall structure and be appreciated by teachers who are imbued with the
image of "teacher as technician". However, such models can regiment inquiry and I
prefer an approach that is more in keeping with the metaphor "teacher as artist". Much
of this research was intuitively guided as I interacted with students. For this reason, I
refer to my study as "classroom research" by a teacher (Hopkins, 1985, p. 40).

It is important to clarify the purposes of my teacher-directed classroom research.
Hopkins (1985) explains that classroom research is "teachers engaging in systematic
self-conscious inquiry in order to understand and improve practice" (p. 21). I wish to
emphasize two important aspects of such research. Self-conscious inquiry does not
focus so much on the details of the teaching practices themselves but rather the meaning of these experiences to the teacher researcher: "the meaning of being an educator, of being in an educational relationship with students" (Oberg, 1990, p. 219). In other words, a very important aspect of classroom research by teachers is their own interpretations of practice within their context and with their students (Sparks-Langer & Colton, 1991). A second purpose of classroom research that is relevant to this inquiry is an emancipatory aim, as outlined by Carr and Kemmis (1982):

...a form of self-reflective inquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out. (p. 162) [emphasis added]

Assumptions of the Writer

Although Grumet (1987) points out that "we do not know ourselves any better than we know others" (p. 321) it is important for those who undertake research to attempt to state their own assumptions, beliefs, inclinations, and biases. A central assumption I hold is that a teacher's beliefs and interpretive frames influence practice. Trumbull (1990) states: "One salient assumption is that our ways of describing and naming the world shape the realities in which we live and limit the possibilities we can see" (p. 163). I also assume that the relationships between my belief structures and teaching practice are not entirely idiosyncratic. I assume that the practices of other industrial/technology educators are also influenced by their own interpretive frames. In particular, I presume that my experiences as a technical specialist and industrial education student teacher may be similar to other teachers. Trumbull (1990) states that a "second assumption is that many of our ways of viewing the world are not peculiar to us but are shared, shaped by our common socialization" (p. 163).

I also assume that "curriculum development must rest on teacher development" (Stenhouse, 1975, p. 24-25) (emphasis mine). Research and curriculum documents are only useful inasmuch as they are embraced by practitioners. I lean strongly toward the
notion of “teacher as artist” and sympathize with Stenhouse’s (cited in Ruddick, 1988) notion that schools are intractable to change apart from the “desire of the artist to improve his or her art” (p. 50):

Only the teacher can change the teacher. You can reorganize schools, yet teachers can still remain as they were. You can pull down the walls and make an open school; but open teaching remains an achievement of the teacher’s art, and an achievement that is an expression of understanding. (ibid, p. 50)

Goodson (1990) points out that it is the teachers who are “the people intimately connected with the day-to-day social construction of curriculum and schooling”, who, in accepting the “‘curriculum as prescription’ myth”, are “effectively disenfranchised in the discourse of schooling” (p. 300). Teachers who involve themselves as researchers are “liberating themselves from ideas solely imposed by others outside the classroom” (Oberg & McCutcheon, 1990, p. 142). Within technology education, Zuga (1995) indicates that "current research paints a picture of a top down curriculum revision in technology education which is meeting with superficial and limited success" (p. 5). It is good to remember that “Teachers, not curriculum packages, are the agents of change” (Ruddick, 1988. p. 32). I argue for technology education curricula that are socially transformative and assume that for teachers to embark on such a curricular orientation, they themselves must gain a heightened social consciousness (Miller and Seller, 1990).

I presume that it is important to reveal my own subjectivity but that it is also important to locate such subjectivity within the larger social contexts of teaching. Teacher growth must include attention to the private as well as public worlds of the teacher. Goodson (1990) refers to the micro world of the individual and macro world of the group or collective and suggests that it is desirable to “re-embrace life history” (p. 306) of the individual while situating it within larger discourses of professions and social movements. Also, I believe that teachers should be critical readers of a variety of knowledge bases, that at first may appear, “external” to their immediate practice and professional culture. Although I express strong regard for teachers as uniquely situated pivotal agents of curricula transformation and implementation, it is also important to
emphasize that there is much to be gained from teachers making forays into the larger scholarly world. Hopkins (1985) points out that teachers and university researchers "live in different intellectual worlds and so their meanings rarely connect" (p. 29). Rather than representing a teacher entering the world of academics or, conversely, focusing too tightly on classroom activity, my story is one of interaction between these worlds. Acknowledging that the relationship between curriculum scholars and school practitioners often constitutes "a model of how to talk past each other" (Goodson, 1990, p. 302). My "talk" in this thesis comes from both worlds.

Extent of Investigation

The limits of this investigation reflect the partiality of my perspective. Although my frames of reference have undergone considerable change as a result of my research, I recognize that my beliefs will continue to change in the future. This thesis, as the story of my experience, research, practice, and reflection, is open to retelling and modification. Reflecting upon my own social construction and teaching experience, I provide only one voice within a predominantly male technical culture and teaching profession and do not attempt to speak for all male technical specialists or industrial/technology education teachers. I make no pretense that this study is in any way exhaustive. The aim of this thesis is not a conceptual framework, but one teacher's mapping of the technocratic culture of technology education. My aim is to gain insight into my immediate and contextual world of teaching.

Significance

This thesis is significant in its account of one teacher's journey of reflection, inquiry, and expression. My stories illustrate how teachers can reflect on their own socialization and "come to understand and reflect upon the broader contexts in which their professional lives are embedded" (Goodson, 1990, p. 308). Through this process of
inner space and outer world reflection, I reveal different dimensions of the technocratic culture that shapes technology education curricula. I argue for a technology education that is socially transformative for both students and teachers. *Teachers cannot provide the conditions that are necessary for transformative learning for students if the same conditions do not exist for transformative growth in teachers* (Sarason, 1990). In examining self as teacher and teaching practice, this thesis may strike a chord with sentiments of other industrial/technology educators. For all teachers who have asked radical questions about who they are and what they teach, or even for those who have not asked such questions, my sojourn through various forms of reflection, inner struggle, and action may prove to be encouraging, thought-provoking, and/or disturbing.

At a wider level, this thesis is significant in its contribution to understanding common sense tales of technology. Worldwide, technological activity is seen as a means of economic survival in an increasingly competitive global marketplace. A foundation of the emerging techno-economic order is the proliferation and intensification of technocratic values, bureaucracy, consumption, mass enculturation to lifelong adaptation to technological change, and technological necessitarianism. More than ever, education is called upon to develop “technological literacy”. This thesis is a critique of the simplistic and “illiterate” ways technology education deals with social/cultural aspects of technology and is significant in its exploration of forms of technological literacy and technology education that are socially transformative. In suggesting that technology education provide opportunities for questioning the underlying ideology of technocratic culture, this thesis holds significance for students. For men, opportunities are described for transformation from traditional and dominant ideals of “man the technician”, “industrial man”, and “consumer man”. Possibilities contained within this thesis point to other roles for male technology teachers that are increasingly sensitive to the subjectiveness of their own realities and the realities of others. For women, my writing may provide insight into underlying complexities of the
male experience and indicate ways in which technology education may be made more suitable to the needs of both males and females.

Implications are raised in this paper for technology education teacher in-service and pre-service. This thesis may also have useful implications for evaluating and transforming other curricula that presently deal with technology. For all levels of education, this thesis provides a perspective that questions the business-economic agenda for education and encourages educators to examine the sorts of socialization that are involved in education.

Organization of Thesis

This thesis is guided by a desire to address issues in technology education from a broader social and cultural perspective; to bring together several aspects that have too frequently been discussed in isolated, fragmented, and technical ways. For the reader, the exploration is organized to provide insight into how one teacher interrogates his micro, macro, and in-between worlds of teaching. These worlds are: teacher, technology, curricula, and teaching.

- Chapter One describes aims, organization, methodology, writer's assumptions, significance, and extent of investigation.
- Chapter Two examines, through autobiographical narrative, the social construction of the interpretative frames of an industrial/technology teacher. Immersed in male cultures of technical specialists and industrial educators, it is shown how a technical, as opposed to contextual, understanding of technology was shaped in the author. Although "non-technical" dimensions of

---

4 For example, computer studies, consumer education, and business education, as well as board, union, and Ministry of Education policies are concerned with the "infusion" of information and other technology into schools. The use of information technology in schools is largely a result of the technocratic ideology of schools (Robins and Webster, 1989). Integration of technology into schools is done largely from the instrumentalist perspective that views technology as value-neutral. This thesis critiques the common sense understanding that technology is value-neutral.
the author are narrated, it is explained how a technocratic orientation became
dominant. The story continues with a description of the author's gradual
dislodgment from dominant technical orientations and increased ability to
"border-cross" into other ways of seeing, knowing, and being.

- Chapter Three summarizes research into accounts or narratives of technology.
Common sense stories of technology are shown to privilege technical understandings of technology. Such understandings focus on technical knowledge, processes and products. Technological determinism, the belief that technology shapes society, is shown to marginalize socio-technical understanding of technology. Such "tales of technology" are master narratives that simplify technology as value neutral and inevitable. Contrasting accounts, such as the social construction of technology and contextualism, are explored as a means to unthink dominant narratives and provide insight into technology as value-laden and complex.

- Chapter Four examines technology education curricula from a cultural perspective. Curriculum is described as a cultural script (Giroux, 1992) that socializes students into particular frames of interpretation. In technology education curricula, a technocratic ideology informs the script. Such ideology is transferred from historic technocratic values found in industrial arts and manual training and reinforced by the technocratic influence of schools, school reforms, and business and industry. Technocratic influence shapes curricula toward portrayals of technology that are technical and deterministic. It is explained how a technical curricular emphasis offers little opportunity for the growth of a socially critical intelligence and consciousness.

- Chapter Five describes one teacher's interpretation of teaching industrial/technology education. Teaching technology education is described as a process of socialization in technocratic ways of knowing. The story is told of how the author helped reproduce technical understandings of technology
and a technocratic subjectivity in primarily male students. In an attempt to
learn new lessons a further story is told of the teacher's experience in
attempting to soften the technocratic classroom through the inclusion of a
social/cultural study of technology. Possible socially transformative
pedagogies are discussed with a view to the growth of a cultural literacy in
technology.

• Chapter Six provides a summary of conclusions and implications of the study.
...we need to redefine the role of teachers as transformative intellectuals.... They understand the nature of their own self-formation... (Giroux, 1992, p.15)

I begin with stories that describe my self-formation. My account reveals predispositions that I brought into teaching as well as my experiences being socialized as an industrial education teacher. Understanding the socialization of an industrial/technology education teacher is an important dimension of the culture of technology education. Teachers are the only people that interact daily with students and it makes sense to learn something about who they are and what they think. The theory and practice of teaching are not isolated from a teacher’s inner spaces. "For a teacher, there is no possible separation of life and practice" (McElroy, 1990, p. 213). This chapter reveals the formation of my constructed subjectivities and how they have influenced my orientation to teaching. Later, in Chapter Five, I describe in more detail how my socially shaped subjectivity found expression in habitual classroom practice.

Life-history reflection sets a basis for integration of the personal and professional, the private and public, and in so doing brings awareness of possibilities for regeneration, reconstruction, transformation, and even healing\(^5\) in both domains. Giroux (1992) points out that teachers need to acknowledge "those places and spaces we inherit and occupy, which frame our lives in very specific and concrete ways, which are as much a part of our psyches as they are a physical or geographical placement" (p. 79).

\(^5\) I believe much of the experience of writing this thesis has initiated a process of healing from entrenched ways of viewing the world, technology, education, and teaching.
By gaining a deeper sense of their own interpretative frames, teachers are able to enlarge their capability for improving teaching. My reflection is not aimed at technical considerations since a technical level of reflection does not examine the ethical, ideological, moral, sociological or cultural dimensions of education (Van Manen, 1977). Entirely new sorts of improvement can be made to teaching through critical reflection of the ideologies embraced by teachers:

Instead of mastering and refining the use of methodologies, teachers and administrators should approach education by examining their own perspectives about society, schools, and emancipation. Rather than attempt to escape from their own ideologies and values, educators should confront them critically so as to understand how society has shaped them as individuals, what it is they believe, and how to structure more positively the effects they have upon students and others. (Giroux, 1988, p. 9) [emphasis added]

Although gender issues are not the focus of this thesis, it is important to gain a sense of how gender plays a strong part in constituting the technocratic culture of technology education. Examination of the links between technology/technology education, male experience, and the socialization of teachers provides important insight into the technocratic culture of technology education. There is a crucial need in technology education to understand how men have overcompensated with rational and emotionally distanced forms of knowing in their approach to dealing with technology. Technology education has a long history of "an ideological bent towards...masculinity" (Zuga, 1995, p. 22). "Men's voices have been effectively privileged over women's in the history of technology education. This reflects the gender biases that have become an endemic organizational problem for technology educators" (Zuga cited in Lewis, Pannabecker, Petrina, Volk, and Zuga, 1995, p. 4). It is therefore important to understand more about the socialization process of male industrial/technology education teachers and how such socialization may influence the shaping of curricula.

---

6 There are immense gender problems in technology education. Such problems need to be addressed in a multiplicity of ways. Other understandings, apart from the efforts of the field to help women "adapt" to male technology or "cure" their "technophobia", need to be heard.
and teaching practices. I believe that for male teachers in particular⁷, active
de/re/construction of personal histories can help to break down the walls between
public and private spheres. For male teachers, critical life-history reflection is a way to
"move beyond a safe, rational distancing into the particular emotional commitments of
their personal histories" (Jackson, 1990, p. 274). Such activity may be a way to heal the
split between reason and emotion in many men's lives (ibid, 1990).

In order to place my voice in context throughout this thesis, it is important to
gain a sense of my initiatory frames of interpretation. My first understanding of
technology and teaching is described in this life-history perspective. My frames of reference are influenced by dominant forms of professional and personal conditioning and incremental deconditioning. My life-history is a story of growth through traditional Western stereotyped notions of technical/rational man, sure of his reality, to one who is increasingly reflective and doubting of the values and doctrines that lie beneath such images. Multiple influences have contributed individually and synergistically to the ways I view the world. These influences include:

• tutelage received from male technocultures in technical/industrial expression,
• industrial education technical training and teacher education,
• experience as a classroom industrial/technology and mathematics teacher,
• socialization within the culture of technology educators,
• long-standing interest in ways of knowing apart from those situated from a male industrial/technical standpoint; ways that acknowledge emotions, intuition, spirituality, and social complexity.

⁷ The vast majority of teachers in industrial/technology education in North America are male.
Acknowledging Complexity: Multiple Men in the Man

Figure 1. Multiple men in the man.

(C. Bastone, 1994)
I make; therefore I am. **Industrial man.**
Sacred place --- factory.

I work; therefore I am. **Economic man.**
Sacred object --- the almighty dollar, investment.

I possess; therefore I am. **Capitalistic man.**
Sacred place --- property.

I consume; therefore I am. **Consuming man.**
Sacred place --- the mall.

I am incorporated; therefore I am. **Corporate man.**
Sacred place --- the company.

I doubt; therefore I am. **Questing man.**
Sacred path --- the pilgrim spirit.

*(Keen, 1991, p. 133, 134)*
In this chapter I acknowledge and examine aspects of my inner complexity, multiplicity, and diverse spaces. I express this complexity as the "multiple men in the man". Through reflection upon different aspects of my makeup I am able to draw attention to multiple selves and multiple subjectivities. Jackson (1990), in his book *Unmasking Masculinity*, describes the potential for change offered by the concept of multiple selves:

The post-structuralist concept of 'subjectivity' has a greater critical potential for **provoking inner and outer change in men** than the liberal humanist notion of the innate, essential self. This is because...It decentres the thrusting, dominating self of traditional masculinity, and replaces it with the possibility of multiple selves, much more fragmented and contradictory in make-up, being formed within changing conditions, practices, relations and frameworks. (p. 269) [emphasis added]

"Poststructuralism is concerned with the problems of metanarratives --- stories that purport to describe, explain or provide a foundation for other stories" (Gough, 1993, p. 4). Internalization of metanarratives can lead to understanding of self as one authentic story. In contrast, the poststructuralist notion of multiple selves acknowledges many different stories of self (Jackson, 1990). In my own experience, recognition of multiple selves has provided opportunities for pulling down walls between different men inside. Prior to this rather extended process of selves-reflection, I tended to seal them from each other, possibly frightened that they may one day meet. Some men were allowed to be dominant and others were passive and subordinate. The process of reflective writing has helped them acknowledge each other and form new relationships. Through writing, a sense of wholeness rather than compartmentalization has emerged. I have chosen to describe three men in order to illustrate multiplicity, difference, and especially contradiction and inner tension. Although I describe three men, technical specialist, industrial education, and intuitive/social, there are also other men inside. Such narration provides a starting point for understanding a teacher's inner space. Acknowledgment of the contradictions and diversity of my inner world has helped me to understand complexities outside myself, within the world of technology, curricula, and teaching practice. Together, a heightened awareness of my complexities of inner
and outer lives has precipitated de/re/construction of both domains. Personal and public lives of teachers are parts of a whole. Deconstruction of life-history, even through the thickening lens of time, is a means for teachers to encounter inner diversity and move into new mosaics of knowing, seeing, being, and teaching.

Life-history reflection has helped me come to realize that my dominant interpretative frames have been shaped through exposure to the worlds of technical specialists and industrial education. I name these inner spaces technical specialist man and industrial education man. These aspects of my self-formation were influenced by male cultures. As a youth, male family members, male friends, and male industrial education teachers provided a strong influence in my upbringing. The social shaping continued through experiences as a student teacher immersed with other male student teachers, male sponsor teachers, male instructors and professors in industrial education teacher education. Later, during 21 years as a teacher at Windsor Secondary School, I was mentored and influenced by male department heads, male department colleagues, male school administrators, and male technology education colleagues who I have come to know in other schools, provinces, and countries. My day-to-day exchanges in the classroom have predominately been with male students. In reflecting on past experiences, it became clear that a large part of me was oriented to men’s technical/industrial ways of knowing, being, and seeing. Understanding that one aspect of my life experience was “male saturation” is crucial to comprehending how I first negotiated the world of technology and industrial/technology education. Although I possessed other ways of knowing, I struggled with tensions between values held by dominant men within inner spaces who were technical/industrial and with

---

8 In the 1994-95 school year at Windsor Secondary School in North Vancouver, the school in which I teach, of approximately 500 industrial/technology education students in the 800 student school body, the female enrollment was as follows: industrial/technology education courses grades 8 through 10: 12%; grade 11 courses: 6%; grade 12 courses: 0%. All courses grades 8 through 12 are elective. These figures illustrate the paucity of females in these courses. For the author, the experience is one of “male immersion”.

24
those of less dominant, almost silenced, diverse men who held other knowledge, values, and wisdom.

Dominant Man 1.00: Technical Specialist Man

I create through design and making;
I master creative, powerful, techniques;
I produce clever, creative solutions;

I am state of the art;
therefore I am.

Male technical specialist man.

Sacred places --- technique, the shop, the gadget, cutting edge technology.

(C. Bastone 1994)

Socialization into the cultures of male technical specialists is a common male experience. Technical familiarization, expertise, expression, addiction, and consumption form a significant part of the socialization process of many North American males. "I am Chevy man", "I am Ford man", and "I am Harley Davidson dude" of the 60's was supplemented with "I am IBM man", and "I am Apple man" of the 80's. Perhaps the technophillic male identity of the 90's is:

---

9 “Note: this thesis is written using a Mac Powerbook 165 operating at 33 MHz with a 160 MB hard drive. It is printed on a 6 page per minute Laserscript LX running at 25MHz”. (Utterance of Technical Specialist Man, 1994)
With my superior software, firmware, and hardware,

I cruise the high-speed information highway;

I challenge the cybernetic net;

I map the electronic frontier;

therefore I am.

Internet man.

Sacred places —— cyberspace, virtual reality, cyborg worlds,
"crash TV", and "excremental culture"10.

(C. Bastone, 1994)

Over time the technology may change but a technical orientation continues to form, in many cases, a significant part of male identity (Cardelle, 1990). Kroker and Weinstein (1994) point out that:

Bourgeois masculinity has always been pre-pubescent: the thoughts of little boys thinking about what they would do if they controlled the world, but now the world is cyber-space. The dream of being the god of cyber-space —— public ideology as the fantasy of pre-pubescent males: a regression from sex to autistic power drive. (p. 11)

Male identification with the made world is only an outward manifestation of a deeper inner condition of technophilia. I should know. I have gone through several technical addictions including "CB radio man", "Dodge 440 man", "cool van man", "stereo amplifier man", "robot man", and "high tech info man". A self-confessed technobuff that has completed detox11, I am here to tell the story that a technophile is one who is strongly oriented to, and frequently, if not incessantly, preoccupied with technique, artifacts, and technical experience. Although technical accomplishment can be

10 "Crash TV" is speed surfing across 500 channels of dead ether going from nowhere to nothing" (Kroker and Weinstein, 1994, p.159). "Excremental culture" is the "recycling culture of the 90's"...contemporary society as a waste-management system, stockpiles dead images and dead sounds, and threatens to suffocate us with its inertia ... TV subjects most of all, produced by excremental culture" (ibid, p.159).

11 I have often mused that "TA" or “Technophiles Anonymous” would be a useful social agency.
extremely fulfilling, technophilia can become an unhealthy addiction for men that Biram (1978) refers to as "teknosis". For men, a technical orientation results from more than just exposure to technical knowledge, mechanisms, industrial materials, tools, and information processing devices. *In my experience it includes a mystical twinning of one's own maleness with technically oriented male cultures.* Such cultures mentor male youth in their ways of knowing, seeing, and being. Such socialization is not all bad, but as I will relate, it is not all good.

Perhaps, more than most of my childhood contemporaries, I was able to develop considerable skill through technical expression. My technical capability is largely due to the detailed practical training I received from my father. He gained his technical orientation from other men. Some of his male tutors included his grandfather, a machinist; his father, a baker; and men whom he apprenticed under as a machinist and mechanic. Technical skill and adroitness provided my father with the ability, confidence, and tenacity to tackle a diversity of technical challenges. Whether it is problems associated with agriculture or raising animals; house, boat or furniture construction; auto, marine or farm mechanics; electrical or electronics repair; he is the most practical man I know. To this day, neighbours, relatives, and former colleagues continue to call on him for practical and creative technical advice. When you need help and practical advice he is the one to ask. To understand my father's technical gifts is to better understand more of the technical influences that form a part of my present understanding of technology. During the writing of this thesis, in his eightieth year, my father undertook and successfully completed the repair of his Stylewriter printer and Mac Plus video control board, invented methods to refill his ink jet printer cartridges with conventional inks, designed and constructed a series of jigs to bind copies of his W.W.II memoirs, solved the problem of jacking up his greenhouse 3 inches to replace a rotting plate, designed a new apparatus for growing tomatoes, improved the carburation in his Chrysler, tested the power supply of his 121MB external hard drive, and re-plumbed his electric hot-water heater.
As a teenager, my interest in technical areas was stimulated by my father’s technical projects and hobbies. My avid interest in electronics was sparked as a result of my father’s hobby. Year after year my father constructed projects such as hi-fi amplifiers, radios, speaker systems, antennas, and oscilloscopes. He set up an electronics/radio room in the basement that became our hobby centre. I remember his patient teaching of practical skills and electronics theory as well as help with personal projects and repairs. Without his care and guidance, I doubt if I would have become an industrial education teacher. To add to my experience of being raised by a master technician, I also had, within a quarter mile of my home, five male relatives all of whom were highly oriented to technical ways of thinking and doing: two machinists, one radar gun control technician, one retired owner of a pipe insulation manufacturing plant, as well as an early potato and holly farmer. These men all served as role models and tutored me in their technical worlds. As a junior member of the family, I was adopted and taught by them. Technical expression was the vocation of my male relatives and it was also a large part of their avocational activities. Reciprocal work and interest from each relative contributed to many large and small joint projects. These multiple talent enterprises further developed the technical expertise and bonds within our male technoculture. Learning practical skills in my family was a rite of passage — there was no misunderstanding, a central part of being male focused on technical competence, work, curiosity, creation, ingenuity, and even infatuation.

The projects of the “techomunity” involved an arsenal of tools and devices from metal lathes, cement mixers, audio frequency generators, band saws, tractors, pumps, voltmeters, dwell meters, to rotivators, arc and gas welders, spray guns, diesel engines, and coal stokers. A communal arrangement allowed the equipment to be shared. There was always some interesting project underway. Some projects involved the repair or modification of existing articles: from mechanical potato planters, car engines modified for use in ski boats, to huge cubical-quad CB antennae. Other activities involved the final completion of new projects: from houses, boats, hi-fi amplifiers, farm irrigation
systems, trailers, to a hand-dug, 12 foot diameter, 120 foot deep reinforced concrete irrigation well. For me these experiences were a living experience of Popular Mechanics, Popular Electronics, and Popular Science all rolled up in one! The projects were most infectious and I caught the technical bug. In reflecting on these experiences I hope to provide some sense that a technophile is not just one who works in technical areas. A technophile is often addicted to the expression, development, application, careful honing, and practice of technique; one who is in love with, and one who's being is entwined with technical activity.

These early experiences provided great experience in working with ideas, people, and things toward the completion of a tangible goal. Very early in life I was able to develop many technical abilities and what is best described as a "technical way of being, knowing, and seeing". My interest in technical areas led to hobbies in electronics, CB radio, auto mechanics, and boats. Through junior and senior high school I developed a wide range of skills on my uncle’s farm in the Gordon Head District of Victoria. From grade seven on, my favourite course was industrial arts. Of all my high school teachers, it was my industrial education teachers whom I liked the most. They were technically oriented men with whom I could identify. They were the only teachers who helped me connect my personal and family experience to the content of schooling. Industrial arts teachers, as adult males, had a strong influence on extending and formalizing my technical abilities. Just as "IA" teachers helped us in our school projects, several students took an interest in our teachers’ projects. For instance, I remember helping one of my junior high industrial education teachers, Leagh Holland, over several weekends with electrical work on his sailing boat, making a megaphone for him from plans he found in Popular Electronics, and wiring up a radio in his little red Renault. Later, in my grade twelve year, with the guidance of another industrial education teacher, I completed the construction of a replica of a quarter-cut oak antique liquor cabinet. Every guy, I thought, needed one!
Further exposure to male technical cultures resulted from part-time employment through secondary school and into university. A variety of jobs included experience in fiber glassing, roofing, house wiring, rock blasting, laying water mains, and constructing underground vaults for the Greater Victoria Water District. I gained experience in forestry and fire suppression with the B. C. Forest Service and gained other practical experience including house construction, general carpentry, steak house cook, and telephone prewiring and installation. My entry into the University of Victoria (UVIC) was on the assumption that I would go on to engineering. After completing first year arts and sciences, a friend interested me in industrial education. I transferred to the UVIC Faculty of Education and completed my first teaching area in secondary mathematics. In my fourth and fifth years, I completed my second teaching area through transfer credits from the Division of Industrial Education of the University of British Columbia situated at the British Columbia Institute of Technology (BCIT). During summers, I took several technical courses, in electronics and drafting, over and above those necessary for my degree. After university, technical experience continued. During my first years teaching I designed and drafted two houses and constructed them with my father. The growth of technical expertise continued through a mix of self-education, workshops, and evening technical courses in areas such as robotics and microprocessors. By this time I was a now a budding specialist within a male technical culture.

A part of me, I suppose the kid in me, still gets excited about things like automotive restoration, new software releases, and solving a wide variety of technical problems. I still help my students celebrate their technical successes, usually the creative gadgets that they conceive and make. Industrial technical tutelage, still largely a male undertaking, continues with the young people who take industrial/technology education. Technical means are a way of providing for human need and want. Skilled technical people are, and always will be, required in this world. As one who has developed as a male technical specialist, I appreciate much of the way in which
technical skill and understanding are passed on to new generations. I am ever indebted to my father's gifts and teaching. Becoming a male technical specialist has many virtues. However, from the point of view of gaining a broad, social, cultural, and critical understanding of technology, the contribution of the male technical experience is extremely partial.
Dominant Man 1.10: Industrial Education Man

I teach how to design, make, repair and be technical;
therefore I am.

Industrial education man.
Sacred places — doing; school shops and labs.

(C. Bastone, 1994)

During the technical phase of industrial education teacher training I was further infused into a tight-knit community of male technical specialists. I boarded with other students in the program and it seemed that we ate, lived, and breathed technical talk. Three-quarters of the students in the program were male technical specialists and tradesmen. These students were enrolled in an “accelerated” 1-year program that fast-tracked technically skilled people into the ranks of teaching. I was one of the “regular program” university students who completed 2 years technical training as part of a 5-year B.Ed. program. To enter either program all candidates had to provide evidence of technical capability. I enjoyed the camaraderie of my new “technobrothers” within this extended family. During the two year period, I remember only one female in the program...we had few “technosisters”. Our instructors were mostly former secondary school industrial arts teachers. They were our role models, mentors and "technodads". We appreciated their technical expertise and wit as they adopted us into a technical family. The metaphors I use are not altogether artificial — even the Chairman of the Division of Industrial Education was known affectionately as “Poppa Seal”! These were great times and over two years close bonds were developed. All technical courses were similar inasmuch as they focused on technical knowledge, skill, and making. The basic technical program included courses in electronics, drafting, woodwork, metalwork, power mechanics, design, and materials technology. Advanced courses were offered in all the basic courses with the addition of plastics, welding, and foundry. For me, such
courses were just a formalization of the multi-technical experience I had received in my early years from my family of male technical specialists. Without realizing it, I was already, to some extent, a generalist in industrial technology. Many of the men from trades backgrounds were versed in only one or two technical areas. For example, a sheet metal worker may have virtually no experience in electronics or design. The overall program did a very good job of developing broad industrial technical competence, preparing us to teach all areas of junior industrial education, and socializing us in the culture of industrial educators. I can never remember, however, any activities, lessons, or assignments that socially or culturally contextualized our technical work. A critical perspective of technology was virtually non-existent. The values we were socialized to embrace regarding technology involved high quality craft, functional and aesthetic design, safe work practices, an industrial work ethic, and technical knowledgeability.

Another aspect of the program was practice teaching. In many of the technical classes we were required to give practice lessons to our classmates. This was a way to familiarize ourselves with the task of teaching and at the same time learn the technical content of the course. The lessons seemed to be an extrapolation of “man as technician” to “teacher as technician”. The subject matter of the lessons was technical and so was the teaching methodology. Teaching was portrayed as the mastery of organization, presentation, and evaluation techniques. Practice focused on developing competence in transmissive lessons and demonstrations. We were male technical specialists about to become teachers. An analogy was made of a teacher requiring a range of teaching "tools" within a "teaching toolbox". This served to reinforce our thinking about industrial education teaching as another type of male technical activity. Most student teachers made a successful transition from male technical specialist to male teacher technician. We had specialized knowledge and were ready to teach it to others. A graduate of the program at 23, my picture of technology was knowledge, skills, attitudes, related to industrial design, making, and doing. Although a technical
orientation was ingrained in my being I was not truly aware of its predominance. This orientation was shaped by my family, confirmed by my part-time employment, personalized in my hobbies, shared through male bonds, and reinforced and polished during teacher education. My technical orientation was my ontological reality and I was about to pass this “reality” on to secondary school students. At the end of the program I was "technical specialist man" qualified and initiated as "industrial education man": a teacher of the industrial young; a fraternal leader of technical enlightenment; a man of the saw, blueprint, and overhead projector. For me, technology was the made world — technology was a male thing — this was the way things were in the summer of 1974.

Undefined Man: Intuitive Inquirer/Socially Critical Man

I am open to new ways of understanding and being,
ways beyond the technical / rational / industrial;
therefore I am.

Intuitive inquirer/socially critical man.
Sacred places --- contradiction, social sensitivity, feelings, a critical spirit.

(C. Bastone, 1994)

It is human nature to take one’s environment for granted. For me, the male environments of technical specialists and industrial education were dominant settings in my life. In my teenage years I became interested in other ways of knowing that were not emphasized in my male environment. For example, I was fascinated by issues involving human values that would surface in English classes. Other experiences eroded my orthodox views of the world. For example, I was impressed when my mother responded exceedingly well to a discovery that the medical profession tried
desperately to block. I was so moved that an alternative technology was available that the story became the focus of a grade eleven English assignment. I expressed my regard for alternative forms of healing and knowing and my contempt for the hegemony of organized medicine. It was my mother's influence that led me to a deep interest in issues of social justice. Unfortunately, my formal education as a mathematics and industrial education teacher did not provide much growth in this area. However, over time my interest in social ways of understanding has grown. This thesis is a manifestation of my mother's interest, influence, and social conscience.

A significant experience in "non-technical" ways of thinking occurred during the technical phase of industrial education teacher training. One instructor in the U. B. C. program was unique, and it wasn't just because he taught art and design alongside courses in industrial technology. Although Roy Lewis was a master of technique he was also enriched by other forms of knowing. His love for art and for people shone above any concern he had for technique. Roy had transgressed technique with other forms of knowing. Here was a man who encouraged students to risk going beyond technical ways of knowing. He encouraged us to enter domains that involved feelings — scary stuff for technomales! Roy projected ways of knowing alternate to the mindset that governs technical thinking — it showed. Most of the students including myself, initially saw the design course as "artsy" and as something that we maybe would just tolerate. After all, we knew that technical "reality" was concrete. "Real" knowledge for us was technical "know how" and "real" making — not just modeling, sculpting, and "feely stuff"! Our view of technology was one linked to industrial technique, mathematics, and science — not artistic pursuits and intuitive, abstract thinking! At first several students put up some resistance. Maybe they thought they would next have us philosophizing!

As the design course progressed, I noticed that many of my fellow classmates began to relax, lose their hang-ups, express other sides of their personalities, and take a real interest in their "artsy" projects. Slowly, the assumption that art was not a part of
technology was eroded. It was a gentle, indirect process. Roy had a way of getting each student involved in an activity matched to individual interest and ability to risk take. It was such a contrast to see guys painting, modeling, and sculpting instead of machining, welding, and repairing. Imagine! A 220 pound, six foot four, steel worker modeling with clay! Gradually through various forms of design, drawing, and sculpting, students escaped from their role as “macho technomale”. Many of us became different men in his class. We were using and stimulating different parts of our being. Guys actually began to relate to each other differently. Rather than a culture of competitive technical machismo, a sharing artistic community sprang forth and another consciousness emerged. Designs of projects in other technical courses, such as woodwork, welding, and metalwork, were influenced by Roy’s course and, in many cases, his personal counsel. By the time the design course was finished, most of the men had experienced using technical skill for a “non-technical” purpose and developed some sense of aesthetic value. I still have the “unorthodox” results of a sculpted organic forms of a human encapsulating stereo “slounge” that I show to my students as design that was intended for the distinct purpose of human expression.  

Roy Lewis was skilled at helping students do what I call a “technical inversion”. By approaching technology differently we attained a distance from the technical focus of the rest of the program. Such activities provided opportunities for seeing the technical in different ways and understanding its relationship to other things. Instead of using technology to make strictly functional devices such as winches, light dimmers, and trailer hitches, we began to taste technology as the artistic expression of modelling, craft, and jewelry making. I began to “sense” another dimension, a sort of a Zen and

---

12 A “slounge” is my name for a laid-back form of a reclining lounge that surrounds the occupant with an atmosphere of user selected sound. Although teenagers are sometimes viewed as radical, I often find their thinking incredibly conservative. Just as student teachers viewed design as a foreign element in technical soil, beginning students in my technology classes find the inclusion of aesthetic values unexpected. Even today, when I show the unusual stereo slounge to my teenage students, many shake their heads thinking, I am sure, that their teacher has flipped out.
the Art of Motorcycle Maintenance (Pirsig, 1974) type oneness with my work. Intuitive knowledge and feelings within my subconscious were given opportunities for expression in my art. Vague perceptions lying deep within me were brought into the conscious realm. Roy’s infectious love for art was expressed in his own bronze sculpting. His art influenced guys to do really wild things (for technical guys, that is). I remember, a mechanically oriented classmate and I attending, on our own time, a gala opening of an art exhibition and hobnobbing with some of Vancouver’s artistic community! We sipped champagne and critically evaluated, using our extensive artistic and cultural knowledge, every work on display. We thought we were qualified art critics! What we were learning was that other men existed besides technical specialist man. I really began to enjoy Roy’s course since it was so different from all my previous experiences in technical areas. Roy’s class was a form of therapy from the intense technical focus of the program. For me the program without the design course would have been deadly technical. I believe the experience in breaking away from previous patterns of working with technology made us better teachers; teachers more able to see and teach the technical field from a wider context; teachers more able to see and experience other interpretive frames. Besides the dominant technical/industrial education men, other men were growing. What many of us didn’t realize was that we were about to enter a further socialization process as “green” teachers in schools. We were about to be mentored by veteran industrial education teachers. Many of these established teachers had never had a “Roy” experience. Many mentors sought to correct the "errors" of our training and resocialize us into the ways of those who "actually taught" industrial education.

---

13 In my first years teaching, attempts by myself and other beginning teachers to replicate "artistic" design experiences with students were looked upon as inappropriate by older industrial education teachers. We were told by them that students should not be allowed to design or be artistic until the senior grades when they had mastered sufficient "technical" skill. They were faithful in following their own advice.
I was fortunate that during my early years of teaching my non-technical side continued to grow. The growth of intuitive/socially critical man was through experiences outside the culture of industrial education. In the late-seventies I worked with professional motivators\(^\text{14}\) conducting workshops of inspiration, positive self-image, health, and well-being for high school and university groups, women's groups, North Shore Continuing Education\(^\text{15}\), business people, school district administrators, and Vancouver Community Television. These experiences expanded my awareness of other cultures of understanding. In my spare time and during vacations I studied metaphysics, natural forms of healing, and theology at Regent College. Intuitively, I believe, I was offsetting the master narratives provided by the socialization processes of male technical specialists, teacher training, and the culture of industrial educators. Such experiences provided a balance in my life and an immunity from totalizing technomale-itis.

\(^{14}\) I worked with John Lee Kootnekoff, president of the Horizon Institute, as a positive self-image workshop facilitator. John is a man enriched by non-technical ways of knowing. As former basketball coach for SFU, John was in the process of acknowledging his multiple men within. John was coming to terms with several dominant men, including macho athlete jock man. I am grateful to John for his friendship and teaching. In 1979, John and I produced and co-hosted two programs for Vancouver Cable 10. One program was called "Healing the Healer".

\(^{15}\) My out-of-school teaching experience shifted entirely from technical areas. I organized two workshops for North Shore Continuing Education called Awareness '79 and '80. Guest speakers spoke on topics of health food, positive self-image, creativity, and colour therapy. This was definitely counterculture to a technical way of knowing the world.
The Dominance of a Technocratic Orientation

Coming to an awareness of my socialization is a time consuming and difficult undertaking. Drengson (1983) points out reasons why our interpretive frames resist examination:

Orientations toward the world are rarely consciously chosen. ...most of us simply inhabit the world with a particular attitude or bias that we never question, partly because we are not aware that it is a conditioning ground of experience for us, but also because our identity is bound up with it in terms of our self image. For us this manner of experiencing the world is reality. (p. 88) [emphasis added]

To examine one's social conditioning, then, is to question one's self image and "reality". Such an examination can be both liberating and threatening. Through my research, I have found encouragement that I am not alone in identification of technical and non-technical orientations within my being. "Heidegger distinguishes between two modes of thinking --- rational, calculative thinking and intuitive, meditative thinking" (Miller and Seller, 1990, p. 123). My stories of inner multiplicity have acknowledged technical specialist/industrial education and intuitive/social aspects that correspond to these modes of thinking. In comparing these modes, it is my experience that technical/rational ways have a tendency to dominate other modes such as the artistic/intuitive. The technical/rational/technophile ways of seeing, thinking, and being overpowered other selves. Technical ways of knowing, being, and seeing are consistent with dominant modes in Western society. Miller and Seller (1990) point out that the:

rational mode predominates in Western technological society: it attempts to objectify things so they can be classified and controlled. In contrast, intuitive thinking is based on an openness to "Being"; it allows for a direct encounter with what is. (p. 123) [emphasis added]

---

16 My experience indicates more than modes of thinking. There are also different ways of being, seeing, knowing, feeling, and doing.
The predominance of my rational/technical/industrial man is consistent with the technical orientation of society and, in particular, the association with masculine traits.

Rational/technical/control approaches to viewing the world are named technocratic (Burris, 1993; Drengson, 1983; Roszak, 1969). A rational/technocratic mode tends to control other things and ways of being. The intuitive, on the other hand, is open to diverse ways of taking up the world. People who have a technocratic orientation have difficulty examining their own subjectivity and have difficulty understanding other ways of knowing. A technocratic mindset has a tendency to become entrenched and shut out other forms of knowing:

The technocratic paradigms do not have a built-in process that evaluates itself as an approach. It cannot question its own orientation as affecting its subjectivity and internal relations, without questioning its basic priorities and its knowledge of subjects. The technocrat rules out, from the outset any possibility of considering contrary values. Its view (it thinks) is the one and only objective, scientific, i.e. true, way of approaching reality. (Drengson, 1983, p. 67,68) [emphasis added]

The technocrat does not recognize the relativity of its own frames of reference, and therefore its own conceptual organizations and paradigms seem all there is to reality. These paradigms overlook significant insights that have arisen in other dimensions of meaning. (ibid, p. 93) [emphasis added]

Rozak (1969) explains that the insufficiency of the technocratic mind to reflect on itself leads to a mythical "objectiveness":

...if we probe the technocracy in search of the peculiar power it holds over us, we arrive at the myth of objective consciousness. There is but one way of gaining access to reality -- so the myth holds -- and this is to cultivate a state of consciousness cleansed of all subjective distortion, all personal involvement. (Roszak, 1969, p. 208)

Claims of the limitations of the technocratic mindset to reflect on its own partiality and contrary values are serious ones indeed. Certainly, such claims cannot be fairly made about all who operate in technical/rational modes. However, my experience within the cultures of male technical specialists and industrial education confirms that such claims are generally true.
On a positive note, Capra (1982) describes a “rising culture” that holds potential for transformation of entrenched mechanistic/technocratic/rational modes in society. A change in consciousness can occur that is an adjustment to the realization that we are “overemphasizing our yang, or masculine side — rational knowledge, analysis, expansion — and neglecting our yin, or feminine side --- intuitive wisdom, synthesis, and ecological awareness” (ibid, p. 42). “Our society has consistently favored the yang over the yin --- rational knowledge over intuitive wisdom, science over religion, competition over cooperation, exploitation of natural resources over conservation, and so on” (ibid, p. 39). “Both yin and yang, integrative and self-assertive tendencies, are necessary for harmonious social and ecological relationships” (ibid, p. 44). The original meanings of this Chinese philosophy are severely distorted by Western society. “Nothing is only yin or only yang. All natural phenomena are manifestations of a continuous oscillation between the two poles...” (ibid, p. 35).

...the Chinese ancients believed that all people, whether men or women, go through a yin and yang phases. The personality of each man and each woman is not a static entity but a dynamic phenomenon resulting from the interplay between feminine and masculine elements. This view is in sharp contrast to our patriarchal culture, which has established a rigid order in which all men are supposed to be masculine and all women feminine, and has distorted the meaning of those terms by giving men the leading roles and most of society’s privileges. (ibid, p. 36) [emphasis added]

Capra (1982) explains the consequences of societal preference of yang activity for technology:

The yang, masculine consciousness that dominates our culture has found its fulfillment not only in “hard” science but also in the “hard” technology derived from it. This technology is fragmented rather than holistic, bent on manipulation and control rather than cooperation, self-assertive rather than integrative... As a result, this technology has become profoundly antiecological, antisocial, unhealthy, and inhuman. (p. 219) [emphasis added]

17 In sharing the “yin-yang” philosophy I do not wish to give the impression that this explains everything. The value of this philosophy, however, is that it illustrates how one aspect of our being has been overemphasized in technological activity.
Technological progress is dominated by one aspect of our being. From this view, our problems with our technology are reflections of which aspects of our being are emphasized. Increasingly, science, particularly the “new physics”, is suggesting non-linear ways of viewing the world that emphasize the “interrelatedness and interdependence of all phenomena” (Capra, 1985, p. 43). Such interdependent views correspond to other outlooks named "pernetarian" (Drengson, 1983), "ecological" (Capra, 1982), and "perennial philosophy" (Huxley, 1970). Ecological or pernetarian views combine “rational knowledge with an intuition for the nonlinear nature of our environment. Such intuitive wisdom is characteristic of traditional, non-literate cultures, especially of American Indian cultures” (Capra, 1982, p. 41; Mander, 1991). Finding means for both intuitive and rational modes to complement each other may offer hope for making technology more just, equitable, democratic, and environmentally safe.

A difficulty in functioning in both intuitive and rational modes is evident in my makeup. One problem is that each mode has been socialized in relative isolation of the other and that there has been little experience combining both modes. Another problem is that intuitive man has not received the same daily nourishment as the man drenched in male technical/rational ways of being, doing, and knowing. I am increasingly sensitive to the intuitive man who has been in me quietly searching out other possibilities but never achieving equal voice. This inner condition was reflected in my teaching: I became increasingly conscious and doubting of the dominance of the technical/industrial man inside. Keen (1992), in a discussion of masculine consciousness, expresses my doubt: “...somehow men got so lost in the doing that we forgot to pause and ask, ‘What is worth doing?’” (p. 66)18.

Destabilizing Dominant Men Within: Discovering Transformative Man

18 An ethic of industrial education is to “keep the students busy”, usually through making and doing. Little time in industrial education is spent on reflection or social critique.
For change to occur in a meaningful way, this bedrock of calcified experience and understanding needs to be disturbed. (Sanger, 1990, p. 175)

The stories I share provide insight into my socialization as an industrial/technology education teacher. Through the notion of multiple men in the man, I gain a sense of my social complexity and diversity. Frames of reference we learn from others are actually narratives of other people's understanding. Such stories are socially constructed and embody particular values, beliefs, mindsets, and ways of viewing the world. Within the culture of industrial educators it is my experience that the master story told to students is the experiences and values of the male experience of the made world: industrial techniques, systems, artifacts, and products. Industrial education teachers are socialized to conform to technical/industrial ways of thinking, feeling, doing, and being. The orientation of the teacher forms a part of an invisible curriculum that has a socializing effect on students. A technocratic orientation is not peculiar to industrial educators. Much of the value system of Western society is rooted in a consumer culture that places great value on technocratic values, material consumption, and accumulation of physical wealth (Campolo, 1991). The work of industrial educators forms a perfect fit within this larger system. A master narrative is one that tends to exclude, limit, or disenfranchise other tales of the world that do not fit its mould. Such narratives become calcified and difficult to disturb.

I came to an increased awareness of the larger context in which my teaching is situated through a slow, painful, but nevertheless transformative process of disturbing my dominant orientation. This process is one of destabilizing and breaking out. Destabilization does not mean that the dominant men are dead but simply that they are removed from their governing platforms and disturbed. They remain a part of who I am, although a much smaller, and much less controlling bit. Destabilization also does not mean that subordinate colonized men, such as intuitive/social man, gain an equal
or dominant foothold. Although I describe two modes of my being, intuitive and rational, dislodging from the dominant industrial/technical men inside, along with their interpretative frames and metanarratives, is not entirely a battle of polarities. Destabilization, explained another way, is a process of decentrering that has allowed many other parts of myself to gain voice and grow beyond the restricting ways of dominant men. In a very real way I feel that I have been set free to learn about the complexity, rather than the singularity, of who I am. This destabilization was recently initiated by the arrival of something called "technology education".

As an industrial education teacher in the late 1980's, I found that my profession was considering a new organization of curriculum based on technology. The industrial education I knew was woodwork, metalwork, automotive, power mechanics, and electronics. But what was technology education? I attended a number of local, provincial, and international conferences and began to modify my classes toward what I thought was a new philosophy. This philosophy was based on the inclusion of new technologies, and then later, on design and problem-solving using technology. Wasn't the inclusion of new technologies and the development of design and problem-solving ability what counted in technology education? Was this not truly a new philosophy? At first it was gratifying that technology was in the limelight in society and education. I thought saying I taught "technology" held a certain aura especially to the "technically inept". On the surface at least, teaching "technology" held more status than teaching

---

19 I do not wish to give the impression that destabilization of dominant selves is painless. For me, disturbing my men inside who were previously very comfortable has involved rupturing many of the assumptions, beliefs, and values under which they have been acting. Such change can be psychologically explosive (Brookfield, 1987).

20 Labelled by the technical specialists, the "technically inept" are people, who cannot negotiate the work of the technician. Such people are often labelled "klutz" or "useless" by those who have technical skill. Technical specialists sometimes boast that they have no use for the world of the intellectual. This is a sort of reverse snobbery to academics who look upon technical people as ones who cannot pursue scholarly work. These myths have been supported by the artificial separation of "those who work with their mind" and "those who work with their hands." Borders are placed around technical and scholarly ways of knowing. Such borders limit travel between these two worlds.
"shop". In spite of this stroke to the ego, deep down inside was the feeling that all of this was just a mirage, an illusion, a bluff.

Day after day, I provided students with opportunities for designing and making. These experiences often involved newer industrial technologies, such as newly released integrated circuits, robotics, lasers, or plastics. I began to wonder how these activities made me a technology educator since only a year before I had been an industrial educator. Although I was now calling myself a technology education teacher, I found I was doing many of the same things as when I was an industrial education teacher. Despite the glitz of new hardware, the stronger emphasis on design, and the availability of technology education hype, many philosophical questions emerged:

- What really is technology?
- What is worth knowing about technology?
- What counts as a good education in technology?
- Am I teaching technology?
- To what extent are my courses technological?
- Am I blinding my students with gadgets?
- Is there more that I should be addressing than just teaching others to adapt to new hardware and become inventive human beings?
- Is there more I should be doing than just teaching others how to become designers, manipulators, modifiers, makers, and systems integrators?

The combined effect of these questions began to disturb my dominant interpretive frame used in my teaching: industrial/technical man. On the surface, emphasis on a wider range of industrial techniques, problem-solving, and design for human need, seemed to be something new. However, I began to see that the

---

21 In recent years associations of technology educators, school districts, as well as individual teachers, and school departments have released brochures, articles, and videos describing the virtues of technology education. Many newspaper articles show "technological" activities of students designing, making, and testing CO2 power model cars, robotic devices, and unique structures.
underlying belief system of technology education was essentially the interpretive frame of industrial education reinvented, repackaged, and sold through new commercials. I looked carefully at the difference between the philosophy of an industrial education teacher and the "new" philosophy that was increasingly being discussed. Although some of the activity had changed, the essential philosophy and mindset of industrial/technical man was intact. In 1988, I compared the curriculum objectives of the 1977 British Columbia Industrial Education Curriculum Guide with curriculum objectives stated in a number of recently released North American technology education curricula. All of the industrial education objectives were contained within the technology education objectives. Just as technical updates are released for versions of computer software, I saw the technology education movement as no more than a technical and pedagogical update for industrial education. The underlying system architecture was unchanged. One significant difference was that technology education was increasingly mandated in North America as a part of the common curriculum for all students. Another question emerged. Was an updated form of industrial education something all students should be required to take?

Coming to an awareness of gaping deficiencies in the "new basic" of technology education was not an isolated activity. Critical examination of curriculum documents, courses, and activities was paralleled by a similar examination of my own assumptions, and beliefs. The destabilization of industrial/technical man was a process and not an event. Renewal came from a withdrawal from the mononarratives of my profession and quiet reflection. As my technical/industrial man was increasingly

---

22 I shared my findings that the goals of industrial education was a "subset" of the goals of technology education at the 1988 British Columbia Technology Education Association Conference: "Teaching Technology Education." At the time my intent was to alleviate fears and show that technology education was basically a modification of what industrial education teachers were already doing.

23 In the late 1980's technology education was heralded as the "new basic" by the International Technology Education Association (ITEA). Prior to 1985, ITEA existed as the American Industrial Arts Association (AIAA).
nudged from his moorings, I was increasingly able to see the partiality, subjectivity, and mythology of the “new” curricular changes in technology education. In rupturing strongholds of master narratives that dominated my thinking, I began to see entirely new possibilities for technology education. Through excursions into other ways of understanding technology and education, apart from those situated within industrial/technology education, further questions emerged:

• Who benefits from these changes I have made? Who loses?
• Am I an educator concerned with the growth of the whole person, or, am I just a technocrat in educator’s clothing?
• Am I creating addicted consumers, or, individuals who have an ability to examine and resist technological momentum?
• Am I helping students discover in themselves social values regarding technology that they deeply care about?
• Am I just telling students my truth or am I helping them to discover their own?
• What technology education curricula and pedagogy are suitable for females as well as males?
• Am I contributing to the initiation of a technophile, or, the growth of a socially critical citizen?

Formulating these questions has been intertwined with a heightened awareness of personal and professional saturation in technical ways of knowing. These questions emanated not only from classroom practice, directions of the profession, and curricular change but also from tensions between my inner multiple men. This snapshot of the stirrings with/in my inner spaces sets the stage for a discussion of my journeys to wider contexts in which my teaching is situated.

From Life-Narrator to Border-Crosser
The technocratic also lacks a wider sense of community with other person-kinds ... and other nation-kinds ..., and thus it bars its members from directly seeking communion with a wider spectrum of beings. The technocrat would try to dispense with cultural diversity by striving to transfer the modern technological infrastructure to every other culture, in the name of progress and development. (Drengson, 1983, p. 96) [emphasis added]

Goodson (1990) points out that personal narrative provides “important insights into teachers’ lives and careers” (p. 306) since “life history penetrates the individual subject’s consciousness and attempts to map changes in that consciousness over the life cycle” (p. 307). Preoccupation with personal experience and even personal transformation, however, can become an insulation from larger contexts in which self and teaching are situated. Goodson (1990) believes that “life history pursued alongside the study of collective grouping and milieu might promote better integration than history alone” (p. 307). Integration of self-examination and a location of self within wider contexts provides opportunities to understand how smaller and larger structures interact. An examination of the life-history of a teacher combined with an examination of larger contexts in which teaching is situated, provides a more complete understanding of how teachers construct their reality. Chapter Three expands my story of changes in consciousness.
...to Think, to Be; to Unthink, to Free  (Bush, 1983, p. 151)

Cultural workers need to unravel...the ideological codes, representations, and practices that structure the dominant order... (Giroux, 1992, p. 79)

I move beyond life history reflection into wider points of reference in this chapter. Understanding dominant and other stories of technology contributes to an understanding of the partiality of accounts of technology embraced by the culture of technology education. Informed by charting expeditions to new locations of understanding, I map pictures of “technology” similar, and different, to those acquired as a male technical specialist and industrial education teacher. From the micro experiences of socialization as a male technical specialist and industrial/technology education teacher, I border cross24 in and out of larger worlds of technology studies25. Rather than review what industrial/technology educators are saying about technology, I have deliberately moved to discourses located in other understandings of technology. I recognize that my research in this area is entirely partial. For example, I have not included a number of perspectives including aboriginal and environmental. It is important that a diversity of accounts be heard in order to transgress the technocratic metanarratives of technology. My research into various meanings or stories of technology is examined with an eye for improving the storyline of technology

---

24 Giroux (1992) is credited with the concept of “border crossings”.

25 Technology studies refers to a wide variety of perspectives on technology. Technology is not just the focus of industrial/technology educators but is examined from entirely different perspectives by historians, philosophers, sociologists, theologians, feminists, psychologists, engineers, and political scientists, to mention a few.
education. This research, combined with reflections upon my socialization, provides a basis for a cultural examination, in Chapter Four, of technology education curricula.

As an educator tasting the edges of post-modern thought, I feel obliged to help deterritorialize and remap the edges of my consciousness. Technology education is a relatively recent movement and I have found much of the discourse within my profession decontextualized from wider structures in which it is situated. As one initially schooled in the ways of technical/industrial man, opening the lens of my investigation to my lowest "f-stop" has been at times overwhelming, confusing, and uncomfortable. Along the way, I have attempted to suspend my attachments to "grand narratives...and any other form of totalizing thought" (Giroux, 1988, p. 70). Such dominant narratives limit my exploration in what is, at first, foreign territory. Just as ideas from poststructuralism help me grasp a sense of my own complexity, they help me gain a deeper understanding of technology. Self can be viewed as essential, innate, and "one true story", and so can technology. In fact there are many stories to technology that we don't hear. The dominant accounts, or metanarratives, of technology are so pervasive they become the only stories we know. According to Gough (1993), metanarratives are:

...stories that purport to describe, explain or provide a foundation for other stories. The poststructuralist position is that a metanarrative is just another narrative, a social agreement constructed by participants in a particular discourse. Being skeptical towards metanarratives encourages an understanding of ‘reality’ that I once saw encapsulated in the words of a poster in an English (language) classroom: ‘the universe is not made of atoms — it is made of stories’. (p. 3)

Perhaps we could similarly say of technology: "technology is not made of things — it is made of stories". Such stories are accounts constructed by the interpretative frame of the observer. The dominant interpretative frame in Western society is rooted in a technocratic consciousness (Bowers, 1977; Drengson, 1983); the dominant ideology of

---

26 Technology education began as a significant movement in North American education in the early 1980's.
schools is technocratic (Bowers, 1982; Robins and Webster, 1989); and the dominant curriculum ideology of industrial arts, the forerunner of technology education, is technocratic (Zuga, 1987, 1995). Such ideology shapes the way in which the world is interpreted and the sorts of stories that are constructed. Since the dominant interpretative frame in Western society, schools, and industrial arts is technocratic, particular sorts of stories of technology, consistent with this view, are formed. Other stories of technology, not consistent with this view, are marginalized and silenced. The dominant stories support each other and collectively form metanarratives. Metanarratives generate “metaphors and cultural myths which are still affecting society in various ways” (Gough, 1993, p. 3). In this chapter I examine some of these myths.

Metanarratives of technology are firmly entrenched in Western consciousness as common sense accounts of technology. In unthinking common sense accounts, or dominant narratives, we become free (Bush, 1983) to explore other stories and, ultimately, other ways of knowing, seeing, and being. Technology teachers, as cultural workers and public intellectuals (Giroux, 1988, 1992), need to unthink the dominant stories of technology. In undertaking research for this chapter, I have found it necessary to accept the notion of plurality, of “multiplicity of perspectives” of technology in order to obtain a sense, not of the common, but of the cosmopolitan. Drawing from the diversity of my research, I provide a cross-section of stories I have researched. The process of understanding stories is similar to the process of digestion. Stories, like food, must be assimilated. Certain stories, especially ones obscured by common sense accounts, require enzymes of assimilation foreign to our system! For example, in my journey, some of the food in the scarier places required a few bromoseltzers, acidophilus caps, or strong coffees to help protect industrial/technical man, even in his dislodged state, from intestinal shock. After a while, however, I formed new enzymes for digesting a range of stories. Several years ago, the dominant men complained loudly about the new food. Now, all the guys inside keep asking to go to the smorgasbord!
Let us shift the metaphor to travel. Charting technology is in many respects like traveling the world. Travel to the land of philosophers of technology and you hear new languages, then move on to the terrain of critical theorists or feminists and you hear other stories. The stories brought home are the stories of others that I retell. All stories are, in themselves, partial. They are selected, blended, and simplified through my present lenses of interpretation. Collectively, pictures that I have named as the good, the bad, or the ugly, all form part my expanded understanding. Seeing new tiles on the wall, whether chipped, crooked, beautiful, or strange, helps one see new mosaics of meaning.

Point of Departure:

The district of technology education until recently, was known as the district of industrial education. Old pictures of the district, before the name change, showed technical accomplishments, skill, and making and doing. There was general agreement that the name “industrial education” adequately described the life world of the area. Then, new developments began to take place within the area. Lasers and robots moved in to district neighbourhoods and new activities focused on design and problem-solving. Since technology is widely acknowledged as an important factor in people’s lives, industry, and the economy, it was agreed that “technology” was a more desirable descriptor than "industrial". Children travelled daily into the district of technology education and new glossy brochures were made to inform people of the change in identity.

There were some who felt the name change was justified. However, others felt that technology was not an entirely accurate descriptor. Some of the doubters were troubled. They admitted that, as industrial educators, they were not sure what technology was in the first place. They wanted to find out more about technology and so they decided to travel to other lands. Some purchased round-trip tickets for group tours or individual exploration and later returned to tell new stories of technology to the citizens in their community. Others, purchased one-way tickets and were never seen again. (C. Bastone, 1994)
Beyond the Technical: Social/Cultural Understandings of Technology

...we have not sufficiently understood, we have not properly 'pictured,' the phenomenon that technology has become for all of us in the last decade of the twentieth century (Hopper, 1992, p. 9).

The question "What is technology education?" is intimately linked to the question "What is technology?" How can one claim to be a technology educator and yet only be versed in dominant tales of technology? Hopper (1992) points out that there is a desperate need to understand technology. It is ironic that in a time of great technological change "we have not sufficiently understood" (ibid, 1992, p. 9) technology. Although technology represents one of the most controversial, powerful, and dynamic phenomena of our time, it seems to evade comprehension and definition. Rybczynski (1983) refers to Freud's metaphor of technology as a set of artificial organs that itch — a "prosthetic god" that we need but don't understand. A problem in attempting to understand the appendage is its subtlety: "a subtlety that has allowed technology to pervade all corners of our lives without a struggle" (Hopper, 1992, p. 9). Many definitions of technology exist but singular sentences cannot capture a sense of the scope and complexity of technology. "To define technology in a global sense is really quite fraught with difficulties; the best minds among philosophers, historians, social scientists, and engineers have attempted to do it" (Franklin, 1990, p. 14). “Trying to describe technology is something akin to trying to describe jello. It is dynamic, multifaceted, slippery, seductive and only partly transparent” (Bastone, 1990, p. 1).

Herein lies a riddle of technology: the more one tries to capture technology in a neat and tidy definition, the more evasive the task becomes. At first, technology seems concrete and easy to describe. As one focuses tightly on technology, in an attempt to define it, it is apparent that bits are inevitably left out. As one looks closer, instead of becoming clearer, technology becomes obscure. Many people are not even aware that there is a riddle to understanding technology; the puzzle is evident to only those who see the
partiality of dominant accounts by unthinking them. In the pages that follow I will attempt, not to solve, but to gain a greater understanding of this riddle.

When is understanding technology not like a riddle? Technology presents no conundrum if one accepts convenient conventional wisdom or common sense explanations. Examples of common sense representations of technology are not difficult to find. At the most restricted level, common sense descriptions of technology focus on the physical outcome of technology: the artifact or thing produced. Technology as products provides only superficial understanding. Franklin (1990), however, points out that "technology is not the sum of the artifacts, of the wheels and gears, of the rails and electronic transmitters. Technology is a system. It entails far more than its individual material components" (p. 12) [emphasis added]. At another level, common sense accounts of technology include the technical means to produce the products. For example, Pacey (1983) describes a "technical aspect" that involves processes as well as products: "knowledge, skill, and technique; tools, machines, chemicals, liveware; resources, products, and wastes" (p. 6). In a similar manner, The Victoria State Board of Education (1989) includes, along with hardware, the processes involved in production:

To many people technology means equipment, gadgets, machinery, tools or objects such as computers, telephones or cars. The view adopted in this paper is much broader and incorporates all the processes of production from design to final product. The elements of technology are people, materials/resources, the productive process and the product. (cited in Gardner, Penna, and Brass, 1989, p. 2)

Although it may not be at the forefront of their awareness, most people acknowledge that processes, or techniques, such as skills, methods, procedures, and design and

---

27 In my experience, equating technology with hardware is the conventional wisdom of many students. Over a period of six years nearly all beginning grade eight students, when asked to define technology, focused on a particular piece of hardware (the computer).
problem-solving, are necessary to make products\textsuperscript{28}. In this slightly larger common sense account of technology, product and processes form the focus of the picture.

According to Pacey (1983), however, there is more to the "technical aspect" of technology than just products and processes. MacKenzie and Wajcman (1985) point out that "the word 'technology' has at least three different layers of meaning": "hardware", human activities of "doing", as well as "knowledge" or "know how" (p. 3). Similarly, Bijker et al., (1987) describe three constituents of technology as "physical objects or artifacts", "activities or processes", and what people "know" (p. 4). All three "layers" of meaning, products, processes, and technical knowledge, fall within Pacey's "technical aspect". But is technology "mainly about making things?" (Pacey, 1983, p. 177).

MacKenzie and Wajcman (1985) and also Bijker et al. (1987) point out that the three aspects normally associated with technology, technical products, processes, and knowledge, only describe one aspect of technological activity. Similarly, Pacey (1983) emphasizes that the "technical aspect" is only one among several. Technological activity takes place within a social and cultural milieu. Since the social/cultural aspects of technology are not accounted for in a technical accounting of products, processes, and knowledge, Pacey (1983) argues that the technical aspect provides a "restricted meaning of 'technology'" (p. 6) [emphasis added].

When technology is viewed from a technical perspective it appears that technology is value-neutral and not a product of social forces. For example, when we look at a simple machine and how it works, it is very difficult to see that it is anything but value-neutral. "Thus in the world at large, it is argued that technology is essentially amoral, a thing apart from values, an instrument which can be used for good or ill".

\textsuperscript{28} I emphasize to beginning students, after completion of a design assignment, that they are in a better position to appreciate the "processes" and "knowledge" involved behind the "surface" view we have of a product. This is only the beginning stage of trying to help students see "invisible" aspects of technology.
(Buchanan, cited in Pacey, 1983, p. 2). Mander (1993) points out that acceptance of the value neutrality of technology myth is widespread:

...views of technology in our society are nearly identical across the political and social spectrum. The Left takes the same view of technology as do corporations, futurists, and the Right. Technology, they all say, is neutral. It has no inherent politics, no inevitable social or environmental consequences. What matters, according to this view, is who controls technology. I have attended dozens of conferences in the last ten years on the future of technology. At every one, whether sponsored by government, industry, or environmentalists or other activists, someone will address the assembly with something like this: "There are many problems with technology and we need to acknowledge them, but the problems are not rooted to the technologies themselves. They are caused by the way we have chosen to use them. We can do better. We must do better. Machines don't cause problems, people do'. This is always said as if it were an original and profound idea, when actually everyone else is saying exactly the same thing. ...the idea that technology is neutral is itself not neutral --- it directly serves the interests of the people who benefit from our inability to see where the juggernaut is headed. (p. 129) [emphasis original]

It just seems that technology is value-neutral. Winner (1986) points out that "I can use my knife to slice a loaf of bread or stab the next person that walks by. Because technological objects and processes have a promiscuous utility, they are taken to be fundamentally neutral as regards to their moral standing" (p. 6). The value-neutral tale is one of the dominant narratives of technology. Since it divorces itself from the values built into technology, the value-neutral myth helps support a common sense technical understanding of technology. Common sense says technology is products, processes, and technical knowledge and that it is value-neutral.

Capra (1982) believes that we need a broad redefinition of technology that makes explicit the underlying value system. Gardner (1991) stresses that “technology is much more than applied science, it is an expression of culture” (p. 22). Franklin (1990) points out a way to understand the cultural base tied to technology: “looking at technology as practice .... links technology directly to culture... a set of socially accepted practices and values” (ibid, p. 15) [emphasis added]. Pacey (1983) argues similarly that

...in medicine, a distinction of the kind required is often made by talking about ‘medical practice' when a general term is required, and employing
the phrase ‘medical science’ for the more strictly technical aspects of the subject. ...Sometimes, references to ‘medical practice’ ...refers to the whole activity of medicine, including its basis in technical knowledge, its organization, and its cultural aspects. The latter comprise the doctor’s sense of vocation, his personal values and satisfactions, and the ethical code of his (sic) profession. Thus ‘practice’ may be a broad and inclusive concept. (p. 3) [emphasis added]

Through the concept of “technology-practice” Pacey (1983) casts a wider net and draws in much more than just technical understanding. Pacey (1983) adds two domains to his technical aspect. The “organizational aspect” includes “economic and industrial activity, professional activity, users and consumers, [and] trade unions” (Pacey, 1983, p. 6). The “cultural aspect” is comprised of “goals, values and ethical codes, belief in progress, awareness and creativity” (Pacey, 1983, p. 6) [emphasis added]. Together, the technical, organizational, and cultural aspects together provide a “general meaning of ‘technology’” (Pacey, 1983, p. 6) (Refer to Figure 2).

Figure 2. Restricted and general meanings of technology (Pacey, 1983).
Gaining a sense of the *practice* of technology is crucial to understanding the meaning of technology in our lives. Technology as practice situates technical processes, products, and knowledge as only one component within a wider frame of interpretation. Dictionary definitions of the word "technology" focus on technical methods and means and generally make no mention of cultural or organizational aspects. Definitions focus on the meaning of a single word "technology" from a technical perspective. Dictionary conceptions of "technology as practice" are non-existent. Understanding what technology *means* can never be obtained through studying definitions. *We should not assume we can understand the meaning of technology by focusing on the term “technology”*. There are compelling reasons, as Pacey (1983) suggests, why technology can be better understood by considering the more global concept of “technology-practice”. Herein lies a way to avoid being trapped by the riddle of technology. Leiss (1990) suggests that “ideas ... about technology ... have a common fault: they place too much of a load on the concept of technology” (p. 29). The folly of studying technology from a socially decontextualized perspective parallels attempts in other fields to extract partialities from the whole. *Ignoring the contexts in which technology is situated leads to a restricted understanding of the meaning of technological activity.* Portraying a large story from a narrow technical perspective leads to considerable loss of understanding. Drengson (1994) makes an analogy:

> Understanding the whole of a technology-practice is akin to understanding a martial art. You cannot understand the art as a whole if you look only at technique. You cannot succeed in defense against a sword, if you focus all of your attention on the sword. The martial artist must take in the whole situation, especially the spiritual. *Likewise, to understand technology-practice we have to be able to grasp the practice as a whole, while being aware of its complexity and detail.* (p. 4) [emphasis added]

Limited understandings of technology are perpetuated by the assumption that it exists as an isolated undertaking. It is assumed that technology can be understood without consideration of the contexts in which it is situated. A decontextualized account of technology portrays it as autonomous, value-neutral, and *constructed solely*
through the application of technical expertise. The practice of technology, on the other hand, is a more cosmopolitan and contextualized view of the world of technology. It must be remembered that "in order for an object to be known, it must be assigned its necessary place within a context" (Tillich, cited in Thomas, 1987, p. 4). "Technology as such can not be isolated from the use to which it is put" (Marcuse, 1968, p. 184). Franklin (1990) displays a high regard for context by stating "I would like to define...technology in its various aspects within the context in which they occur" and "...context is what matters most" (p. 14,15) [emphasis added].

Conceptualizing technology in the more general sense of technology-practice (Pacey, 1983) provides a more complete portrait — a picture that places the highly visible technical aspect in context. Bijker et al., (1987) refer to larger portrayals of technology, such as Pacey's (1983), as "thick" (p. 5) descriptions. "A thick description results in a wealth of detailed information about the technical, social, economic, and political aspects" (Bijker et al., 1987, p. 5). Such "thick" approaches draw attention to the social complexity of technology. We might call the new picture more "complete", "holistic", "general", "whole" or "in context". Regardless of how we name it, a view of technology that incorporates the social/cultural and organizational aspects provides a means of understanding technology and people together.

Pacey's (1983) technology-practice model provides a means for unthinking common sense accounts of technology rooted in technical fixation. Technology cannot be understood by technical frames of reference alone. Many others emphasize that technology is inherently tied to social considerations. For example, Medway (1989) believes that "technological activity is informed by values at every point" (p. 11). Gilberti (1990) states that "In many cases, the major questions regarding technology are not technical questions, but human questions involving choices and values" (p. 3). Such questions and choices suggest that technology is a moral activity: "technology is a branch of moral philosophy, not of science" (Goodman, cited in Postman, 1992, preface). Jonas (cited in DeVore, 1991) states that "if the realm of making has invaded the space
of essential action, then morality must invade the realm of making, from which it has formally stayed aloof" (p. 272).

In acknowledging social and cultural considerations of technology, we may ask how it is that in our dealings with technology there is a strong tendency to gravitate toward the technical aspects and away from the social and cultural aspects? Several writers believe that the dominant world view of our time is a technological consciousness or mindset (Bowers, 1980, 1988; Stanley, 1978; Drengson, 1983). Bowers (1988) points out that the technological mind-set is technocratic in that it "tends to view all aspects of experience in terms of problems that require technical solutions" (p. 8) [emphasis added]. "In its present form this mind-set recognizes only explicit forms of knowledge .... in addition to discounting the implicit knowledge that enables us to be effective cultural beings, the technicist mind-set devalues the importance of context" (ibid, p. 8, 9) [emphasis added]. "The overriding ideal of this mind-set is the creation of a model or program that is not context-specific but has universal application" (ibid, p. 8, 9). Within the present era of technological consciousness, technical accounts of technology have become dominant narratives. Such accounts are only partial stories or narratives that devalue and obscure deeper understandings such as "technology-practice" (Pacey, 1983). These dominant stories inform orthodox, conventional, and common sense views of technology. In the next section, I adopt a critical perspective toward two dominant stories of technology, technological determinism and technophilia, that are perpetuated by technical understandings of technology.

Technological Sleepwalking: Uncritical Acceptance of Dominant Narratives

...it seems characteristic of our culture's involvement with technology that we are seldom inclined to examine, discuss, or judge pending innovations with broad, keen awareness of what those changes mean. In the technical realm we repeatedly enter into a series of social contracts, the terms of which are revealed only after the signing. (Winner, 1986, p. 9) [emphasis added]
Winner (1986) describes a condition of "technological somnambulism"\(^29\) (p. 5): "for the interesting puzzle in our times is that we so willingly sleepwalk through the process of reconstituting the conditions of human existence" (p. 10). Technological sleepwalking can be thought of as a sort of technological trance. Mander (1991) describes how such sleepwalking and trancelike states occur:

Because technology is now everywhere apparent, pervasive, and obvious, we lose awareness of its presence. ....We live our lives in reconstructed, human-created environments; we are *inside* manufactured goods. We do not easily grasp technology from the outside, or, in McLuhan’s terms, "extraenvironmentally". And once we accept life within a technically mediated reality, we become less aware of anything that preceded it.

....With each new generation of technology, and with each stage of technological expansion into pristine environments, human beings have fewer alternatives and become more deeply immersed within technological consciousness. We have a harder time seeing our way out. Living constantly inside an environment of our own invention, reacting solely to things we ourselves have created, we are essentially living *inside our own minds*. ....We are essentially coevolving with ourselves in a weird kind of intraspecies incest. ....We become ever more enclosed and ever less aware of that fact. (p. 31,32) \[emphasis original\]

As well as "living constantly inside an environment of our own invention" (Mander, 1991, p. 32) we are also living constantly within the confines of the dominant stories of technology. To question such stories may at first seem unthinkable. Through their constant repetition we learn these stories by heart. One such pervasive story is the tale of technological determinism. It acknowledges the social and cultural, but from a technical perspective.

**The Master Tale of Technological Determinism**

In the expanded picture I have discussed for technology, one that attempts to portray the practice of technology, I have illuminated features of the social/cultural scene that place technical aspects in context. When a picture or portrait is viewed, one

\(^{29}\) Somnambulism is sleepwalking.
sees the complexity of the whole picture: the subject and background context working together and interacting. One does not see the subject and background isolated from each other or, separately at different times. The setting of the picture puts the subject in context and has as much to say about the mood of the overall picture as the subject does. An artist understands that both elements must "work together", interacting synergistically to create the whole picture. Suppose we distorted the picture by expanding the technical subject so it completely overwhelms and obscures the context. This is the sort of distortion that occurs in portraying social aspects from a technological determinist perspective.

Technological determinism is a master narrative that undermines thicker depictions of technology and denies a sense of social complexity. It portrays technology as an autonomous force responsible for both beneficial and detrimental social effects (MacKenzie and Wajcman, 1985). In acknowledging and critically examining the increased interdependence of technology and society, it is important to avoid simplistic explanations that contribute to the dichotomization between technology on one hand, and society on the other. Where technology is seen solely "as the metaphenomenon or defining characteristic of contemporary life" (Kraft and Vig, 1988, p. 3), without reference to society's role in shaping technology, we have a deterministic portrayal. Technological determinism does little to acknowledge the reciprocal role of society in shaping technology. Determinism presents an oversimplification of the relationship between technology and society and thereby limits alternative ways of understanding complex and interactive sociotechnical relationships. For example, McGinn (1991) sees existing models that talk of the "impact" of scientific and technological changes on society as profoundly misleading. "It implies that the effect of scientific and

---

30 Paul (1984) in a discussion of critical thinking points out that a one-dimensional explanation "testifies to the primitive state of much of our thinking when it comes to nontechnical, non-technical human problems" (Paul, 1984, p.8). "To the extent that a problem about humans is rendered technical it is reduced to a relatively narrow system of exclusionary ideas" (ibid p.10).
technological changes on society is, like a billiard ball occurrence, simply absorbing the momentum of the 'incoming' innovation and being moved accordingly" (ibid, p. 100). "Impacts" is a transference from the realm of Newtonian physics to the realm of society. It "aids and abets the pernicious notions of autonomous technology and technological determinism" (ibid, p. 101). Reference to "impacts" that technology makes on society is deterministic in that it provides a simplistic one-way portrayals of technology shaping society. Unfortunately, use of "impact" terminology is common and is an indication of the pervasiveness of deterministic assumptions.

There are numerous logical faults with a deterministic portrayal of technology. Robbins and Webster (1989) draw attention to two assumptions of technological determinism:

First, technology is regarded as the determinant factor of social life. It is taken as a given, a requisite of all else, the bedrock, the base, the premise of social existence. Second, technology is isolated from society, and is granted an autonomous existence beyond the arena of morality and human decision-making. (p. 24) [emphasis mine]

Leiss (1990) believes the fault of technological determinism is that it places too much emphasis on the concept of technology and is an "unwarranted exaggeration of the effects of the purely technical aspects of technologies 'on' social systems" (1990, p. 34) [emphasis added]. It only seems that we are being subjected to the pressures of technology, when in fact it is the social forces behind technology that are responsible. Again, in focusing too tightly on the technical, it is difficult to see the context. Through a study of the history of American industrial automation, Noble (1984) reveals technology as both a technological and social process and exposes technological determinism for what it is: a faulty social logic.

At every point, technological developments are mediated by social power and domination, by irrational fantasies of omnipotence, by legitimating

---

31 The use of the term "impacts" is common within technology education curricula and teaching. Pannabecker (1991) points out that persistent use of this term perpetuates the myth of technological determinism in technology education.
notions of progress, and by the contradictions rooted in the technological projects themselves and the social relations of production. ... Technological determinism, the view that machines make history rather than people, is not correct; it is only a cryptic, mystifying, escapist, and pacifying explanation of a reality perhaps too forbidding (and familiar) to confront directly. If the social changes now upon us seem necessary, it is because they follow not from any disembodied technological logic but from a social logic – to which we all conform. (1984, p. 324) [emphasis added]

**Deterministic Logic: Causes and Consequences**

I will discuss five key reasons why technological determinism is a widely held assumption. First, the deterministically fueled emphasis of beneficial and detrimental effects of technology on society is a simplistic, yet very powerful snare. Noble (1984) points out that although determinism "simplifies life, it also diminishes life, fostering compulsion and fatalism, on the one hand, and an extravagant futuristic, faith in false promises, on the other" (p.xi). People are trapped into "an arbitrary polarization between subjective feelings of pessimism and optimism and between warnings of doom and complacent advocacy of a 'technological fix'" (Leiss, 1990 p. 28). Both views lead people to believe that their technology shapes them rather than the other way around (MacKenzie & Wajcman, 1985).

A second factor that may contribute to deterministic views is the relative difficulty in understanding and demonstrating the influence of society on the course of technological development. Although the physical presence of technology is highly visible, the ways in which societal forces shape technological activity are less visible. The contributions of social groups to the design of artifacts are not entirely obvious. For example, Bijker, et al., (1984) researched the social constructions of bicycles and Bakelite. The effects of social forces on the decision making processes of the innovators of these products provides examples of how social values are embedded in products. Such stories are invisible if we look only at the product. The social construction of technology is a process that is often obscured by the highly visible technical.
A third factor is the tendency of a technocratic paradigm to produce deterministic accounts (p. 3). For example, Smith (1991), in his critique of the tyranny of Japanese megaprojects in Australia, illuminates the underlying deterministic assumption of the “high tech fix”:

The metaphysical elements of the technocratic paradigm, and their concrete political application are denoted here by the expression the high tech fix – the thesis that human societies are infinitely plastic and readily moulded by technological change and that all environmental problems can be solved by the application of new technology and by increasing the rate of economic growth. (p. 2) [emphasis original]

Technocratic power structures “imply technological determinism, in that advanced technology is viewed as a powerful independent variable, shaping society” (Burris, 1993, p. 3) [emphasis added].

A fourth agent nourishing deterministic mindsets is the high profile of science and technology on value systems. Capra (1982) comments:

Technological growth is not only regarded as the ultimate problem solver but is also seen as determining our life styles, our social organizations, and our value system. Such “technological determinism” seems to be a consequence of the high status of science in our public life — compared to philosophy, art, or religion — and of the fact that scientists have generally failed to deal with human values in significant ways. This has led most people to believe that technology determines the nature of our value system and our social relations, rather than recognizing that it is the other way round; that our values and social relations determine the nature of our technology. (p. 219)

Shor (1986) points out that the ability of science to dictate its own value system and its inability to deal with the question of human values is rooted in a value-neutral approach:

Moral lessons fled science. They retreated to some parts of the humanities. The closeness of science to the power elite equaled its distance from the heart of ethics. Science has made business and the military powerful, so science education cannot include a critical study of science in society. The very idea of business-dominated science or military dominated research is anathema to the value-free pretensions of science. (p. 53) [emphasis added]
A fifth factor that perpetuates technological determinism is language. Persistent reference to "technological impacts" and the need to "adapt to technology" fuel the notion of a one-way relationship between technology and society. There are other factors, in addition to the five mentioned here, that perpetuate deterministic tales of technology. As Capra (1982) points out, technological determinism has influenced limited and monocular understandings of technology by most people. If the social/cultural aspect of technology is to be addressed beyond a parochial characterization in technology education curricula, it is important to recognize technological determinism as one of the strongest myths perpetuated by ordinary understanding.

What are the consequences of accepting the myth of technological determinism? Technological determinism is much more than a false view of technology. One of the most pernicious consequences of deterministic logic is that it suggests there is little opportunity for people to direct and control technology. Deterministic characterizations fuel a technological "imperative" obliging society to continually adapt to technology. Technological determinism "presents technical advance as a process of steady development dragging human society along in its train" (Pacey, 1983, p. 24). This type of thinking straight-jackets or "bluffs" (Ellul, 1990) society into forming compliant responses (Franklin, 1990) toward technological development. Hickman (1990) points out that treating technology as a force in its own right, renders "human beings increasingly impotent with respect to control over their lives" (p. 9). Noble (1984) maintains that technology has become a "deterministic device of our own making with which to disarm critics, divert attention, depoliticize debate, and dismiss discussion of the fundamental antagonisms and inequities" (p.ix) [emphasis added]. One-way portrayals of technologically determined society can unfairly point to people as problematic and machines as neutral. Pacey (1983), for example, points out that "many social problems are regarded as being due to 'culture lag', which arises when social norms and institutions fail to adapt to the latest developments" (p. 24).
My critical examination of technological determinism sets an additional reference point in researching dominant and other stories of technology. I do not wish to treat this last topic too lightly. Teachers of technology must understand the partial story of technological determinism. It is so entrenched in popular thought that it often escapes detection. In fact technological determinism is firmly in place within master tales of technology: "the good guy/bad guy story". In other words, is deeply entrenched within prevailing optimistic and pessimistic accounts of technology. It is important to recognize that both optimists and pessimists can become trapped in deterministic logic.

**Optimism and Technophilia**

*That our society would tend to view new technologies favorably is understandable. The first waves of news concerning any technical innovation are invariably positive and optimistic. That's because, in our society, the information is purveyed by those who stand to gain from our acceptance of it: corporations and their retainers in the government and scientific communities. None is motivated to report the negative sides of new technologies, so the public gets its first insights and expectations from sources that are clearly biased. (Mander, 1993, p. 129)*

Optimists see technology as the provider of bountiful returns for society such as "higher living standards", "opportunity for choice", "more leisure" and "improved communications" (Barbour, 1993, p. 4,5). Fleming (1989) points out that "optimism was based primarily on the notion that technology held the key to economic prosperity... Technology became the focus of public homage" (p. 391). The cornucopia of material production leads us to view technology as primarily beneficial, particularly with regard to economic growth. Noble (1984) points out examples of great confidence in technology:

...touted as the creator of jobs and the key to prosperity and social stability...heralded as the only guarantor of ecological integrity...championed as the vehicle of emancipation and greater democracy...acclaimed as the preserver of peace...and worshipped as the supreme expression of mankind's freedom and power. (p. x)
Many writers have pointed to a future where technology will increasingly be the
determiner of society. For example, Noble (1984) points out that we cling to the
"fantasy of technological transcendence" since "whatever the question, technology has
typically been the ever-ready American answer, identified at once as the cause of the
nation’s problems and the surest solution to them" (p.x). The assumption is that
technology can solve the world’s problems including its own. The whiz-bang world of
high-tech gadgets is for many an enticing outflow of technology. “Never before has a
people been so tempted to believe that anything is technologically possible” (Boornstin,
1978, p. 34) [emphasis original]. Godet (1984) comments that: “in the new creeds of the
technological (and other ‘ic’) revolutions, nothing is a priori impossible and every
problem has a solution, even those stemming from technology itself” (p. 120). If a
problem arises there are those who point to a technical fix as the answer. Godet (1984)
points out that the

...myth of salvation through a technological godmother will be long-lived,
because it is consciously maintained by an entire intelligentsia. Powerful
lobbying by technocratic and industrial groups which have risked their
reputations can only change direction if/when the mirage fades in the face
of evidence. (p. 121) [emphasis added]

Hopper (1991) explains that the historic notion of progress was “always
conceived in broad social terms” and asks why have we “come to identify progress
chiefly with growth, with technology?” (p. 53). Placing our hope in technology has
resulted from a disillusionment with the promise of politics (ibid) but the promises of
technology are temporary:

Technology provides a lesser hope... It offers something of a distraction
from the earlier hopes... Technology’s distractions are short-lived: a new
style, a new design, a new convenience, the passage of some time and then
boredom, and the search for something new...But with the passage of five
or six years, the excitement, the stir, the resolve are gone, and we wait for
something new. Technology will provide this and we forget the promises
with which the last technology came. (p. 74)
A current example of technological optimism is the promises heralded by the shakers and movers of the information revolution. Winner (1986) comments on the optimistic technobabble:

...taken as a whole, beliefs of this kind constitute what I would call mythinformation: the almost religious conviction that a widespread adoption of computers and communications systems along with easy access to electronic information will automatically produce a better world for human living. It is a peculiar form of enthusiasm that characterizes social fashions of the latter decades of the twentieth century. Many people who have grown cynical or discouraged about other aspects of social life are completely enthralled by the supposed redemptive qualities of computers and telecommunications. (p. 105)

Other critics of information, after "smelling the virtual flowers and counting the road-kill on the digital superhighway", propose "the theory of the virtual class" (Kroker and Weinstein, 1994, cover). The promises made by proponents of the information highway are contrasted with a theory of the formation of a "virtual class" and culture that is "wired shut" (ibid, p. 4):

The twentieth century ends with the growth of cyber-authoritarianism, a stridently pro-technology movement, particularly in the mass media, typified by an obsession to the point of hysteria with emergent technologies, and with a consistent and very deliberate attempt to shut down, silence, and exclude any perspectives critical of technotopia. Not a wired culture, but a virtual culture that is wired shut: compulsively fixated on digital technology as a source of salvation from the reality of a lonely culture and radical social disconnection from everyday life, and determined to exclude from public debate any perspective that is not a cheerleader for the coming-to-be of the fully realized technological society. The virtual class is populated by would-be astronauts who never got the chance to go to the moon, and they do not easily accept criticism of the new Apollo project for the body telematic. This is unfortunate since it is less a matter of being pro- or anti-technology, but of developing a critical perspective on the ethics of virtuality. (ibid, p. 4,5)

Drengson (1990) points out that optimism with technology, in its extreme form, leads to the love of technology, or technophilia, "...that turns the pursuit of technology into the main end of life...it eventually aims to apply technology to everything" (p. 30). Many people are strongly oriented toward, and even preoccupied with, the application of technology. Although optimists may recognize environmental consequences and
human risk, they are hesitant to place these concerns before perceived benefits especially those involving financial advantage. In their quest to extract utilitarian benefits from technology, technophiles tend to ignore technology as a value-laden, social, and problematic force. Earlier, I discussed the problems with value-neutral accounts. Value-neutral accounts are rooted in instrumental theory that

...offers the most widely accepted view of technology. It is based on the common sense idea that technologies are "tools" standing ready to serve the purposes of their users. Technology is deemed 'neutral', without valutative content of its own. (Feenberg, 1991, p. 5) [emphasis added]

According to Borgmann (1984), an instrumentalist view sees human beings as basically tool users, inventors, makers. Feenberg (1991) points out that technology as instrumentality "...is indifferent to the variety of ends it can be employed to achieve" and "...appears to be indifferent with respect to politics" (p. 5,6). "The socio-political neutrality of technology is usually attributed to its 'rational' character and the universality of truth it embodies" (ibid, p. 6). The language of the instrumentalist in regard to technological issues focuses on "trade-offs" (ibid, p. 6) and suggests that two variables cannot be optimized. In other words, we face "tough decisions" to either use a technology and suffer any negative outcomes or to not use a technology. Instrumental theory, as such, is "the dominant view of modern governments and the policy sciences on which they rely" (ibid, p. 6). Narratives that are highly optimistic of technology seldom acknowledge the social construction of technology. As deterministic accounts they provide the ideal myth to obscure the notion that alternatives to technical fixes are possible (Leiss, 1990). It is important to recognize the strongest optimistic claims of a new technology come its proponents (Mander, 1991). As such, we should "be deeply skeptical of all claims" (ibid, p. 49). The optimist description of the relationship between technology and society is something like a technological one-way conveyor belt that drops off a constant stream of technical blessings at society's door. In this accounting, the only choice permitted is to keep the conveyor moving or to turn it off --- and who could conceive of turning it off? What optimists don't point out is that it is possible for
the conveyer to return to technology with input from people. The voices proclaiming
the promises of technology obscure the voices proclaiming the promises of people.

The stories provided by the optimists of technology have led to the "pro-
technology paradigm" (Mander, 1991, p. 30). Mander (1991) believes "we are now
embedded in a system of perceptions that make us blind and passive when it comes to
technology" (p. 30) [emphasis added]. The following factors have led to the
pervasiveness and deep rootedness of the "pro-technology paradigm":

- dominance of best-case scenarios
- pervasiveness and invisibility of technology
- limitations of assessing technology from a personal view
- the inherent appeal of the machine
- the assumption that technology is neutral (ibid, p. 30-36)

The above factors bias people's attitudes toward an optimistic account of technology
and marginalize their ability to be critical. However, many people who work with
technology who were originally optimists, including myself, have realized they have
placed too much faith in technology. Reflection upon the human and environmental
costs, as well as the contribution by technology to "...the concentration of economic and
political power" (Barbour, 1993, p. 8,9), have led to serious concerns regarding the
threat of technology. The realization that "...technology is becoming an autonomous
force endangering human and nonhuman values" (Drengson, 1990, p. 30) can cause the
technophile to shift toward the position of the technophobe.

Undervalued Accounts: Pessimism and Technophobia

In thinking about technology within the present climate of technological worship,
emphasize the negative. This brings balance. Negativity is positive. (Mander,
1991, p. 50)
In charting a larger mapping for understanding technology, perhaps no other group has provided me with greater food for thought than those who hold a pessimistic view. I suppose this is partly because I was not fully aware of the extent of their position. In my experience, technical specialists and industrial educators are generally optimists, that is, they have confidence in technology's ability to get a job done. One of the primary tasks of an industrial educator is to interest others in technique and the process of solving technical problems. Typical practice of industrial education does not help students gain a critical perspective on the industry and technology. *It is very difficult to be preoccupied with technique and at the same time subject it to critical questioning.*

Upon examination of a variety of pessimist writings, the ideas conveyed put into words many of the uneasy and empty feelings I had experienced with technical fixation. Although technophobic thought can become an obsession in itself, it holds a particular value in an age of unrelenting obsession with technology. Pessimists are able to form critical comment because they have distanced themselves from the "fantasy of 'empowerment'" (Kroker and Weinstein, 1994) of the technophile.

Noble (1984) points out examples of some of the concerns pessimists have with technology:

*...feared as a threat to pastoral innocence...assailed as the harbinger of unemployment and social disintegration...condemned as the cause of environmental decay...denounced as the handmaiden of exploitation and tyranny...targeted as the silent cause of war...reviled as the modern enslaver of mankind...*(p.x)

Such attacks against the virtues of technology hold considerable substance and are more than mere counterpositions to the claims of the optimists. The "grow at any price" mentality of the industrial era which saw technology as an "expander of human capabilities" is being tempered with the reality that it is also a "limiter" (Volk, 1991, p. 1). The effects of technology on the human landscape may be more difficult to measure than effects on the physical landscape. Nevertheless, there are those who believe them to be significant and pervasive. For example, some have written about the way technology alters both the physical and *psychological* fabric of society (Kipnis, 1990).
Gergen (1991) refers to "technologies of saturation" that have contributed to the "saturated self" (p. x) --- working lives that are overwhelmed and driven by technology. Marcuse (1964) argues that thinking is dominated by technological rationality and creates "one-dimensional man" (sic).

A consistent theme of many pessimists is that much of the negative consequences of technology happen as a result of preoccupation with technique. The real danger for society in technology may not be the risks and threats through technological catastrophe, such as Chernobyl, but in the mindset and the subtle ways we can let it order our lives. Stanley (1978), for example, recognizes limitations that develop from a chiefly positive view of technology and defines "parochial technicism" as unconsciously taken for granted assumptions that contribute to a "common state of mind in which the world is viewed myopically through the lens of some particular technique" (p. 10). Widespread parochial technicism becomes "pantechnicism" (ibid) which is the domination of the world's social order wholly by techniques. Technicism, or preoccupation with technique, a tenet of the technocratic paradigm, Drengson (1983) describes how such orientation limits the scope for human growth:

The technocratic paradigm carries a concept of persons as "one-dimensional". Persons are reduced to functions. Their education becomes mere vocational training. Nature is an inert resource, not a source of intrinsic values. Rich intersubjective life becomes almost nonexistent, in technocratically controlled, programmed, and canned, technocentric entertainment. In technotopia there is no concept of personal development, beyond the automated life of comfort and pleasure in a controlled environment. Yet if life is to have meaning and significance, persons must discover values that lie outside the limits set by the technocratic orientation. For the technocrat there are no new values to be discovered. We already know all we can know about them. We lack only

---

32 Davis (1981) provides an example of technical preoccupation. Through personal experience of working within the narrow intellectual perspective of a technician, Davis (1981) exposes a subculture who spend their time solving technical but not moral problems. "It is illuminating to recognize the degree to which we live in two very different noetic worlds: a world of technical and technological order and clarity, and a world of personal and social disorder and confusion. We are increasingly adept at solving problems in the first domain and increasingly endangered by our inability to solve problems in the other" (Paul, 1984, p.7).
information and technical ability. But we can know how to get these, i.e.
by means of technological procedures. Spiritual development, aesthetic
appreciation, transformation of our consciousness, these all lie outside the
scope of the possible, as seen from the perspective of the technocratic
mind-set. (p. 85) [emphasis added]

Campolo (1991) maintains that we have become so preoccupied with the promises of
technology we have lost sight of its effect on our spirits and values.

Another theme within pessimistic accounts of technology is the portrayal of
technology as an overwhelming force. For example, Winner (1990) sees each technical
area within society as a kind of “regime of instrumentality, under which we are obliged
to live” and collectively likens these to a parallel constitution or authority for society (p.
409, 410). Boornstin (1978) refers to the “overwhelming forces of technology that
homogenize the culture of the human race” (p.xiv) and believes that “the converging
powers of technology will eventually triumph” (p. xv). “With crushing inevitability, the
advance of technology brings nations together and narrows the differences between the
experiences of their people” (ibid, p. 6) thus contributing to a worldwide “Republic of
Technology” (ibid p. 2). Using deterministic language, Boornstin (1978) states “here are
a few of the forces at work in the Republic of Technology that will shape our American
lives in the next century” (p. 8) [emphasis added]:

Technology invents needs and exports problems...a way of multiplying
the unnecessary...

Technology creates momentum and is irreversible. Nothing can be
uninvented.

Technology assimilates...forces us to equalize our experience...

Technology insulates and isolates...making new ways to insulate us from
each other...each of us in danger of being suffocated by his own
tastes.

Technology uproots...separates us from our own special time and place.
(p. 8-11)

Ellul (1990) says that humanity is “bluffed” by technology:

The great design has three panels...On the central panel is humanity
perfectly adapted to the requirements of the smooth functioning of
sciences and techniques. People are trained for this from their youth.
Their mission is to promote it. On the left panel is fascinated humanity: fascinated by the marvels of science and technique and by the ever-growing opportunities of our life. On the right panel is diverted humanity: games and distractions of all kinds, gadgets, etc. People here are diverted from seeing reality. (p. 405)

Adapted, fascinated, and diverted humanity are a humanity numbed into compliant and passive roles. “What is required of people today? ....to work well...not to become involved...to be a good consumer...to follow the opinions propagated by the media....These, then, are the four duties of people today” (ibid, p. 405,406)33.

Positions such as those held by Winner, Ellul, and Boornstin, that emphasize technology as sovereign force are rooted in substantive theory. According to Hickman (1990) substantive approaches “reify technology by treating it as a force in its own right” (p. 9). In portraying a technology that completely dominates the human landscape, such portrayals are problematic. “Unrelieved pessimism undercuts human action and becomes a self-fulfilling prophecy. If we are convinced that nothing can be done to improve the system, we will indeed do nothing to try to improve it” (Barbour, 1993, p. 15). Feenberg (1991) points out that although substantive theory “denies the neutrality of technology”, “…the issue is not that machines have ‘taken over,’ but that in choosing to use them we make many unwitting cultural choices” (p. 7) [emphasis added].

Having pointed out fault with the deterministic messages of pessimists, it is important to remember that pessimistic accounts are healthy inasmuch as they counter the exaggerated claims of the optimists34 (Mander, 1991). Although bleak, pessimistic pictures undercut the value-neutral assumptions of instrumental theory. The

---

33 I saw a very similar social comment on a label in an Oregon telephone booth. The sticker had an American flag and read: “Don’t ask questions, become a good consumer, die!” Such deterministic statements imply that we must adapt to the existing societal order.

34 A technophile’s view of technophobia is a problem to be fixed. Technophobia is usually regarded as a fear of interacting with things such as computers rather than as a source of legitimate doubt.
soujourner in technology can now search for alternatives to the binary conflict of technological optimism and pessimism.

Revealing Accounts: Technology as a Social Construction

Our culture objectifies technology and sets it apart and above human affairs. (Noble, 1984, p.ix)

What is needed is an understanding of technology from inside, both as a body of knowledge and as a social system. Instead, technology is often treated as a “black box” whose contents and behaviour may be assumed to be common knowledge. (Layton cited in Bijker et al, 1987, p. 198) [emphasis added]

The instrumentalist viewpoint, often embodied by the optimists of technology, “is based on the common sense idea that technologies are ‘tools’” and are value free (Feenberg, 1991, p. 5). Such accounts are the common sense view of governments and industry (Barbour, 1993; Mander, 1991). In contrast, the substantive view frequently held by pessimists represents a minority position (Barbour, 1993) “that attributes an autonomous cultural force to technology that overrides all traditional or competing values” (Feenberg, 1991, p. 5). Both instrumental and substantive accounts of technology provide food for thought for the traveller attempting to understand the meaning of technology. Humans, however, like to “think in terms of extreme opposites” (Dewey cited in Robins and Webster, 1989, p. 271) [emphasis added]. By considering only these two ways of seeing, it is possible to get caught in a binarism. Giroux (1992) believes that “the logic of binary oppositions appears to have become an obsessive fatal attraction” (p. 23). For example, Davis (1980) refers to confined technical activity as “technological nihilism” and argues for a technological humanism to act as a
counterforce. In calling for a counterforce, a “technology versus humanism” conflict is set up (Feenberg, 1991).

Such binarisms obscure many other ways of comprehending technology. Giroux (1992) points out in general terms that "the violence of master narratives formed in the language of binary oppositions" (p. 23) may actually reinforce dominant narratives since "within such polarities there is little room for understanding the points of resistance, multiplicities, complicities, oppressions, and liberating elements that undermine all binary oppositions" (p. 24). In unthinking the simplicity of polarized positions we are able to “name its complexity” (Bush, 1983, p. 156). The effect of the polarized rhetoric of technophiles and technophobes creates compliant attitudes toward technology:

Polarizing the rhetoric about technology enables advocates of particular points of view to gain adherents and power while doing nothing to empower citizens to understand, discuss, and control technology on their own. ‘Making it o’er simple all along’ has proven an excellent technique for maintaining social control. The assertion that technology is beneficial lulls people into believing that there is nothing wrong that can’t be fixed, so they do nothing. Likewise, the technophobia that sees technology as evil frightens people into passivity and they do nothing....In all cases, the result is that people feel they can do nothing....rhetoric wars draw public attention away from more important questions such as who is making technological decisions?, on what basis?, what will the effects be? (ibid, p. 156) [emphasis added]

Although my categorization of “optimists” and “pessimists” is in itself a construction, it serves to point out a common weakness. Both accounts of technology are deterministic in that they emphasize technology’s “impact” on society and do little to focus attention on the socially constructed complexity of technology. “Technology does appear to have its own impact upon our lives, when we fail to recognize the human choices, intentions, and compulsions that lie behind it” (Noble, 1984, p.xi) [emphasis added]. Noble (1984) further explains the dilemma:

The focus here is upon things but the real concern is with people, with the social relations which bind and divide them, with the shared dreams and delusions which inspire and blind them. For this is the substrate from which all of our technology emerges, the power and promise which give it shape and meaning. For some reason, this seemingly self-evident truth
has been lost to modern Americans, who have come to believe instead that their technology shapes them rather than the other way around. (p.ix) [emphasis added]

Noble (1984) argues that technological development is a social process:

...technology does appear to have its own impact upon our lives, when we fail to recognize the human choices, intentions, and compulsions that lie behind it. Because of its very concreteness, people tend to confront technology as an irreducible brute fact, a given, a first cause, rather than as hardened history, frozen fragments of human and social endeavor....for the process of technological development is essentially social, and thus there is always a large measure of indeterminacy, of freedom, within it. (Noble, 1984, p.xi)

In understanding technology as a social process, underlying issues of power, class, politics, equity, values, morals, and choice are made perspicuous. Barbour (1993) explains that technology is "an ambiguous instrument of power whose consequences depend on its social context" and that "technologies are social constructions, and they are seldom neutral because particular purposes are already built into their design" (p. 15) [emphasis added]. Bush (1983) points out that "equity has not been a major concern of either technophobes or technophiles" (p. 163).

Leiss (1990) describes "technologies" from a social construction perspective and points out that by distinguishing between techniques and technologies it is possible to achieve a more accurate view of technology. Techniques are described as "solutions to practical or theoretical problems" (ibid, p. 29). Techniques may be lying dormant or actively in use in society. Technologies, on the other hand, are combinations of those techniques that have attained general social significance (ibid):

...only general modes of social organization, not the specific properties of techniques themselves, determine which types of techniques will be encouraged and promoted and which will be played down or perhaps forbidden. (p. 30) [emphasis added]

In established social patterns, techniques are almost always combined with class, status, and role determinations that specify who can perform the operations associated with techniques and under what culturally legitimated conditions (p. 31). Technology, therefore, is an aggregation of techniques that is operational only as a result of the social
Determinations of a culture. When the technological imperative shouts its rallying cry "adapt to technology!" in effect it is not saying "adapt to value-neutral technical knowledge" but rather "adapt to the techniques that the social order has given significance to". Understanding technology as a social construction exposes the polarized myths perpetuated by the "technology as threat" and "technology as triumph" positions. Social constructivist accounts of technology do not buy into the 'technology as value neutral tool' rhetoric of instrumentalist portrayals. Technology as a social process also undermines the 'technology as autonomous force' claim of substantive theory. In examining how technology is socially determined, the taken-for-granted assumption of technologically determined society is undermined.

The social construction story of technology stresses that technologies are value-laden and socially determined. Technologies are themselves determined by modes of social reproduction:

Just as techniques are incorporated into technologies, so are the latter in turn incorporated into wider frameworks that I call 'modes of social reproduction'. These are the predominant forms of institutional organization in economy, politics, and social relations. The distribution and significance of power, authority, property, class, status relationships, and social roles are the decisive attributes of these institutional forms. (Leiss, 1990, p. 32)

The dominant mode of social reproduction in western society is capitalism. "Such a system will have a bias in favour of technologies that enhance the power of these institutional arrangements – for example, industrial technologies." (ibid, p. 32) [emphasis added]. The "adaptation to technology" message of technological determinism is of direct benefit to the corporate economic agenda based in a competitive market environment. Corporate leaders use their influence to "perpetuate a value system consistent with corporate interests" (Capra, 1982, p. 221). Technological determinism casts society as a passive party and helps perpetuate the dominant social control corporate institutions have over the creation of technologies. Technological determinism obscures the underlying social processes that establish certain groups of techniques as operating technologies. As social determinants are made less visible, there is
less perceived need to examine technological development with a socially critical eye. A social determinist explanation offers a counter argument to technological determinism.

Acknowledging and Valuing Complexity: Contextualism

*Society and technology are not two ontologically distinct entities but more like phases of the same essential action.* (Latour cited in Law, 1991, p. 129)

Accounts of technology that provide for the multiple direction interactions between technology and its larger contexts, such as social, political, and economic, are referred to in this thesis as contextualized accounts. The contextualist position emphasizes the mutual shaping of society and technology. Contextualist accounts of technology seek to understand the complexity of technology. The contextualist outlook attempts to understand the multiplicity and complexity of that which is considered inseparable. Contextualization is therefore a way to escape the trap of social and technological determinism, permitting new understandings of technology to emerge. A diagrammatic depiction (see Figure 3) contrasts contextualism with deterministic accounts:

---

35 Drengson (1983) points out that a technocratic view of technology cannot acknowledge complexity since *the technocrat strives to reduce this complexity to monolithic, material simplicity.* (p.92).
DETERMINISM
• emphasizes linear one-way cause and effect actions

TECHNOLOGICAL DETERMINISTS:
• view technology as: a force that "impacts" on society and produces positive or negative outcomes, technology determines society

Optimists/Technophiles
• technology gives primarily positive "impacts", • any problems can be corrected with a "technical fix", • "promise" of technology as liberator and economic benefits, • technology as value-neutral, • often rooted in "instrumental theory" (technology as neutral tools) – the accepted theory of most governments and industry

Technology → Society +

Pessimists/ Technophobes
• technology gives primarily negative "impacts", • threat to humanity, • autonomous force that orders people's lives, • imperialistic and addictive force, • technology as value-laden), often rooted in "substantive theory" (technology dominates people) – a minority position

Technology ← Society −

SOCIAL CONSTRUCTIVISTS/DETERMINISTS
• technology is directed by human values, choices and intentions

Society → Technology

CONTEXTUALISM
• emphasizes multiplicity of actions, interrelatedness, interdependence
• context is emphasized (relationships to other things are important)

TECHNOLOGICAL CONTEXTUALISTS:
• acknowledge that technology can be socially determined and that society can be technologically determined
• technology as: context dependent, a diversity of interactions with society, "an ambiguous instrument of power" that can become the "servant of human values" (Barbour, 1993, p.15)
• technology and society as inseparable; "...phases of the same essential action" (Latour, cited in Law, 1991, p.129)

Figure 3. Determinist and contextualist "stories" of technology.
The advantage of a contextual view of technology is its celebration of the diversity of interactions between technology and the contexts in which it is situated. Staudenmaier writes that

...contextualism is rooted in the proposition that technical designs cannot be meaningfully interpreted in abstraction from their human context. The human fabric is not an envelope around a culturally neutral artifact. The values and world views, the intelligence and stupidity, the biases and vested interests of those who design, accept and maintain a technology are embedded in the technology itself. (Staudenmaier, cited in Barbour, 1993, p. 22)

Contextualism emphasizes that it is important to view technology in terms of its relationship to other things. Law (1991) points out that we need methods for dealing simultaneously with both the social and the technical and argues that there needs to be a way to talk about "the-social-and-the-technical" "all in one breath" (p. 8). Bush (1983) identifies four contexts of technology that require consideration:

1. The design or developmental context which includes all the decisions, materials, personnel, processes, and systems necessary to create tools and techniques from raw materials.

2. The user context which includes all the motivations, intentions, advantages, and adjustments called into play by the use of particular techniques or tools.

3. The environmental context that describes nonspecific physical surroundings in which technology or tool is developed and used.

4. The cultural context which includes all the norms, values, myths, aspirations, laws, and interactions of the society of which the tool or technique is a part.

Of these, much more is known about the design or developmental context of technology than about the other three put together. (p. 157) [emphasis added]

The design or developmental context corresponds to Pacey's (1983) "technical aspect". Technology education emphasizes this technical aspect (Foster, 1995). A context sensitive approach views technology as a form of human cultural activity that "creates immediate particular, and personal and/or competitive advantages in a given ecological, economic, and social context" (Bush, cited in Bush, 1983, p. 164). In other
words, a contextualist study of technology includes an "equity analysis" (ibid, p. 164). For an example of what this analysis might entail see Appendix I. Capra (1982) points out that fragmented approaches to understanding technology results in a technology that has become “profoundly antiecological, antisocial, unhealthy, and inhuman" (Capra, 1982, p. 219). Approaches to technology that emphasize context must replace fragmented approaches (Capra, 1982; Franklin, 1990).

Technocratic Metanarrative as Common Sense Reality

This chapter has described dominant and other stories of technology. Dominant stories of technology included the tale of technological determinism, the pro-technology orientation, and the technophile/technophobe binarism. Such stories are standard tales of a technocratic orientation and focus on a restricted technical, as opposed to general or contextual, understanding of technology. I have pointed out the fault of these common sense accounts. They focus too tightly on the term “technology" and portray technology as value-neutral. A value-neutral perspective views technology instrumentally as tools. Another common sense understanding is technological determinism. Technological determinism suggests that people have little influence over technological development and are destined to be compliant participants who receive inevitable positive and negative impacts of technology. Such common sense views make it difficult to comprehend broader understandings of technology such as technology-practice (Pacey, 1983). To show the partiality of these technocratic metanarratives I have shared other less visible stories such as the pessimism of the technophobe, social constructivism, and contextualism. To keep a check on the influence of technocratic metanarrative I have included a list "Recommended Attitudes" (Mander, 1991) (see Appendix II).

It is a responsibility of a technology teacher to understand a diversity of stories of technology. To do otherwise is to default one's consciousness and teaching to the
common sense of technocratic metanarrative. This statement may sound fatalistic but there is considerable opinion that technocratic metanarrative is a foundation of Western consciousness and reality. Bowers (1977) uses the term "technological consciousness" as an "inclusive term for designating the interlocking set of beliefs and assumptions that are emerging from the Western way of integrating science, technology, and bureaucracy" (p. 36). Underlying such consciousness is a technocratic ideology:

Technocratic ideology is becoming our everyday common sense reality; to identify its essential characteristics is essentially the same as mapping the way our taken-for-granted consciousness organizes the world. This ideology is not being proclaimed as the vision of truth by a radical minority, but instead is represented in the routine work of those scientists, bureaucrats, educators, and businessmen who occupy the conservative centre of society. For many people it is the expression of modernity and inevitable progress. Its underlying epistemology is ... positivism, its principles for organizing social behavior are derived from bureaucratic procedure, and its ability to make the cult of consumerism a reality for the middle class is made possible through the use of scientific technique. In looking at the influence of the technological ideology on the structure of human consciousness we can see that it involves specific ways of organizing reality.  

Over time, incremental changes are cumulative. "Modern technology advanced in such tiny increments for so long that we never realized how much our world was being altered, or the ultimate direction of the process" (Mander, 1991, p. 9). Perhaps we never realized how much our consciousness was being altered. Borgman (1984) describes the social paradigm and ontological dimension generated by technology as largely invisible:

When a social paradigm is deeply entrenched, it not only informs most human practices but it also patterns the organizations, institutions, the daily implements, the structures of civilization, and even the ways in which nature and culture are arranged and accessible. All of reality is

---

36 Bowers (1977) describes characteristics of technocratic ideology that underlies technological consciousness. "Technological production has structured consciousness to think in terms of mechanisticity..., reproducibility..., measurability..., componentiality..., problem solving inventiveness..., and self-anonymization" (Bowers, 1977, p. 36, 37).

37 Ontology is the theory of being. (Epistemology is the theory of knowing.)
patterned after the paradigm, and in this sense we can say that the paradigm has acquired an *ontological dimension*. When applied to technology, this is not to explain the paradigm's origin but to highlight the extent and intensity of its rule. *When the pattern is so firmly established, it also tends to become invisible...* (p. 104)

Borgmann (1984) describes the subtlety of technological influence on consciousness:

> The relation to technology is neither one of domination by technology nor one of conscious direction of technology. It is perhaps best called one of implication in technology. Living in an advanced country, one is always and already implicated in technology and so profoundly and extensively that one's involvement normally remains implicit. The rule of technology is not the reign of a substantive force people would bear with resentment and resistance. Rather technology is the rule today in constituting the inconspicuous pattern by which we normally orient ourselves. (Borgmann, 1984, p. 104-5) [emphasis added]

Technological orientations that embody a technocratic rationality and an instrumental reason are increasingly the dominant way Western society relates to the world (Borgmann, 1984; Bowers, 1977). Society, although highly reflective of the visible aspects of technology, is much less reflective of the effect of a technological orientation on consciousness. A technological orientation is the "background horizon most of us use to give meaning to experience" (Bowers, 1977, p. 36). It is important to remember that a technological consciousness is largely unreflective of its own subjectivity since it is the "inconspicuous pattern by which we normally orient ourselves" and organize reality (Borgmann, 1984, p. 105). Bowers (1977) comments on the lack of awareness that a technological frame of reference has on its own subjectivity:

> ...the technological mind set does not recognize its own constitutive role as a coproducer of reality....While the individual may be explicitly aware of certain aspects of his frame of reference --- that is, he [sic] may be conscious of certain assumptions and categories he is operating with --- many of the assumptions and categories are experienced as taken for granted and thus remain hidden from conscious awareness. Modern physicists have long understood this constituting function of human consciousness, but this has not been seen by the more instrumentally oriented technocrats. This latter group continues in the naive belief that they are observing and measuring an objective world. (Bowers, 1980, p. 305)
Teachers are no exception to the lack of awareness of the partiality of a technocratic interpretive frame. In fact, I have suggested that technology teachers, due to their technical background and teacher socialization, are entrenched in technocratic ideology.

For teachers to engage in socially transformative orientations of teaching they must first work on themselves (Miller and Seller, 1990). A socially transformative technology education would help students understand the values and assumptions that lie beneath technocratic metanarrative and culture. In order to embark on a socially transformative orientation for technology education, teachers need a cultural understanding of technology and also a cultural understanding of curricula.
CHAPTER IV  CURRICULA: GAINING A CULTURAL PERSPECTIVE

In previous chapters I shared dominant and other stories of both technology and self. Both teachers and master stories of technology inform the culture of technology education. In the case of teacher socialization and common sense accounts of technology I have shown that the dominant orientation and storyline is technocratic. In other words, teachers are socialized into technocratic frames of interpretation and so is Western society. In Chapter Three, my research revealed entire contexts obscured by technocratic accounts of technology. In this chapter, I similarly contextualize the curricula of industrial arts and its namesake, technology education. Just as social contextualization of technology reveals invisible aspects, a socially critical view of technology education curricula reveals hidden dimensions. Contextualization makes perspicuous underpinning curricular views, beliefs, and assumptions, and ideology. I believe ideologies embedded within curriculum are, at worst largely invisible, or, at best vaguely perceived, by teachers who are preoccupied by daily duties of teaching, distracted by the rhetoric of surface school reforms, and overwhelmed by the increasing demands placed upon them. Rather than try to respond to the myriad of challenges that are placed in my path as a classroom teacher, this research experience requires that I disengage from the saturations of schooling and the rhetoric of technology education. Such examination enables teachers to come upon their practice in new ways, think

38 Although technology education bears a different name from industrial education, I assume in this thesis that there is little, if any, substantial difference in their underlying assumptions, beliefs, aims, and philosophies. This view is supported by Zuga (1995), Foster (1994), O’Riley (1991), and Bastone (1991).

39 Until recently, I only vaguely perceived, underpinning technocratic ideology, beliefs, and assumptions of industrial/technology education.
critically in a deeper sense, and realize new “in-between” pathways for both being and teaching. Teachers who think critically in this deeper sense “try to place the events of their individual lives within the context of broader social forces...” (Brookfield, 1994, p. 57). Teachers who think critically begin to question the assumptions and beliefs under which they have been acting. It is difficult for teachers to become transformative in their practice if they are unable to examine tacit ideology.

As I turn my attention from contextualization of technology toward contextualization of technology education curricula it may be surprising that I deliberately move away from discussion of specific technology education curricula documents. Such documents are temporary and typically do not make perspicuous underlying ideology. Instead, I examine technology education curricula from social and historical contexts. In attempting to understand technology education, I believe it crucial to examine contextual forces that shape it. Technology education has focused on economic and curriculum issues (Perrina and Volk, 1995) and little effort has been made to locate it within wider social and historical terrain. Understanding of technology education curricula is limited without consideration of the contexts in which it is situated. Within the tangle of technology education there is no escape apart from establishing a critical distance. My intent here is not so much to find a “solution” as it is to locate, examine, and repicture such curricula from new standpoints. Just as contextualization of technology opens entirely new vistas for understanding technology, teachers are able to locate their practice by interrogating the contexts that inform technology education curricula. Just as contextualization provides a “thick” (Bijker et al., 1987) account of technology, it can also provide a thicker, more informative account of technology education. Locating technology education within larger contexts reveals a hidden curriculum, softens assumed borders, and provides possibilities for curricula to undergo significant rather than just superficial change. In situating teachers as cultural workers within larger social, economic, and educational contexts, I open areas where teachers may gain a further understanding of the cultural work in which they are
engaged. To gain a sense of the cultural aspect of technology education curricula it is necessary to gain a cultural understanding of curricula.

Beyond a Technical Understanding: Curriculum as Cultural Script

...the environment itself conveys the critical and dominant messages by controlling the perceptions and attitudes of those who participate in it. .....message here means the perceptions you are allowed to build, the attitudes you are enticed to assume, the sensitivities you are encouraged to develop — almost all the things you learn to feel and value. You learn them because your environment is organized in such a way that it permits or encourages or insists that you learn them. (Postman and Weingartner, 1969, p. 17)

The concept of curriculum, as discussed in this thesis, is considered to be more than a combination of course offerings and units of study. At one level, technology education curriculum, can be examined as explicit curricular aims, intentions, and goals. Generally, at this level, one examines what technology education claims through examination of documents such as curriculum guides. Such examination, however, provides only a restricted, technical, and surface understanding of curricula. At quite another level, it is possible to examine the underlying values, assumptions, world views, beliefs, and ideologies of curriculum. Curriculum and technology share the distinction that they are value-laden. Values that are embedded within the curriculum "product" are largely obscure or invisible to readers of the "official text" of curriculum guides, textbooks, and the visible aspects of classroom activities. Beneath the surface of official text and classroom practice lie tacit or hidden aspects of the curriculum. Bloom (1972) refers to the hidden curriculum as the "latent" curriculum and the overt content of curricula as the "manifest" curriculum (p. 343). Giroux (1988) points out that "educational theory has usually not included a language or mode of analysis that looks beyond the given or the phenomenal" (p. 4). Educators typically concern themselves
with technical questions involving objectives, instruction, and evaluation. Giroux (1988) believes that concerns about the overt aspects of curriculum, although important:

...do not include a focus on the nature and function of the hidden curriculum, that is, those messages and values that are conveyed to students silently through the selection of specific forms of knowledge, the use of specific classroom relations, and the defining characteristics of the school organizational structure. (p. 4,5) [emphasis added]

"Our innocence has been in giving our attention solely to the manifest curriculum while we overlooked the latent one" (ibid, p. 344). Bloom (1972) argues that the hidden curriculum is not insignificant:

Indeed, the latent curriculum is in many respects likely to be more effective than the manifest curriculum. The lessons it teaches are long remembered because it is so pervasive and consistent over the many years in which our students attend school. Its lessons are experienced daily and learned firmly. It is probable that the lessons of the latent curriculum are learned so well because they are spelled out in the behavior of the students and adults in the school and are only rarely verbalized or justified. (p. 343) [emphasis added]

Gordon (1984) points out that research on the hidden curriculum could be seen as being concerned with what was really important in schools" 40 (p. 368) [emphasis original].

We pay a high price for our innocence if we only concern ourselves with aspects of the overt curricula (Bloom, 1972). Through an investigation of the values and world view that informs technology education curricula, this chapter examines aspects of its latent or hidden dimensions. Such examination constitutes an exploration of the culture of curriculum. Kreisberg (1992) quotes McLaren’s definition of culture as “the particular ways in which a social group lives out and makes sense of its ‘given’ circumstances and conditions of life” and as the “set of practices, ideologies and values from which different groups draw to make sense of the world” (p. 13). The culture of curriculum is conveyed through both the overt and hidden aspects of curricula. I have already

---

40 Gordon (1984) points out that resistance theorists believe that the hidden curriculum is not always as effective as Bloom (1972) suggests. Resistance theorists argue that aspects of the hidden curriculum are often resisted, either consciously or unconsciously, by students. Gordon (1984), however, argues that common sense images of science are not resisted by the students.
discussed my own experience with two cultural dimensions of technology education, teachers and common sense accounts of technology, that reinforce each other’s orientation to technology. In acknowledging my own historical construction, subjectivity, and partiality, I now examine similar partiality and subjectiveness within technology education curricula. Curricula typically conceal their own social construction and in so doing present themselves as objective knowledge rather than just one story among many. This chapter examines some of the dominant social forces that shape technology education.

Much like the values embedded in an artifact or product, the elements of curricula construction are fused together with particular social values, ideologies, world views, political positions, and forms of reason (Giroux, 1992). Pedagogy is a form of technology:

Pedagogy is, in part, a technology of power, language, and practice that produces and legitimates forms of moral and political regulation, that construct and offer human beings particular views of themselves and the world. (ibid, p. 81) [emphasis added]

Questioning what views, beliefs, and modes of reason are conveyed opens an examination of curriculum as a medium of cultural and ideological re-/production. Figure 4 illustrates how a broader meaning of curriculum can be conceived. Together, overt and hidden aspects constitute curriculum as a “cultural script” (Giroux, 1992):
As curriculum is experienced by students, embedded values and forms of reason are conveyed inconspicuously, along with the more visible "official" content. It is important to understand that change made to the overt aspects of curricula will not necessarily change the overall cultural script. Since ideology, values, and modes of reason are often tenacious, a new curriculum of content cannot change the lessons of the hidden curriculum. "Genuine curriculum reform involves more than putting new content into the old format. The format itself must be changed" (Bowers, 1976, p. 64). A revision of the overt curricula may convey the exact same ideologies and values as the previous curricula and hence provide the exact same cultural script. The hidden curriculum is therefore persistent and may be intractable to change through sole manipulation of overt curricula aspects. After the high visibility of curricula revisions, the effect of reproducing the same culture can go unnoticed. The same ideology can be reproduced in "new" curricula without being subjected to much question. As mentioned previously, ideology is often based on common sense assumptions for constructing reality. To question common sense assumptions is uncomfortable since it
often involves questioning one's self image and reality. Bowers (1980) explains that cultural assumptions are often ignored because of a technological mode of thought: "The inability of the technological mode of thought to think dialectically within the field of education leads to ignoring the cultural assumptions embedded in the curriculum" (p. 320). More importantly ignoring the cultural assumptions embedded within the hidden curriculum also leads to ignoring "whether the curriculum constrains through the epistemic code it transmits or has a more liberating potential" (ibid, p. 320).

Embedded practices, ideologies, and values of the hidden curriculum can be considered cultural elements. Such cultural elements lead students into particular ways of viewing themselves and the world. As such, curriculum is a cultural script (Giroux, 1992) that guides students into particular belief systems, ways of knowing, and forms of reason. “The pedagogical dimension of cultural work refers to the process of creating symbolic representations and the practices within which they are engaged” (Giroux, 1992, p. 5). Bowers (1977) points out that schools do more than help students acquire knowledge and skills to function in institutions. Schools also convey cultural assumptions. "Its power to control and legitimate the language the students uses to symbolize these areas of cultural experience becomes an especially influential factor in the socialization of the student's consciousness.... Defining reality in a specific way is a political process" (Bowers, 1977, p. 34). In this sense, public State-funded schools can be viewed as powerful conveyers of ideology.

Turning our attention to technology education, we may ask what sort of symbolic representations do technology education curricula convey? What values, modes of reason, and cultural assumptions are communicated inconspicuously to students in technology education? We may ask what culture is being presented to students and what cultures omitted? Is the culture presented one that reinforces dominant narratives of technology or is it one that seeks a critical and contextual understanding of technology? When curriculum is viewed as a form of cultural scripting, teachers are viewed as cultural workers (Giroux, 1992) who, consciously or
unconsciously, help impart a particular culture to students through the combined influence of the explicit and implicit curriculum:

Rather than defining teacher work through the narrow language of professionalism, a critical pedagogy needs to ascertain more carefully what the role of teachers might be as cultural workers engaged in the production of ideologies and social practices. (ibid, p. 74)

We may rightly ask, what sort of cultural workers should teachers of technology be? What sort of cultural workers do they wish to be? How aware are teachers of their cultural influence? Are teachers fully aware of the hidden curricula conveyed? To address these questions I begin by examining the larger contexts surrounding technology education.

Technology Education Curricula: Situated Within a Technocratic Milieu

Technology education curriculum, as all curriculum, is socially shaped. Such curricula are influenced by the technocratic ideology that is deeply ingrained within industrial arts (Zuga, 1987). "Total reliance upon a technocratic ideology is restrictive to the development of subject matter such as industrial arts" (ibid, p. 17). *Industrial arts teachers are saturated in technocratic ideology from a variety of sources:*

Presently, industrial arts teachers are being immersed in a technocratic ideology through their own professional practice, association with industrialists, literature in the field of industrial education, and the ideology of the administration\(^4^1\) of public schools. This, in turn, has influenced their ability to reconceptualize curriculum. This will also influence ability of technology education, the newer version of industrial arts, to become truly a general education subject matter. (ibid, p. 17)

\(^{41}\) "Earlier metaphors of factory and corporation have given way to a desire on the part of school administrators to emulate technologically advanced industry" (Burris, 1993, p.131).
Some conditions that reinforce technocratic ideology are a result of shortcomings in professional activity of industrial/technology educators. However, singling out a curricula area and its predominant ideology may not be entirely fair without also attempting to understand factors outside technology education which may reinforce and perpetuate dominant ideology. The technocratic ideology predominant within industrial/technology education is a result of many influences. To ignore the larger contexts that influence the social construction of technology education curricula is to treat such curricula as isolated components of schools and society. These contexts include the larger school culture, educational reform, and the corporate business community. All three contexts embrace technocratic values, beliefs, and modes of reason. Since industrial/technology education is interconnected with these contexts it is not only internally "trapped in a technocratic ideology" (Zuga, 1987, p. 3) but also, in a sense, externally. As a classroom teacher, I attempt to critically reflect upon the milieu in which my practice is situated:

Critical theorists see knowledge as socially constructed, that is, constructed symbolically by the mind through social interaction with others. This knowledge is determined by the surrounding culture, context, customs, and historical era. All of these are heavily dependent of the social milieu in which the teacher develops. (Sparks-Langer and Colton, 1991, p. 40) [emphasis added]

---

42 Zuga (1995) describes some of the shortcomings of industrial/technology educators: "inbreeding of industrial educators" (p.13), "no place for women" (p.14), "positivist research" (p.18), "reproducing determinism" (p.28), and "a single cultural view" (p.29).

43 Other contexts of technocratic influence on technology educators include the consumer-oriented and popular culture, the politics of technology, and the implications of military technologies on education (Robins and Webster, 1989).

44 After 21 years of teacher and recent involvement with provincial, national, and international efforts towards the transition from industrial education to technology education, I have gained a sense of my location as a classroom teacher within the existing profession. I now research my location in broader terms of reference.
The Technocratic Culture of Schooling

The dominant ideology embraced and conveyed by schools is technocratic (Bowers, 1980; Robins and Webster, 1989). Within a society that many would characterize as technological or technocratic, it can be argued that a technocratic orientation for schools is necessary for the continuation of modern technological production and consumption. A technocrat's version of a "technological literate" person is one who possesses the necessary knowledge, skills, and attitudes required for functioning within a technocratic environment. Since it is not within the interests of those who control technological production to advocate understanding of technology beyond common sense, a technocratic "technological literacy" will emphasize restricted technical understanding and omit critical and contextual examination. But is this literacy? From the technocratic perspective it can be conceived as a sort of literacy. From a democratic perspective, however, such literacy is restrictive and detrimental to the need of an informed and critical citizenry. Democracy is a celebration of difference, the politics of difference, I call it, and the dominant philosophies fear this" (Giroux, 1992, p. 11). "What the dominant educational philosophies want is to educate people to adapt to those social forms rather than critically interrogate them" (ibid, p. 11). It can be argued therefore, that a technocratic technology education is really miseducation since it portrays a restrictive image of technology. This brings us back to schools and the thought that a technocratic orientation for them is understandable. As understandable as a technocratic orientation might be for schools, it is nevertheless, as I have argued problematic from a democratic perspective. The problems associated with entrenched technocratic ideology in schools are highly resistant to change. Since technology education curricula are bound up with this larger context, I will examine several reasons why such ideology is deeply ingrained in schools.

1) Schools are part of society
Bush (1983) refers to common sense ideas about technology that have lodged within our consciousness as "techno-myths". Since schools reflect the culture of dominant society (Freire, 1973), the school system is not isolated from "common sense" views of technology.

2) Unreflective Postures and Technical Understanding

Like the wider culture in which it is situated, technocratic rationality, consciousness, and instrumental reason have almost invisibly permeated the school system. Within the school system's curricula there is a largely unreflective stance toward its technocratic assumptions. This is not surprising since a technocratic orientation is largely unreflective of itself (Ellul, 1990; Drengson, 1983; Bowers, 1980; Rozak, 1969). Ellul (1990) points out that "It is the most educated people with the most developed personalities who are the most fascinated" (p. 135) and who show no critical spirit.

Davis (1981) believes that the values of the technician invade and transform all aspects of life and points out that governments and corporations oppose critiques of modern technology as well as seek to perpetuate the values of the technician in various ways, including education. The technocratic ideology of schools is obscured by its preoccupation with technical matters and technical questions such as "What is the best way to learn this given body of knowledge?" (Giroux, 1988, p. 14). In their preparation for teaching, teachers are often asked to focus on the technical aspects of their work rather than on its cultural significance. "The classroom can become a precarious place indeed, particularly when neither the teacher nor student is fully aware of the hidden cultural messages being communicated and reinforced" (Bowers, 1976, p. 62). "The real

---

45 Preoccupation with technical aspects is not isolated to male technical cultures, industrial educators, and orthodox tales of technology. I believe a form of teknosis (Biram, 1978) exists within all activities based in a technocratic ideology.
problem that we face, and one that even now threatens our very survival, is in truth what might be called the technocratic disease.... The new pedagogy is about education for technocracy; about the increasing subordination of education to this ideology” (Robins and Webster, 1989, p. 257) [emphasis added]. This disease corresponds to Biram's (1978) description of "teknosis" as a chronic fixation "toward technical thought or action" (p. 16). If one has teknosis, questions that lead to a critical understanding of its technocratic subjectivity are largely ignored.

3) A Liberal/Vocational Binarism

Robins and Webster (1989) describe another preoccupation that prevents examination of technocratic ideology in schools: the school system is preoccupied with resolving an “unworldly liberalism” versus “a misguided and discriminatory vocationalism”46 (p. 256). This binary opposition obscures the underlying technocratic values of the school system (Robins and Webster, 1989). Such polarized debates conceal the deeply entrenched “technocratic imagination which has come to dominate and deform education (and indeed society as a whole)…” (Robins and Webster, 1989, p. 256). "So powerful is the technocratic agenda that to question it seems arrogant, absurd and incredible" (Robins and Webster, 1989, p272). Consequently, technocratic ideology is embraced in schools without much question.

4) Instrumental Reason

46 Educational debate locked in a vocational/utilitarian/skills versus liberal/academic/pure knowledge polarization is similar to the optimist versus pessimist binary opposition that limits understanding of technology. As I have discussed, such discourse regarding technology perpetuates the mythology of technological determinism and faith in the technical fix. Similarly, the liberal versus skills debate obscures the underlying technocratic consciousness of schools.
Robins and Webster (1989) point out that "We are now witnessing a new phase in the technocratic appropriation of education" (p. 261) and argue that such appropriation underlies the increased dominance of instrumental reason in schools:

What is becoming increasingly significant is the growing centrality of instrumental reason and the subjugation of other knowledges. The world of emotion, of feelings, of values and of the unconscious becomes increasingly repressed by the rationalist ideology. Consequently, the question of the 'good life' becomes a matter of scientific and technological advance and the further application of instrumental reason. To question this centrality then seems to fly in the face of progress and reason itself. Yet this is what is called for. We need to move beyond debates about liberal and vocational knowledge to the critique of instrumental and technocratic reason which underpins comment on educational reform in the present period (p. 273).

Technocratic and instrumental reasoning increasingly guide the direction of schools and yet they are not widely questioned.

5) Accepting Technocratic Mythology and Consciousness

Bush (1983) describes how bureaucracy in general has accepted the myths of the technocratic mind-set:

Partly because it is in their best interest to do so and partly because they truly see nothing else, most politicians and technocrats paint the canvas of popular opinion about technology with the broadest possible brushstrokes, rendering it, in pure type, as TOOL, as THREAT, or as TRIUMPH. From each of these assumptions proceed argument, legislation, public policy... (p. 153)

Stemming from unreflective acceptance of orthodox tales of technology, the bureaucracy of the school system bluffes itself into technocratic approaches toward technology, policy, curriculum and pedagogy. Pinar (1978) identified technocratic rationality as a dominant paradigm embraced in varying degrees by a majority of curriculum workers. The culture of society and the school system provide an environment for the cultural workers of the school system to re/produce curricula rooted in technocratic ideology that in turn re/produces a technological consciousness in students. Bowers (1980) argues that "public schools in North America are one of the
primary carriers of technological consciousness and thus should not be viewed as conservative institutions" (p. 294). Such consciousness is conveyed silently to students as part of the hidden curriculum and cultural scripting of schooling. Bowers (1980) points out that technological orientation of schools is seldom noticed or challenged:

The folk myth about the conservative nature of school continues to persist partly because it is difficult to see the structure and content of taken-for-granted beliefs that become part of an individual's attitude. The technological mode of thought has become so widely held in society, and so much a part of the taken-for-granted sense of reality, that its pervasive presence in schools has largely gone unnoticed. .... [Teachers] are generally not challenging the basic tenets of technological consciousness that manifest themselves in the organization and operation of the classroom, and in the curriculum itself. .... As most adults have also been socialized to the taken-for-granted reality shaped by the episteme of technological consciousness, they too tend not to see the manifestations of technological consciousness in the schools. The result is that the process of socializing students to the technological mode of consciousness goes largely unnoticed by most educators and the public. (p. 295)

School Reforms: Determinism, Practical Intelligence, and Prescription

The technological consciousness within schooling, entrenched as the dominant curriculum paradigm, increasingly shapes the direction of North American educational reform. The school reforms of the 80's and 90's came at a time when industrial education was reformulating its curriculum to technology education. Such reforms did little to encourage technology education to loosen from its technocratic foundation.

47 Bowers (1980) points out that although administrators have traditionally been seen as conservative in resisting change "their approach to administering what goes on in the school, however, has become increasingly based in the most extreme tenets of technological consciousness ...."they have become as a group, apostles of technicism" (p.295).

48 Bowers (1977) explains in considerable detail how behavior modification, competency-based education (CBE), and career education are products of technocratic ideology.

49 It was during the 1980's and early 1990's that industrial arts associations and curricula were renamed "technology education". For example, after several years discussing technology as the new curriculum organizer, The American Industrial Arts Association changed its name to the International Technology Education Association (ITEA) in 1985. The British Columbia association did likewise in 1988.
The present emphasis on tech prep, applied learning, skills acquisition, hacking the Internet, principles of technology, engineering education, and integration of math, science and technology are indicators that schools and technology education are increasingly privileging the technical aspects of technology (Foster, 1995), and thus, technocratic ideology. Supporting such technical emphasis are educational reforms. Ornstein and Hunkins (1988) point out education reform documents make frequent reference to "great waves of change that are impacting on the social fabric: ...changes in levels of technology" (p. 145). Boyer (1983) in "High School: A Report on Secondary Education in America" is a typical case: "The great urgency is for 'technological literacy,' the need for students to see how society is being reshaped by our inventions, just as tools of earlier eras changed the course of history" (p. 111) [emphasis added]. A deterministic logic is pervasive at the highest levels of educational policy. For example, the British Columbia Royal Commission on Education (Government of British Columbia, 1988) acknowledges technological change: "...as in all modern societies, the character of British Columbia life is also being reshaped by recent advances in technology...the changes brought by such new communications networks affect the way we live, the way we work, how we interact with others close to us and far away, how we use our leisure time, and how we are educated" (p. 14) [emphasis added]. "The great urgency is for 'technology literacy,' the need for students to see how society is being reshaped by our inventions, just as tools of earlier eras changed the course of history" (ibid, p. 111). I now ask, what is problematic with such reforms?

1) Deterministic Fueled Fatalism

It is clear that the sort of technological literacy advocated is a technocratic and deterministic one. No mention is made of a need to critically interrogate technological change. A technological "imperative" implies only compliant and adaptive responses. According to Robbins and Webster (1989) "when educational institutions are instructed to change in the name of adaptation to technological progress we may properly ask.
Reforms that embrace deterministic language in their rationales for change do little to suggest that there are any alternatives but to get on board the technological train. A restrictive vocabulary and language code reinforce, in educators, the notion of technological inevitability, necessitarianism, and consciousness. Ultimately, such consciousness is conveyed to students.

2) Lack of a Critical Spirit: Technological Immune Deficiency

Education has bought heavily into the technical aspect of technology-practice and, at best, only rhetorically into a critical examination of the social/cultural context. Technological "imperatives" claimed by the education system, that call for the "need to adapt to technology", portray technology as an independent force that shapes society rather than as a codependent variable. In such portrayals, a critical spirit is lacking. In lacking a critical spirit we lack an immunity to the "terrorism of opinion and communication regarding technique" (Ellul, 1990, p. 400):

'This society is inevitable and we are thus preparing young people to enter it, to find a place and a job in it.' This is the terrorist argument, as we have said. What seems not to be considered is that this society is not inevitable. By preparing people to enter it, by giving them a frantic need to work on technique, by soaking them in the knowledge and coherent practices of this society, we are making it increasingly probable. What will finally make it inevitable is neither the development of science and technique nor economic needs but the shaping of people who can do nothing else and will not be comfortable in any other society. What makes techno-science inevitable is the belief that it is, the pseudo-predictive boasting, and the assuring of people that it is in the process of realization. (ibid, p. 400) [emphasis added]

---

50 For example, Willard Daggart (1993) suggests that school experiences be relevant to the technological society in which students will live and work. He emphasizes the need for technical reading and writing and applied learning. Although Daggart emphasizes that he does not want to eliminate traditional "academic" content or turn schools into training institutions for career focus, he fails to include in his argument, the need for students to question technology.
The lack of a critical spirit is due to immersion in technical thinking and the adoption of a narrow technical vision:

...they are plunged into a universal technical bath which gains its fascination from the extraordinary potential of the machines. (Naturally, there is no place for reflection, for reserve, for a critical spirit!)\(^{51}\) The obvious aim is to stir many people to become research scientists, technicians, and industrialists. ....we must set them on the right track by preadaptation to what is thought to be the future. (p. 393) [emphasis added]

It is understandable that “in times of great change, society looks to its schools to help its citizens adjust” (Ornstein and Hunkins, 1988, p. 145) but this should be tempered with the concomitant goal of helping students critically reflect upon such change. A student needs to become "critically aware of his [sic] own cultural experience, and the assumptions upon which it rests" (Bowers, 1976, p. 63). Aiming to shape students as mere functionaries in what is thought to be a technological future is increasingly becoming the accepted practice within education in general, and technology education in particular. Postman’s (1992) book “Technopoly: The Surrender of Culture to Technology” could be paralleled by a book “Technotracks: The Surrender of Education to Technopoly!”.

3) Technological Success Recipe

Education based on machine fascination socializes students into believing the myth that there is a technological recipe for success:

In the case of technocratic ideology the bind arises from the sense of power it conveys; its basic message is that knowledge, particularly scientific-technological knowledge, leads to success. All the individual must do is choose to work, to consume, to organize and manipulate the world in accordance with the principles of scientific technology, and success will be assured. (Bowers, 1977, p. 45)

\(^{51}\) “Been there, done that.” The author is a self-confessed, but hopefully reformed, technical addict.
4) Omission of Other Futures

The increasing technical focus of schooling, and the careerism\textsuperscript{52} that it spawns, omissions to articulate a whole range of possible futures for students. Students are socialized into the technocrat's sense of career possibilities. For example, Shor (1992) points out that in vocationalism\textsuperscript{53}:

...students are not socialized into seeing themselves as change-agents, thinkers, artists, citizens, activists, critics, reformers, policymakers, environmentalists, organizers, global residents, peacemakers, or public interest defenders; these social roles are invisible to them... (p. 218)

5) Belief in Unlimited Progress

There is a strong move afoot in society as a whole, as Ellul (1990) describes, to "bring us face-to-face with the great technical innovation, the integration of people and society into the technical world" (p. 19). "There is still a gap between society and the technical system, between individuals and technique which surrounds them. But this gap is constantly narrowing and a new model of humanity is emerging in the West" (Ellul, 1990, p. 19). The optimism generated by such models are "an absolute belief in unlimited progress" (ibid, p. 21).

6) Pedagogies of Practical Intelligence; Prescription of Curricula

...the first step is the development of a technical culture, beginning with education...In primary schools children are being initiated into science and technology...High schools have detailed technicized instruction in industrial techniques and mechanics...Curriculum restructuring is making technique central...Pedagogy is a central feature of the of instruction,

\textsuperscript{52} According to Shor (1986) career education is just a new name for vocational education — vocational and career education embrace the same ideology.

\textsuperscript{53} Zuga (1995) points out that industrial arts has really been "vocational education in practice" (p.10): "mainstream practice in industrial arts has been more a study of the skills needed in order to perform a trade, rather than a study of the relationship of industry to society and the problems of life related to industry" (p.10).
which implies a culture of practical intelligence in place of reflective or critical intelligence. (Ellul, p. 135, 136)

In British Columbia, for example, plans for school reform based on progressive pedagogy and constructivist view of knowledge and learning, were suddenly abandoned and replaced with schemes based on measurable learning outcomes (British Columbia Teachers' Federation, 1995a). For individual curricula in British Columbia, such as technology education, broad developmental objectives or curriculum frameworks have been replaced with the notion of prescribed curriculum. Such reforms "have the potential to change teaching from a professional to a technical occupation in which teachers merely implement..." (British Columbia Teachers' Federation, 1995b, p. 9):

What is to be learned is determined by an external authority, with neither the student nor the teacher being empowered to choose what is most appropriate to the individual student. The technology of control over what happens in the classroom is to be the 'Integrated Resource Package' or IRP, currently being created for all subject areas. Each of these is to identify the sequence of intended learning outcomes, provide resource materials to be used, and assessment tools directly related to the intended learning outcomes. The professional role of the teacher is much narrower... (British Columbia Teachers' Federation, 1995a, p. 3)

Deterministic fueled fatalism, acceptance of a technologically determined future, lack of a critical spirit, omission of other futures, the subordination of critical intelligence to practical intelligence, and the increased prescription of curricula,

---

54 Valuing doing over careful reflection is a tenet of technocratic ideology and the technical fix. For example, the British Columbia Teacher's Federation, (1995a) points out that "Too little discussion takes place within the profession about the big questions: What is the nature of knowledge and learning? What are the implications for teaching, curriculum, organization of the system? Instead, we wait for others to say what we should do, and spend most of our efforts on how it should be done rather than on whether it is the right thing to do"(p.5).

55 The author has first hand experience, through visitations to a number of technology education classrooms, primarily in the United States, where teachers have been effectively reduced, through the top-down prescription of content and even methodology, to "high-level" technicians. Such technology education programs often utilize prepackaged or regimented competency based curricula and hardware dependent modular "learning systems". Such approaches increasingly technicize, devalue, and deskill the work of teachers.
pedagogy, and assessment "tools", are all outcomes of "technocratic appropriation of education" (Robins and Webster's, 1989, p. 261). Postman (1969) would argue that:

These aims are truly subversive since they undermine our chances of surviving as a viable, democratic society. And they do their work in the name of convention and standard practice. We would like to see the schools go into the anti-entropy business. Now, that is subversive too. (p. 15)

Within such a climate, what hope is there for a technology education curricula to go against the grain and provide opportunities for the growth of a critical and contextual understanding of technology? Since the overt and hidden curricula of schooling are increasingly technocratic, will any attempt towards transformative curricula, curricula that enable students to be agents for social change within a democracy, be restricted to the subversive activities of teachers?

The Business/Corporate Influence

..in the social change orientation...educators must take a more critical view of the role of schools in society so that schools do not just mirror dominant economic interests (Miller and Seller, 1990, p. 8).

Schools are more than company stores. They have the much more radical purpose of educating citizens. (Giroux, 1992, p. 10)

What influence do business and industry have on technology education? To begin with it is well documented that industrial educators have a history of strong relationships with business and industry. At one level, business has always had an interest in selling hardware to school shops56. From manual training to industrial arts and technology education the equipment and room organizations have changed but the

56 Gotta (1993) describes how an entire industry has formed around the sale of materials and equipment to schools. It is traditional in industrial arts and technology education conferences to invite industrial exhibitors. Conference organizers admit that if the trade show aspect of such conferences were eliminated, attendance, particularly from industrial/technology teachers would fall.
opportunities for business remain. Just as such industrial arts unit shops replaced the general shops of manual training, integrated "hi-tech" labs that offer a modular approach to technology education (MATE) have replaced entire industrial arts shops. The equipment that business tells education it needs can influence curricula in particular directions. A question that emerges is whether equipment and salespeople should direct curriculum or whether curriculum should direct the acquisition of tools.

At another level of involvement, Zuga (1987) describes how solicitation of business advice has a more direct influence on curricula:

Industrial arts educators have also maintained a close relationship with industrialists. That relationship involves not only seeking the support of industrialists for the teaching of industrial arts on the schools, but also learning from industrialists for the purpose of developing curriculum. Advisors and consultants from industry are commonly sought during curriculum revision projects, literature designed for industry is often reviewed and used as content, and teachers often take industry sponsored training programs in order to improve technical skills. Through these kinds of relationships the ideology of industry enters into the curriculum of industrial arts education. Those who are involved in industry place a high priority upon skill training. This priority filters into the framework of thought about industrial arts purposes and goals... (p. 17) [emphasis added]

The influence of business and industry on industrial arts curriculum can be traced as far back as the 1920s and 1930s (Petrina and Volk, 1995). "The politics of accepting one form of industrial education over another extended beyond the arena of teacher education programs and was interrelated with business and corporate ties" (ibid, p. 6).

In 1934, Ganders (cited in Petrina and Volk, 1995) shared concern for the level of involvement with industry:

\[57\] Zuga (1995) indicates that much of the curriculum research of technology educators involves inbreeding within a "closed circle of technology educational professionals and industrialists" (p.20). "Including industrialists on the panels indicates the continuation of the twentieth century historical trend of focusing on industry for content" (Zuga, 1995, p.20).

The strong links with business and industry are confirmed by my own experience of one of only two teachers members of the Technology Education Advisory Council (TEAC) of the International Technology Education Association (ITEA). For details on members of TEAC who advise ITEA's Board of Directors on issues that include curriculum see Appendix III.
...in industrial-art shops, so much is heard about industrial processes and so little about education that it seems appropriate to raise the question, if perchance industrial-arts shops are primarily industrial plants and only secondarily educational institutions. *It is one thing to cooperate with industry, but quite another to light educational lamps at its altars.* (p. 7) [emphasis added]

Contemporary technology education continues with the practice of industrial arts educators in seeking the advice of business, industry, and the engineering profession. Apple (1982) points out that the business is truly engaged in influencing education:

> We are witnessing a remarkable business offensive, one in which our educational system is slowly being more and more drawn into the ideological orbit of the corporation and its needs. 'What's good for business is good for the country and its people' may not be very good educational policy but it is becoming an all-too-accurate reflection of what is happening. (p. ix)

What sort of political influence does the business community bring to bear on education? What sort of socialization is envisioned by businesses and corporations? I will discuss two influences.

1) Socialization to Corporate Values, Industrial Technology, and Adaptation

Rozak (1969) in describing the socialization of "technocracy's children" does not dignify such socialization as education. "We call it 'education,' the 'life of the mind,' the 'pursuit of the truth.' But it is a matter of machine-tooling the young to the needs of our various baroque bureaucracies: corporate, governmental, military, trade union,

---

58 My personal experience confirms strong ties between technology education and industry. I served for three years (1991-93) as one of only two teachers on the International Technology Education Association’s Technology Education Advisory Council (TEAC). Industrial leaders were asked for their advice in directing the affairs of ITEA and goals for technology education curricula. See Appendix III to gain a sense of the strong visibility of business interests in TEAC.

59 Cooper (1995) points out that business influence is extended into sponsorship of education. Cooper (1995) states "corporate sponsorship of education will create a 'slippery slope' of events that eventually may completely alter the role of the public education system". Accepting such influence of "special (read: self-) interest groups" is "a type of sell-out of basic and guiding educational tenets. It's an involvement that rewards participating business in two distinct ways. One is steering future employees into the required courses, and the other is preparing future consumers to purchase the company's goods" (p. D10).
educational" (p. 16). Corporate leaders use their influence to "perpetuate a value system consistent with corporate interests" (Capra, 1982, p. 221). For example, business is biased "in favour of technologies that enhance the power of these institutional arrangements – for example, industrial technologies" (Leiss, 1990, p. 32) [emphasis added]. Messages conveyed to education by business are ones that serve self-interest (Cooper, 1995). For example, the "adaptation to technology" message of technological determinism is of direct benefit to the corporate economic agenda rooted in a competitive market and consumer environment. Kroker and Weinstein (1994), in describing an updated imperative of the "techno-utopian high-speed cybernetic grid", point out the general attitude of business toward technological change:

In this mythology of the new technological frontier, contemporary society is either equipped for fast travel down the main arterial lanes of the information highway, or it simply ceases to exist as a functioning member of technotopia. As the CEO's and the specialist consultants of the virtual class triumphantly proclaim: "Adapt or you're toast". (p. 7)

Casting society in a passive role helps perpetuate the dominant social control corporate institutions have over the creation of technologies. As business draws education closer to its orbit, it helps reinforce "techno-myths" (Bush, 1983), that serve business's own interests. In this sense, business is clearly involved in a "technological terrorism" (Ellul, 1990) schools. Such corporate activity and control are increasingly influencing school reform and curricula.

2) Socialization Through Economic Blackmail

---

Often the messages from business are confused. For example, the British Columbia Teacher's Federation (1995a) points out that: "Business puts out powerful, but confused messages" (p. 5). On one hand business "places emphasis on creative thinking, teamwork and flexibility" but on the other hand "business is a prime source of pressure for the system accountability measures that are concrete and inflexible, and which produce a more rigid system, less capable of preparing the 'product' from our schools that they claim to want" (p.6).
A further message from business is the suggestion that the public education system "is at fault for the decline of the nation's technological-economic leadership" (Hopper, 1991, p. 25). Hopper (1991) comments on American school reforms of the 80's: "there can be little question that the real driving force of this national educational reform movement is the growing impact of technology upon the competitive relationship of nations and states" and points out that "the large multinational corporations, in their struggle to maintain and expand their command of markets, are the agents of this competitive drive" (p. 28). *The implied message is that schools should follow the advice of the business community if economic health is to be realized.* Apple (1993) describes this argument in more detail:

...educators have witnessed a massive attempt — one that has been more than a little successful — at exporting the crisis in the economy and in authority relations from the practices and policies of dominant groups onto the schools. If schools and their teachers were more tightly controlled, more closely linked to the needs of business and industry, more technically oriented, with more stress on traditional values and workplace norms, then the problems of achievement, of unemployment, of international competitiveness, of the disintegration of the inner city, and so on, would supposedly disappear. (p. 119)

Eisner (1992) counters such arguments:

Education is about how to deal with uncertainty and ambiguity. It is about how to savour the quality of the journey. It is about inquiry and deliberation. It is about becoming critically minded and intellectually curious, and it is about learning how to frame and pursue your own educational aims. It is not about regaining our competitive edge. (p. 723)

Preoccupation by technology educators with matters that serve the economic and industrial agenda has drawn attention away from critical examination of underlying technocratic ideology. Curriculum reforms, consequently, have repeated a monocular industrial/technical view of technology; shutting out any portrayals of technology that do not correspond to a standardized technocratic image of technology. For technology education to be connected to all members of our culture, a diversity of views of technology must exist.
Technology Education Curricula: History Repeats Itself

The technocratic ideology ingrained within technology education is by no means limited to the influence of schools, school reforms, and business and industry. Technology educators themselves bear significant responsibility.

Ideaological Transferance

"Vocational education and manual training, through unit shops, job analysis and an industrial ethos had been reproduced and merely continued under the 'new' name, industrial arts" (Petrina and Volk, 1995). Included in this transference was the technical skills focus of manual training to industrial arts:

Highly resistant to prescriptive theory of what ought to be in industrial arts, the mainstream pattern of industrial arts curriculum was the manual training curriculum initiated in the 1870's. ....With respect to what was taught as industrial arts, the familiar and successful patterns of manual training which relied upon tool instruction and material processing in order to learn specific skills predominated ....While many students did enjoy the activities, they lacked, for as many, the meaningfulness associated with either personal or social purpose as teachers selected projects through manual training ideological filters in order to achieve vocational skill development. (Zuga, 1995, p. 11)

Underlying the technical focus of industrial arts was a technocratic orientation. "Industrial arts education is grounded in a technocratic ideology. Throughout its history as a subject matter in the public schools both content and process were influenced by technical models of content and curriculum design" (ibid, 1987, p. 3). In turn, technology education, with its origins firmly rooted in industrial arts, was also rooted in technocratic ideology (ibid). "The historical and dominant curriculum theoretical frameworks and designs of industrial arts serve as roadblocks to change and reproduce, in contemporary research and practice [technology education]...a
technocratic rationality based in positivism, a deterministic view of technology, and monoculturalism" (Zuga, 1995, p. 3)\textsuperscript{61} [clarification added].

Without an examination of underlying technocratic ideology that is transferred from curricula to curricula, only overt curricula aspects can change. Foster (1994) adopts an "alias" theory for technology education, described by Pulias (cited in Foster, 1994) as trying "to disguise what we have been doing for years and [trying] to make it look like a new curriculum" (p. 15, 16). Foster (1994) rejects accounts of technology education that portray it as a revolution from, or evolution of, industrial education: "Just as the definition and philosophical base for technology education have existed for years as the ideals for industrial arts, so have its teaching strategies and methodologies" (p. 26,27) [emphasis added]. Foster (1994) concludes from his analysis that "the theoretical philosophy and methodology of technology education are not significantly different from those of industrial arts" (p. 16). In other words, "technology education" is an alias for "industrial education" --- they are, in philosophy, the same\textsuperscript{62}. The collective work of Zuga (1987, 1995), Petrina and Volk (1995), and Foster (1994, 1995) links the philosophy and practice of contemporary technology education to entrenched technical orientations within industrial arts and manual training. This historical connection is seldom addressed by technology educators (Petrina and Volk, 1995)\textsuperscript{63} perhaps because

\textsuperscript{61} "Due to a long association with trade and industrial vocational education, a technical method of constructing curriculum, trade and job analysis, has permeated the thinking of industrial arts educators". (Zuga, 1987, p.4).

\textsuperscript{62} Through stronger emphasis on problem and design centred activities, and new equipment and labs, the change from industrial to technology education appeared, at first glance, significant. However, beneath the guise of the modern technology, groomed learning labs and heightened opportunities for human innovation, the curriculum alterations amounted to little more than a substitution of updated techniques and skills. Rather than reflect a wide continuum of perspectives on technology, the curriculum has become compliant to the dominant technological mindset driving corporate industrial technology and public education. Deeper structures, such as those dealing with social, philosophical and political aspects of technology, have been omitted and undervalued. Consequently, a narrow and self-perpetuating conception of technology is reflected and reproduced by technology education curricula.

\textsuperscript{63} Petrina and Volk (1995) point out that "technology education stands to be little more than a guise for disparate education ideas and approaches as problems of identity, curriculum, and mission have
they wish to give the impression that technology education is new\textsuperscript{64}. The technocratic beliefs, values and assumptions that are carried over to technology education are seldom addressed by technology educators.

**Privileging the Technical, Omitting the Social**

Foster, (1995) points out that "The profession of technology education is at present emphasizing the technical aspects of industry, not social considerations. Emphases such as math/science/technology, the "modular approach," engineering technology, and "tech prep" are currently in favor (p. 5). In emphasizing the technical aspects of technology and not social aspects, as do manual training and industrial arts, technology education is caught in a duplication process. Sarason (1990) refers to such a process as "the repetition compulsion" (p. 148) and explains the cause of repetition:

...you don't examine your bedrock assumptions. Instead, you come up with variations on past themes... Instead of stimulating discussion in which no assumption is sacred, no alternative automatically off limits, and arguments for practicality and the status quo are no inhibitors of envisioning alternatives, intractability has reinforced the *repetition compulsion*." (p. 148) [emphasis added]

A compulsive repetition of technical emphasis in the transition from manual training to industrial arts (Foster, 1995; Zuga, 1995) is recurring in the transition from industrial arts to technology education.

\textsuperscript{64} For example, "Technology: A National Imperative" is a 24 page report that argues the importance of technology education in our schools (International Technology Education Association, 1988). No mention is made in the report that three years previously the association was called the American Industrial Arts Association. No mention is made of former industrial arts educators as the writers of the document. No mention is made of industrial arts as the forerunner of technology education.
This repetition has causes entrenchment of rationality based on a technocratic ideology (Zuga, 1987). Giroux (1988) points out that:

> All modes of rationality contain conceptual structures identified both by the questions raised and questions ignored. These are called problematics. Problematics refer to not only what is included in a worldview, but also, to what is left out and silenced. That which is not said is as important as that which is said. (Giroux, 1988, p. 4) [emphasis added]

In other words, all modes of rationality are problematic in that they are never complete. Replace one mode of rationality with another and you will find new problematics. What is of issue here is that all rationality be subjected to critical evaluation so that problematics can be addressed. Giroux (1988) points out that "the technocratic model of curriculum has been criticized both for its stated claims to the truth and the assumptions implicit in the kinds of questions it ignores (p. 13). These exclusions are "audible silences --- seen but unnoticed omissions" (Gouldner, cited in Bowers, 1977, p. 49). Postman (1992) explains in examining what is omitted and disregarded "we may learn what a serious student ought not to think about" (p. 75). Commenting on Spender's examination of knowledge and control, Robins and Webster (1989) state that...

...Spender is concerned with what is not known or knowable in society; with repressed, suppressed and subjugated knowledges. What she addresses is... What is taught in schools? Why is it taught? In whose interests is it taught in this way at this time? Above all, what is not taught? And why not? (p. 276) [emphasis added]

What is "repressed, suppressed and subjugated" in technology education curricula is, as I have argued in this thesis, a critical examination of the social and cultural meaning of technology. Such examination requires that technology education curricula adopt a socially transformative orientation. Such an ideal can be traced to the origins of industrial arts.

**Social Ideals of Industrial Arts**

Examining the ideals of several early industrial arts educators, Petrina and Volk (1995) state that "Industrial arts was not to be construed as a narrow study of industry,
as a study constrained by contrived disciplinary structures, or vocational” (p. 25) [emphasis added]. The ideals and visions held by these early practitioners are much broader in scope (ibid) and are not dictated by technocratic values:

These educators articulated their ideals within a sociological mission for industrial arts....Rather than receiving and adapting to culture, students were seen as citizens who shared in the envisioning of a just society and responsible for transformative action in producing social change....Industrial arts was seen as a means of empowering students to help resolve problems in an industrial order containing injustices reflected in working conditions, poverty and distribution of wealth. (p. 24) [emphasis added]

Such ideals contrast with those of vocational educators:

Early pioneers in industrial arts education aligned themselves with those who interpreted the purpose of the curriculum as social reconstruction as opposed to vocational educators who interpreted the purpose of the curriculum as social control. Yet, industrial arts educators have often had a close alliance with trade and industrial educators and, perhaps, more important relationships with industrialists. (Zuga, 1987, p. 15)

Petrina and Volk (1995) point out that:

Dewey...disagreed with the notion of economically driven education and the socialization of students into an existing technological order, he projected a reconstructionist vision into his view of "vocational" subjects. In a response to an article written by Snedden, he stated:

...The kind of vocational education in which I am interested is not one which will "adapt" workers to the existing industrial regime: I am not sufficiently in love with the regime for that. It seems to me that the business of all who would not be educational time-savers is to resist every move in that direction, and to strive for a kind of vocational education which will first alter the existing industrial system, and ultimately transform it. (p. 13, 14)

Social ideals for industrial arts necessitated a contextual study of technology; an education in the interrelationships between technology and society. "At its most

---

65 Dewey has serious concerns about the separation of academic and vocational education. "There is a danger that vocational education will be interpreted in theory and practice as trade education.... Education would then become an instrument of perpetuating unchanged the existing industrial order of society, instead of operating as a means for its transformation" Dewey (cited in Shor, 1986, p.48).
constructive, industrial arts was to provide critical insight into labor, gender, racial, capital biases, and problems of modern times" (ibid p. 24) [emphasis added]. In 1942, Bode (cited in Petrina and Volk, 1995) expressed concern with an industrial arts education that socializes students into the existing technological order:

My concern is with the general proposition that the teaching of industrial arts should be as much a process of shaping social outlook as it is anything else. It seems obvious, for example, that our present industrial order is in many ways an obstacle to the kind of continuous development for which a truly democratic order should provide opportunity. To make this industrial order more flexible, so that it will become a source of intellectual, social, and esthetic stimulation is one of the major problems of our democracy. It may fairly be claimed that a student has not studied industrial arts as he (sic) should, if he (sic) has not acquired some convictions with respect to social reconstruction which is necessary if the possibilities of this field are to be realized...It is time to stop putting old wine in new bottles. (p. 15)

Very different visions existed for both industrial arts and vocational education. In practice what occurred in industrial arts was an emphasis on solving technical problems and not social ones. Although mainstream industrial arts claimed a social purpose it did not realize in practice the social ideals envisioned (Petrina and Volk, 1995). What happened to these social ideals over the years? What forces shaped industrial arts and technology education to emphasize technical understanding and adaptative response to the technological order?

**Political Shaping of a Technical Curriculum**

Shor (1986) points out that much of the public education system of the 1920's adopted a "pro-business ideology" (p. 46). It is well documented that a technical focus for industrial arts was influenced by the anti-union stance of business. "Existing apprenticeship programs and job entry were under the control of unions. Industrial education would, by providing an alternative method of training, weaken this aspect of union control" (Lazerson and Grubb, cited in Shor, 1986, p. 46). "If industrial training and certification...could be removed from the factory to the public high schools, then the unions would be unable to exercise any control on the size of the industrial workforce"
"Industrial education has proved to be an ingenious way of providing universal secondary schooling without disturbing the shape of the social structure and without permitting excessive amounts of social mobility" (Katz, cited in Shor, 1986, p. 47) [emphasis added]. "Despite the historical fact that industrial education was developed on the backs of the laboring class in the U.S., commitment to the democratic needs of this class has been basically non-existent" (Petrina, cited in Lewis, et al., p. 5).

History repeats itself. Foster (1995) compares similarities in the definitions of industrial arts and technology education:

Bonser and Mossman defined *industrial arts* as 'a study of the changes made by man [sic] in the forms of materials...and of problems of life related to those changes' (1923);

*technology education* is an 'educational program concerned with technical means...with industry...and their socio-cultural impacts.' (American Industrial Arts Association, 1985)

From these definitions it is clear that industrial arts and technology education both claim social ideals. However, technology education, like industrial arts, emphasizes technical aspects over social ones (Foster, 1995).

Mathematics is not mentioned in the definition of technology education...science is not mentioned...The study of society and culture is. (Foster, 1995) [emphasis added]

The idea of industrial arts being a social study is a reaction to the narrow technical training of manual arts and "it is highly ironic that the profession which adopted this radical philosophy is today returning to the state which demanded its very creation" (ibid, p. 15). Technology education continues to favor the interests of business and the emphasis on technical aspects of technology:

---

It is interesting to speculate on what sort of workforce and employment patterns may have resulted if skill training and certification had remained under the control of unions.
The end of technology education....aside from rhetoric on 'technological literacy,' is preparation for the use of high technologies in a competitive economy. This end was set in the context of economic fears diffused during the 1930's...commitments to this end are aligned with commercial interests and material values — with economic priorities of business and ideologies of technological progress. This commitment has been made at the expense of an alignment with labor and movements such as appropriate technology. (Petrina, cited in Lewis, et al., 1995, p. 5)

Technology education, despite claims to the contrary, has not realized the social ideals that it claims. Postman (1992) describes three technology mediated cultures: "tool using culture" in which technology supports and serves social culture, "technocracy" in which technology is intertwined with culture, and "technopoly" in which culture surrenders to technology. "Technopoly eliminates alternatives to itself in precisely the way Aldous Huxley outlines in Brave New World. ....It makes them invisible and therefore irrelevant....Technopoly, in other words, is totalitarian technocracy" (Postman, 1992, p. 48). If one considers manual training's technical emphasis on hand and machine training for a tool-using culture, industrial arts as a means of socialization for technocracy, is technology education destined to fall in line as "technopoly prep"? It would be more accurate to name technology education for its dominant technocratic ideology. For example, the following names are more accurate descriptors: technocratic technology education, teknotic technology education, industrial technology education, commercial technology education, entrepreneurial technology education, standard image of technology technology education, common sense technology education, technological imperative technology education, deterministic technology education, or career technology. Many technology education curricula claim social goals for

---

67 I do not believe that Postman's (1992) suggestion for education to return to the study of the classics is the best way for education to address technopoly. I favour Postman's earlier "subversive" philosophy outlined in Teaching as a Subversive Activity (1969).

68 Postman suggests that technopoly is interested in functional, not critical literacy. "Into this void comes the Technopoly story, with its emphasis on progress without limits, rights without responsibilities, and technology without cost. Its purpose is to produce functionaries for an ongoing technopoly" (Postman, 1992, p.179).
technology education, or, claim that it provides "technological literacy". Such claims amount to no more than support for a technocratic and deterministic portrayal of society and technology (Pannabecker, 1991).

Educating students in the technical aspects of the day, to the exclusion of social ones, is the case in the 125 year practices of manual arts, industrial arts, and technology education. Technology education is caught in the compulsion to emphasize the technical. It claims an examination of the social and cultural significance of technology in theory. In practice, however, it is technical education. It privileges the technical, embraces the teknotic, and entrenches technocratic common sense as the standard image of technology. The repetition compulsion has led to a technocratic curriculum culture for technology education. What are the possibilities for a classroom teacher to transgress such hegemony?

Ideological Un/Reflection: Technological Miseducation

The problem inheres in your unreflective acceptance of assumptions and axioms that seem so obviously right, natural, and proper that to question them is to question your reality. (Sarason, 1990, p. 148)

There is considerable evidence suggesting that the underlying ideology of technology education curricula is technocratic. A technocratic orientation is evident within the history and practice of technology education and is present in the milieu of schooling, school reform and business influence. The inertia of a technocratic culture makes it difficult for significant change to take place in curricula, particularly involving social and cultural examinations of technology. Contributing to this inertia is the "unreflective acceptance of assumptions and axioms" (Sarason, 1990, p. 148) based in
technocratic ideology. Technocratic ideology is not widely addressed in technology education. (Zuga, 1995) stresses that technology education faces significant ideological problems:

Improving the image of technology education and its relevance to all students is not a simple content problem. The results of the changes in content since the 1960s have not brought about widespread endorsement or recognition of the subject. Technology educators face a larger ideological issue; one that has grown in complexity due to 100 years of inbreeding and benign neglect and one that is evident in current classroom and research practices. Significant changes must occur in the ideology of technology education in order to meet the challenges of future society. (Zuga, 1995, p. 34) [emphasis added]

In order for technology education curricula to provide opportunities for students to critically interrogate the technocratic aspects of society their foundation in technocratic ideology must be examined and destabilized. Earlier in this thesis I have described my socialization in technocratic orientations. Zuga (1987) suggests that such experience is not idiosyncratic: "The technocratic ideology which influences industrial arts educators is part of the daily functioning of the members of the field" (p. 3). In order to begin a process of renewal, technology educators must understand the degree to which they have been drenched in technocratic ways of seeing, knowing and being. Stemming from such reflection, new possibilities may arise for the curriculum, and new opportunities for students to dislodge from inherited and hegemonic ways of studying technology. Carr and Kemmis (1982) point out that "a paradigm is an inherited mode of thinking that is acquired in a largely non-reflective way" (p. 74). In my experience, technology educators are no exception to the general acceptance of technocratic common sense accounts of technology. In addition, the thinking of industrial/technology educators is influenced through socialization in male technical culture and industrial education teacher education. Curriculum writers, initially trained as industrial educators, tend to view the practice of technology as tools, materials, and industrial process, in other words the "technical aspect" (Pacey, 1983). A key to understanding, critically analyzing and improving technology education is a realization of the difficulty
industrial/technology educators have in negotiating and conveying broader meanings for the practice of technology.

At a crucial time when technology educators need to reflect on their own socialization, they are faced with a deluge of technological change. With the rapid changes in technology, technology educators are in danger of becoming fascinated educators. Ellul (1990) describes those who are “so fascinated by the kaleidoscope of techniques invading their universe that they do not know and cannot want anything other than to adapt fully to them” (p. 19). Although Ellul’s comments many be extreme, there is certain danger in becoming so focused on the technical aspect that it is possible to know no other. Industrial educators are increasingly immersed in a world of gadgets and technological change. The environment of their profession has not exposed them to the world of social critique in the same way it has immersed them in technocratic rationality. For example, 47/60 workshops (based on workshop titles) and 9/10 tours of the 1994 B. C. Technology Education Association Conference focus on technique and technical skill (see Appendix IV and V). No workshop titles suggest content involving the social aspect of technology. This is not meant to be a criticism but rather an observation that the professional environment remains largely divorced from social and cultural aspects. As a technology educator immersed in technique and gadgetry, I understand how easy and comfortable it is to remain in a technical focus.

Technology educators have a democratic responsibility to examine the dominant ideology of technology education. Significant curricula change that addresses social considerations of technology is not possible as long as technocratic ideology is unreflectively accepted. A true “paradigm shift” for technology education is not found in acceptance of curricula developed with the old mindset. Such curricula provide the appearance of

69 According to Zuga (1987), "industrial arts teachers tend to be "technonuts'. They enjoy learning about new technical processes, creating products, and working with tools and materials. This is evident in their desire to learn more about technology" (p. 12).
improvement through change but in reality are committed to technocratic values, attitudes and beliefs. Unless industrial educators are able to detach themselves from their entrenched ideology, which is very difficult apart from exercising critical inner space reflection\textsuperscript{70}, curricula produced will continue to embrace common sense approaches to studying technology rather than ones that employ critical, social, and cultural perspectives. Giroux (1988) points out that teachers often operate out of common sense assumptions and fail to raise fundamental questions about the cultural nature of their work. "To ignore this important notion is to relinquish the possibility for students and teachers alike to shape reality in an image other than one that is socially prescribed and institutionally legitimated" and such oversight is a "serious ethical and political failing" (Giroux, 1988, p. 17).

\textsuperscript{70} It is important not to forget that “the technocratic mind is driven by the logic of its own paradigms” (Drengson, 1983, p. 82).
CHAPTER V  TEACHING: EXAMINING CULTURAL SCRIPTS

It is the teacher who, in the end, will change the world of the classroom by understanding it.71

In previous chapters I examined dominant technocratic and other stories of: myself as a teacher, technology, and technology education curricula. I now focus attention to the activity of teaching. Together, these four aspects provide a perspective of dominant and subordinate cultures of technology education. In focusing on teaching I begin to reflect on the day to day experience of a teacher interacting with students. I begin with my own stories and consider such accounts as adding to the diversity of knowledge in technology education. According to Zuga (1995) there is little research in technology education curriculum on the experiences and beliefs of teachers. Sparks-Langer and Colton (1991) point out that a teacher's interpretation of teaching through narrative is a way to "gain a deeper understanding of their experience" (p. 42). My interpretations, however, reveal more than just stories. They also reveal something of the storyteller.

The images of practice revealed through my stories disclose my consciousness of practice (Connelly and Clandinin, 1988) or, the way I look upon my practice. Understanding a teachers' consciousness is important since "consciousness and values have to do with what are usually called 'problematics,' namely, the viewpoints that make certain things a problem for us" (Tripp, 1990, p. 162). As consciousness changes so do the problematics. For example, early in my career a technical consciousness saw

71 During my visit in 1991, this quotation was prominently displayed in the office of Dr. David Hopkins at the Cambridge Institute of Education.
problems associated with classroom management, the acquisition of equipment and supplies, and student motivation. Later, as my consciousness became sensitized to rapid technological change, my problematics shifted to concerns of technological updating and new hardware. Next, I came to a heightened awareness of cognitive processes and my concerns centred on helping students learn processes in technological design and problem-solving. My present consciousness has led to a problematization of teaching in terms of its social and cultural significance. According to Tripp (1990), teacher reflection becomes "socially critical when they become aware of the social implications of their practice and begin to work on those" (p. 163). My stories are from the viewpoint of a technology education teacher who views the work of teaching in social and cultural terms. Although my consciousness will continue to change, I recognize that a social consciousness is very different for me in that it problematizes previous consciousness as technocratically oriented. A transformation to a social/cultural consciousness has led to a tremendous change in values and viewpoint. I problematize the partiality of social understanding within technocratic consciousness.

Teachers have a responsibility to examine their roles as cultural workers:

Because education is a social practice, its techniques are not socially neutral: They produce, reproduce, and transform people's abilities, attitudes, and ideas. If teaching is a profession, then it is not enough merely to keep improving the technical expertise of teachers. Teachers need to...have some understanding of, influence over, and responsibility for the social conditions and outcomes of education" (Tripp, 1990, p. 165).

In the previous chapter I described how curricula can be viewed as cultural scripts that socialize students into particular values, beliefs, assumption, and modes of reason. The work of teachers is the process of primary socialization (Bowers, 1988). "The teacher is playing a unique gate keeper role that can have a powerful influence on the development of the student's conceptual map (ability to interpret and make one's way through or around the cultural patterns within which everyday experience is organized)" (ibid, p. 97). Teachers need to take responsibility for their work in both the technical and social aspects of teaching (Tripp, 1990; Bowers, 1988). To evaluate the
cultural activity in which they are engaged, teachers must gain the necessary knowledge and consciousness. Without a heightened social and cultural consciousness, teachers will be unable to critically interrogate the social/cultural aspects of their work. It is difficult to value the social aspects of teaching if one's consciousness is predominately technical. The problematics engaged by a technical consciousness of teaching will be technical and not socially critical.

My stories of teaching are ones that examine the cultural effects of my work as an industrial/technology education teacher. I wish to point out that I am only beginning to engage my work in a cultural sense. My narrative of experience begins with a story of how the culture of technical specialist/industrial education man was reproduced in students. In particular, I wish to share my experiences and interpretation regarding the socialization of male students.

Reproducing a Technocratic Subjectivity

We teach who we are.

(Sign at a teacher's conference)

Teaching is not a thing detached from self, but rather something that is implicated with/in self. Pinar and Grumet (1981) express how teachers' lives are intertwined with their work: "...curriculum that was drenched in their histories, poured through their bodies as well as their brains, connected to the places where they played and fought and ate and slept" (p. 37). Curriculum is with/in the teacher and the teacher is with/in the curriculum. In expressing this relationship I do not wish to give the impression that all teaching stems from the idiosyncratic beliefs of teachers. Rather, I wish to show how my interpretive frames played a major role in my overall pattern of teaching. The dominant frames of reference in my teaching were informed by male technical specialist man and industrial education man. My lessons in industrial
education attempted to replicate in both male and female students, the values, behaviour, attitudes, and ways of knowing that are deemed of value by male technicians and male industrial educators. It is also important, however, to point out that in small ways, my teaching contradicted, perhaps as a form of intuitive guided rebellion, engrained patterns of technical thought and habit. For example, there were times when intuitive/social man found his voice through crevices and gaps in the bulwarks of making, doing, measuring, calculating, drafting, cutting, and "gadgeting". Usually, intuitive/social and other less dominant men had trouble maintaining their voice and, when push came to shove, quieter men retreated into the shadows. My story of the dynamics, ambiguities, and tensions between my quieter and dominant men helps me explain my teaching as a form of social reproduction.

In 1974 I began teaching industrial education, mainly grades eight through twelve electronics\textsuperscript{72}, at Windsor Secondary School in North Vancouver. I saw my task as trying to interest students in technical things through experiences similar to my own. I taught chiefly in the ways of technical specialist man and industrial education man but also with a good dose of mathematician man. In my first years of teaching, I tried to mentor my students, both male and female\textsuperscript{73}, through the rites of technical manhood. It is no wonder that a 1980 accreditation report noted "a paucity of females" in the industrial education department\textsuperscript{74}. It is also no wonder that very few females who

\textsuperscript{72} I also taught woodwork, metalwork, and drafting as well as mathematics 8 to 11. (What better academic area but mathematics to accompany a technically focused subject like industrial education?)

\textsuperscript{73} In over 20 years of teaching, over 90\% of my students have been male. Contrary to commonly held perceptions, these students have NOT been "low achieving boys". Typically, junior grades include a good cross-section of abilities and senior grades are characterized by above average ability and honor roll students. Electronics attracted many students who took three sciences in grades eleven and twelve.

\textsuperscript{74} External accreditation evaluator for the Industrial Education Department was North Vancouver District Principal, Leagh Farrell. The department objected to the observation of a scarcity of females since we felt it implied we were biased against females. Because we were not conscious of the bias at the time we honestly felt it did not exist. The department believed it was not discriminatory since there was equal access for boys and girls to all courses. This does not mean, however, there was equal opportunity for females. (It did not occur to us that it is mostly boys who are interested in the male technical rites of passage.) I now have little doubt that industrial education is socially constructed to
started in grade eight remained until grade twelve! Nevertheless, I tried to serve as a role model to students in technical areas and spent much of my time trying to design projects that I thought would be attractive to students. Feedback from male students during my first 10 to 15 years of teaching indicated they were happy with their technical accomplishments and many of these students moved on to successful post-secondary education and careers in technical fields. The male world of industrial education seemed simple during those years and I had little awareness of its social construction, history, or technocratic ideology. Nevertheless, certain irritations caused me to rethink the purpose of industrial education and make minor adjustments to curriculum. One such adjustment was a response to something I call “maker's syndrome”.

Through my own experience as a teenager, as well as years of teaching teenagers, primarily boys, I observed the powerful promise of fulfillment that is generated in anticipation of making a technical device. Just as enthusiasm in making, and fascination in technique, was modelled to me, I shared my own genuine excitement in proposed projects with students. Enthusiasm is infectious and students usually caught the making/doing bug. Through the design of experiences for students in making and doing, the script of technical/specialist man was inherited. I saw intense enthusiasm and ardent involvement in making/doing repeated hundreds of times in students. But I also observed, after the successful creation of a project, what is best described as a sense of emptiness. Upon completion of a project the excitement and motivation reflect the values and ways of knowing of men. Although there is greater awareness of female issues, within the technology education facelift for industrial education, male dominance remains.

Many of my former students have entered a full range of technical occupations. Former students have become tradespeople, technicians, and engineers.

In an area such as electronics, I believe the lure of the gadget is an important factor in generating enthusiasm. In electronics, teenage boys seemed to be particularly enthused in making projects such as high powered amplifiers, long range listening devices, “bugs”, noisemakers, and high tech looking cabinets. Boys are particularly interested in projects that involve control of power such as robots and power mechanics.
quickly wane and the only thing that seems to satisfy the vacuum is to begin another construction project. Usually the next project would have to be bigger, more sophisticated, more powerful, or more macho. "What are we going to make next?" was asked of me incessantly. The practical-work "post-partum" phenomenon is a vacuum that abhors technical emptiness. My intuitive side informs me that this cycle of making/doing can become a syndrome to which boys are particularly vulnerable during their adolescent years. Making and doing are not bad things but I am convinced that getting caught in a making/doing syndrome prevents students from seeing technology, themselves, and their world in different ways. For example, emphasizing only the decisions regarding materials, design, processes, tools and techniques necessary for technical activity serves to perpetuate the "technology = tools = made world = reality" instrumentalist myth examined in Chapter Three. Such activity does little to reveal the social, political, and moral issues underlying the culture of technology. Emphasis on technical making and doing do little to provide opportunities for alternate ways of knowing, seeing, and being.

**Interpreting Social Significance**

The myopia created through narrow technical approaches to the study of technology may prevent men from seeing themselves in different ways. It is possible for both industrial/technology education teachers and students to become caught in this snare. Within a syndrome of making and technical exploration, men quite simply have no place else to go, and more importantly, no other person to become. Fixation with technical doing at a particularly vulnerable stage of growth may trap areas of men’s lives in a perpetual adolescent state. Obsession with technical pursuits, can

77 The emptiness is sensed in students through “maker’s syndrome” was paralleled in other activities where making was not present. For example, non-making activities involving familiarization with new gadgets such as lasers, computer programs, CAD, or robotics can lead to a “fascination syndrome”. After exposure to a cornucopia of new technologies many of my students seemed almost jaded and expressed the attitude “so what?”
become all too easily a convenient way for men to mask other areas of their lives that need attention. Keen (1991) has further stimulated my thoughts on my interpretation by suggesting that for men “…the hidden intent of technology is to create a perfect mechanical baby…man creates himself in the image of a god he imagines has fabricated the world like a craftsman” (p. 18). Technical males conceive and give birth to gadgets and technical solutions all by themselves. They are enraptured in technical conception, delighted in technical creation, and addicted to repetition of the process. The downside of this infatuation for men is that technical areas can become an identity as well as a place of escape. Inside the haven of technical activity, men find a place of acceptance, apparent certainty, control, and predictability in the midst of a world that is ambiguous and contradictory. Cardelle (1990) explains:

One way of coping with suppressed emotions is the male attachment to mechanical toys....These mechanical toys give him complete control over their function. The toys are often tangible examples of speed, power and of man’s technological achievements....Owning a machine gives one title to status, prestige and position, adding to the false sense of being a man. (p. 38, 39)

Winner (1979) states that “the standard tenets of the technical orthodoxy of our time” include “that men know best what they themselves have made” and “the things men make are under their firm control” (p. 75). Bush (1983) points out that "if one accepts these assumptions, then there is very little to do except study processes of design and invent ever-newer gadgets" (p. 157). Technological prowess is seen as a manly activity. The twinning of masculinity with instrumental (tool) notions of technology and material possession is depicted by T-shirts worn by one of my senior students. (See Figure 5)

78 I discussed the meaning of the T-shirts with the young man wearing it. I shared that the phallic depiction of tools = man was, in my opinion, a good characterization of the way men have identified their masculinity with technology tool culture and material possession. However, I also shared that I felt the wrench graphic was not appropriate for school.
Figure 5. "Masculinity = Tools = Products" T-shirts.

Immodest graphic and statement associating masculinity with product/tool/technical aspects of macho-technology. (Permission granted to publish.)
"Different social formations have integrated technology differently. Machines as male territory...are not universal" (Hubbard, cited in Rothschild, 1983, p.viii).

Through modes of social reproduction, a Western masculine identification exists with tools, machines, and industrial/technical endeavors. Industrial/technology education, I believe, is one of those modes. Such identification may be at high social cost since it can become part of the way males see the world and interact with others. Cardelle (1990) points out "how we grow up as males and how we learn to integrate technology into our lives is a powerful influence in shaping our human interactions" (p. 3). Habits of control with/in the realm of technology and the world of machines may be transferred to ways of interacting with others. Keen (1991) believes that identification of masculinity with the made world has also been damaging to men themselves.

"Nothing has eroded the dignity of manhood more than the cult of youth that grows out of the ideology of technology" (Keen, 1991, p. 164). As I have pointed out, the dominant ideology of industrial/technology education is technocratic. Doyle (1983) explains that "The industrial revolution replaced the ancient male roles of strong provider and skilled artisan with the role of keeper of the machines" (p. 11). With the advent of rapid technological change, men whose identities are linked to technical ways of knowing, seeing, and being may be increasingly vulnerable to crises in identity.

New computer technology, job obsolescence, and deskilling of the workforce have destabilized the machine identity for men. Such changes erode "their long-cherished belief that they controlled their lives and their world" (Doyle, 1983, p. 11).

Biram (1978) describes men as being particularly susceptible to an unhealthy condition he calls "teknosis":

"Teknosis" is not to be found in any dictionary: it has been coined to refer to all noxious or nefarious aspects of technology and scientific thought. In Attic Greek *techne* means "craft" or "skill"; in modern Greek *osis(othesis)* means "drive", "impulse". "K" as used by modern classicists for the Greek letter *chi*, has been retained here for its ugliness, suitable to the subject of teknosis....In one sense, then, "teknosis" means the drive toward technical thought or action. But in English the suffix -osis implies a morbid or diseased state, and this is the primary meaning of teknosis. The
adjective, of course, is "teknotic"; and "antiteknosis" refer to any form of opposition to teknosis and to the absence of teknosis. (p. 16) [emphasis mine]

In the main, teknosis is a male disorder, or is initiated by males: their aggressiveness, type of intelligence, objectives and beliefs are principal generators of teknosis. Women may, of course, become teknotic and support, condone, applaud or exploit teknosis; but they seldom originate it, having a different approach to technology. (ibid, p. 20)

Teknosis is an unhealthy state of obsession with technical things, ways of knowing, seeing, and being (Biram, 1978). The description of the symptoms of teknosis seem to be an advanced state of "maker’s syndrome" I observed in teenagers. Biram (1978) points out symptoms of "adult" teknosis:

Teknotic symptoms in technologists themselves are, for example: 
"designer's itch" --- the compulsion to make unnecessary improvements; narrowness of mind; neglect of non-scientific faculties or skill; adulation of technical achievement or equipment; lack of conscience regarding applications of research results; the belief that human problems have exclusively technical solutions; narrowly defined efficiency; simplicity of outlook based on ignorance of rather than mastery of complexity; a tendency to view human beings as objects; Nature as an enemy to be conquered; brains as computers; intuition as superstition, art as entertainment and society as an engineering complex. (p. 16) [emphasis added]

Industrial/technology education influences the consciousness of the student at several levels. This is done through what technology education both emphasizes and omits. Technology education does little if anything to critique the technological consciousness that is prevalent in society. It reinforces a technological consciousness through technical ways of thinking, doing, and being. Such restricted experiences for students may predispose them to unhealthy conditions such as teknosis. It would seem that if one were to consciously design a technology education curriculum that would lead people into teknotic ways of knowing, seeing, and being; strong emphasis would need to be placed on things such as:

- making and doing,
- technical concepts, theories, knowledge, and processes,
• acclaim and fascination in "technical progress", "state of the art" techniques and high-tech cyber-culture, equipment, tools, and gadgets,
• ever increasing sophistication in technical knowledge, skill, and expression,
• common sense understanding of technology,
• technology aimed at manipulation, control, modification, and standardization,
• rational knowledge, linear and analytic thinking,
• yang values such as competition, control, aggression, "ego-action" (Capra, 1982),
• transmission of knowledge, skills, and values of the male technical culture,
• technological determinism,
• design and technical problem-solving activities, especially competitive ones.

For the origins of teknosis to take root, other ways of taking up the study of technology would need to be neglected, marginalized, or treated in trivialized:

• all forms of intuitive wisdom,
• values used in technical activity,
• practice in resolving social problems related to technology,
• contextual understanding of technology,
• non-scientific/technical ways of knowing, being,
• complexity of technological and social systems,
• social/cultural costs of technology,
• humans values and technology,
• yin values such as cooperation, synthesis, and ecological awareness (Capra, 1982).
The Lessons That I Teach

In small ways, I attempt to soften the making/doing cycle in my teaching. For example, drawing from intuitive/social man, I provide opportunities in electronics projects for the integration of artistic expression as well as design and creative thinking. I suppose I reproduce part of the artistic culture I experienced in Roy Lewis' design class. But broader ways of understanding technology are not my primary lesson. Although I am officially a "technology education" teacher, I do not provide what I consider, a balanced education in technology. One lesson I teach quite well, through an invisible curriculum, is male identification with industrial and technical aspects of technology. I technoteach young people in the ways of technical/industrial men. I socialize adolescents into a technical culture and direct them into further technical interests, education and careers. I teach these lessons well and even win awards at it.

I now wonder how many of my students went into personal and working lives predisposed to teknosis? I focused on making and doing and did little to raise the consciousness of students regarding the social/cultural aspects of technology. I have come a point in my teaching where I sympathize with McElroy's (1988) reflection of the how the system rewards teachers who reproduce narrow and orthodox views:

What's the use of having an idea that education holds unlimited possibilities for exciting people, for helping them to see the potential meaning of their own lives, for helping them to clarify their possibilities, if the bureaucratic mind set that pervades in the system where most 'schooling' occurs accepts or perhaps even demands a limited view, a "narrow view" that sets technical competencies as its standard? ...The system will recognize, even laud, those aspects of teaching, of classroom life, that constitute the narrow view. (p. 38)

I identify with Gatto's (1992) realization, after his 26 years of teaching, that his institutional teaching was diminishing rather than enlarging the power of children. Education is meant to enlarge and not narrow awareness. In my restricted

---

79 I received a 1994 Canadian Prime Minister's Award for Excellence in Teaching Technology, Science and Math. This award recognizes teachers who have a record of interesting students in science and technology and directing them into technological careers.
consciousness, I was implicated in an invisible curriculum that provided a narrow
cultural script. Lewis (cited in Lewis, et al., 1995) points out that there are two
dimensions to "technological citizenship": "critical literacy" and technical "capability or
competence" (p. 5). I focused on the lessons of the latter and ignored those of the
former. This is what I was socialized to do. Becoming aware of the partiality of my
teaching has helped me understand the need to revise my lessons.

Learning New Lessons: Softening the Technocratic Classroom

Only recently, I have grown in awareness of the technocratic culture of
technology education. I am only beginning to include other ways of knowing
technology, other than those of industrial/technical specialist man, in my teaching. I
am now trying to help students build some resistance to technophilia, teknosis,
technocratic consciousness, technolust, and the fatalism of technological determinism.
Recognizing that any education I provide will be partial, I believe students need a way
to study technology without the harmful effects of a technocratic approach. They
cannot become good citizens without being provided opportunities to understand
technology in a general sense. Socially contextualizing technology is a way to start the
process of softening the technocratic classroom.

Helping students develop a socially critical perspective of technology is my
response to improve the justice of my teaching practices (Carr and Kemmis, 1983). The
motivation for classroom research is a desire to heighten social consciousness of
technology. Alternative pictures of technology that provide a sense of technology as
political, moral, and value-laden are often obscured in many technology education
classrooms by the sheer dominance of technical hardware, making, and doing. Is it just
to portray technology solely as a "technical means"? Is it just to imply, through
repetitive technical skill development and manufacture of artifacts, that technology is
value-free and constructed solely through the application of technical expertise? Is it
just to provide only one-way deterministic characterizations of technology when
referring to the relationship between technology and society? Is it just to focus on high
technology and integrated systems as the important things to learn? The account I tell
is not one of “final solutions” but one of an attempt to try something different.

The place to start is where you are and with what you know. At this time of this
research I was in the early stages of consciousness regarding the social/cultural aspects
of both technology and teaching. My classroom research involved examination of social
aspects of technology with four Electronics classes during the spring of 1993. These
were the only classes available. 71 students were involved in the research. Two
Electronics 9/10 classes each had 22 students and the two Electronics 11 classes had 13
and 14. The majority of Electronics 9/10 students were grade nines and the majority of
Electronics 11 students were in grade ten. Only five of the total number of students
were female and all of these were enrolled in Electronics 9/10. Windsor Secondary
School is in a middle to upper middle class neighbourhood in North Vancouver, B.C.
Electronics is part of the industrial education curriculum in British Columbia and has
traditionally not addressed the social aspects of technology. Electronics courses
typically focus on the theory, construction and testing of electronic devices and systems.
Students assume that practical activity will be the focus of the course. Because of
student expectations I felt these classes would not provide the most conducive setting to
examine social aspects of electronics culture. On the other hand, I felt that since
electronics was about as narrowly technical as courses come, it would be interesting to
see what students felt about studying some social aspects of electronics. The story I
share provides just a glimpse of the opportunities and obstacles involved when teachers
begin to address the cultural aspects of their work.

My initial plan was to incorporate a unit within electronics that would provide
opportunities for students to examine the social aspects of technology. I was very

80 Industrial education in British Columbia is presently in the process of revision to technology
education.
aware, from 20 years of teaching experience, that students would likely reject a
"theoretical" approach to such a unit. Students primarily elect to take technology
courses because they want to be involved in practical work. The expectation of hands-
on making and doing is well-established in industrial/technology courses. This
expectation is evident from interviews with students during the planning phase for the
proposed unit of study and the following is a typical response:

Interviewer81: What do you think a technology course should include?
Student #1: Learning how to create products and make drawings to help you
make things.

A central part of a student’s expectation about an industrial/technology course
focuses on the creation of products and making. Much of this expectation may come
from their experience in previous technology courses or from the experience of a friend
or relative who may have taken such a course. Although students usually focus on the
making aspect, they will often acknowledge that there are other aspects linked to
making and doing. For example, some students felt technology education should
integrate learning from other subjects. However, this was limited to knowledge from
science and mathematics applied to practical problems:

Interviewer: Brainstorm all the possibilities for the content of a technology
education course.
Student #1: Combine math into technology to learn how to solve real
problems.
Interviewer: Why would you prefer that?
Student #1: Well in just plain math you don’t see how it is involved with a
real problem.
Interviewer: Do you see this combination as more meaningful?
Student #1: Yes, because the math that I am learning now, for example
trigonometry, I am not sure how it would fit in to the workplace.

81 I was the sole interviewer and tape recorded all interviews. Interviews were conducted
informally over a 6 week period.
Interviewer: Does this mean you see technology as making the academics become more understandable?

Student #1: Yeah

Interviewer: Would math be the only subject to integrate?

Student #1: No, also science.

Interviewer: Are those the only subjects you see?

Student #1: Yeah

It is significant that the student could not see any other aspects that were linked to technology education. This was a typical response. No student suggested that a social aspect belonged in a technology course. Students saw science and mathematics as obvious links to technology. This is not surprising since common sense understandings of technology focus on technical aspects. From the interviews, as well as years of working with students, it is apparent that the social aspect of technology is just not part of the "picture" students have about both technology and technology education. Student #2, a grade 10 student enrolled in Electronics 11, expressed another possibility for technology education:

Interviewer: What do you think a course in technology should involve? If you could design a course what would you want to do.

Student #2: I'd definitely have career prep in it, theory and practical work related to work. All in one.

Interviewer: What sorts of things might it include that we don't include now?

Student #2: More computer work.

Interviewer: Why?

Student #2: Cause everything uses computers.

Interviewer: So if we don't include computers what's wrong with that?

Student #2: We're behind.

This student believed that technology education should be linked to the world of work. The student also saw it important to keep up with technological change and information technology. Again, no concerns were expressed regarding the social
aspects of technology. It is clear that students were not in any way resisting a technocratic script for technology education, in fact, they expected it.

A concern in introducing the social aspect was, understandably, the “disruption” of existing pictures. A certain amount of uncomfortableness would be necessary for students to assess their existing portrayals of technology. However, I was also concerned that I might “turn off” students by overloading them. As a result of these concerns, I felt it best to link the social unit to a practical unit on robotics technology. Again, student input was solicited regarding the upcoming robotics unit:

Interviewer: Now let’s move on to robotics; what do you expect to learn? If we start robotics, understanding that we only have two months to work on it, what would you like to get out of it?

Student #1: How motors work, like a little tiny motor; the magnetic field behind it.

Interviewer: The theory behind it?

Student #1: Yeah and then do a project exposing the theory.

Interviewer: What sort of project would you like to do?

Student #1: Just build something small like a car or windmill or something that would be useful.

Interviewer: Can you be more specific?

Student #1: Well, we could do some simple programming so that when you press a button something happens or whatever. But I don’t think we could get into full scale robotics.

Interviewer: Do you have any experience in robotics?

Student #1: Not really.

Within this student’s conception of robotics existed an expectation that the theory of "how motors work" would accompany making. Again a technical understanding, not a social one, was expressed. This was not surprising since, in previous electronics courses, a social aspect had not been addressed. I liked the phrasing the student used: “a project exposing the theory” since over the years I have used an indirect project approach to teach electronics theory. The grades 8 to 12 electronics program at Windsor
Secondary has centred on the development of student designed products. Present and former students have always remarked on how much they enjoy the challenge of designing and making. Building on this base of enthusiasm, I have taught electronic theory “around” the project. Students are more willing to examine theory if they can see a practical and immediately relevant use for it. It has always amazed me that theory taken out of a practical context will bore students, but within a practical context, it will be accepted and even relished. My idea regarding the social aspect of technology for the research was similar. I would provide opportunities to connect practical technical activity not only to technical theory but also to social contexts. Students would still be learning about the technical knowledge and skills but would also have an opportunity to discover something about its social aspect. In this way, students would be learning about *technology in its more general rather than restricted sense* (Pacey, 1983). Along the way opportunities would arise for students to begin to understand more about the culture of technology. In other words, I thought that I could redirect some of the energy tied up with "maker's syndrome" toward social aspects.

In beginning to explore student's social understanding of technology I was often shocked by what I heard:

**Interviewer:** Do you see technology as being a problem insofar as its impacts on the environment and society?  
**Student #2:** I guess it destroys the environment but it also can be a positive force.

---

82 For example, students who build “mini-amps” for connecting their Walkmans to speakers, are asked to learn amplifier theory, testing procedure, data interpretation, and related mathematics. It is interesting that students who would otherwise “turn off” during a lesson about amplifiers are generally cooperative and even eager to follow testing and measurement procedures to calculate the distortion and power output of their project. Incidentally, measurability is a tenet of technocratic ideology (Bowers, 1977).

83 Just as every made project has a body of associated technical theory, I believe every technical area also has social/cultural issues linked to it. Why not extend the idea of a project that exposing technical theory to a “project exposing the social aspect”? In this way social and technical thought could be developed hand in hand, and hopefully, new ways of seeing “sociotechnically” would emerge.
Interviewer: Should the concerns about the negative aspects of technology be part of the school curriculum?

Student #2: Probably not because it is such a small scale.

Generally, I found students to be quite aware of environmental "impacts", but less aware of human costs associated with technology. Before starting the robotics activity, I prepared the ground, so to speak, by providing opportunities for students to investigate the effects of technology on people. I shared unusual stories of technology. The essential ambiguity of "technology as liberator" and "technology as dehumanizer" is rich territory for students to begin to deal with the values question of technology: technology as a dream or nightmare, emancipator or limiter of human freedom. Although good guy/bad guy stories of technology focus on the "impact" of technology, such stories "fit" with student's common sense images of technology. It was storytime. I shared stories about case histories of how technology can adversely effect people. Also, I gave students a variety of short articles to read. Some were given extremely pro-technology stories while others were given horror stories of technological disaster. The discussion that resulted was most lively. Students love horror stories. My repertoire of technological horror stories included:

- The Chinese restaurant syndrome/MSG
- Botulism found in canned food: soup company forced into bankruptcy.
- Agent Orange
- X-ray shoe fitting machine: fluoroscope
- Colour TV X-ray radiation: GE recall of 100,000 TV's that gave off low level of x-rays (led to radiation control act)
- Project Sanguine: plans for giant underground transmitter 21,000 sq. mile gridwork transmitter
- Mercury in tuna scare; industrial waste washed in to sea.
- DDT
- Asbestos
- The Dugway sheep kill incident (nerve gas)
• MACE: riot control; can cause permanent injury

An excerpt from my daily reflections read:

E block Elx 9/10 students liked the stories and there is good feedback. Showed the Robot Revolution video perfect since it linked in with stories. How will robots effect employment? etc.

Students were engaged as they read and discussed the articles with each other and in a class forum. However, students quickly lost attention as they viewed a video on the social aspects of robots. I observed the same disengagement as students viewed a video called "The Global Production Line". This video outlines the plight of third world electronic assembly workers in the Philippines and Mexico. It is an excellent video that raises issues of exportation of employment to offshore locations, exploitation of workers, exploitation of women, unhealthy working conditions, the power of multinational corporations, and the competitive nature of the electronics industry. It told of a darker tale of electronics.

An excerpt from my daily reflections read:

Yesterday I showed the video "Global Production Line" and although many kids appeared to watch, especially the girls, I felt that many students lost interest and missed the significance. It was almost as if they have seen it before and are numbed to the fact that these are real people. Steve Martin, a socials teacher, shared that his students have just met real victims of the holocaust and that the effect was far different watching films about it. If we are trying to sensitize kids to the social effects of technology through the use of technology perhaps it won't break through. I sense that these kids are the products of media technology and have learnt to tune it out. And so we are going to try to break through and increase awareness using technology? There has to be better ways to break through.

Maybe my perception of student disinterest was in fact student boredom. Maybe students were getting tired of the stories and videos. My diary excerpt:

Just reading about the psychology of power by David Kipnis and perhaps there are clues in there. Kipnis says we have formed a culture of compliance and so when we show people these things they still remain compliant to technology. What is involved in connecting this aspect to where students live?
Maybe I was looking for reactions too early. Several days later a senior student expressed that he was quite moved by the working conditions shown in the video.

A few days later I interviewed several students again regarding plans for the immediate introduction of robotics:

Interviewer: Your class did extremely well on the power supply - you were self-directed. What would be a similar framework that could be set up for robotics so that students become much more aware of human choice and values? How do we do this and help people be much more critical of technology. How do we set up the activity?

Student #4: How to gear technology toward a better society is to integrate different morals or values into the technological products. Like video games now depict fights, wars, missiles and bombs.

I was encouraged. Even though values were seen as one need to improve products, this student was beginning to use sociotechnical language! I asked the senior student for more advice and guidance on what could be done:

Interviewer: How do you get companies to change the content of those games.
Student #4: Consumer demand for different products.
Interviewer: How do you help people into a questioning mindset.
Student #4: Make it more clear to them that their lives are directly affected by all technological products and if they don’t assume a more aggressive role in the evaluation of these products then nothing will change and they will merely be controlled by others who produce products.

Interviewer: We have spent 3 days showing videos, initiating discussions and sharing stories. Now what would you suggest happen as I hand this over to the students? Is it possible to tie this into robotics? How do you get people to become self-aware of their choices in design.

Student #4: If someone is creating a product then as they go through the process then they must be able to see how each decision they make will affect society as a whole or those affected by their product.

Following the advice of this student, and similar advice from others, electronic students were asked to design and make a robot in a socially conscious way. We
discussed how most people design from the technical first and ignore the social implications. Although social outcomes cannot always be anticipated, socially thoughtless design often leads to negative social impacts. Students were asked to give serious thought to the social purpose of their design. Interesting student ideas included the following types of robots: surveillance, entertainment, hazardous duty, service. It was stressed that the social purpose should influence the robot design and construction. Here is some classroom dialogue to illustrate the role I tried to take as a critical helper in the socially conscious design process:

Student #5: Could you have a 4 wheel drive robot?
Helper: Technically it is possible. But is it socially desireable?
Student #5: Probably not because it is a waste of energy and doesn't really serve a purpose
Helper: You can do anything you want but it must be linked to a social purpose. Start with the social problems or questions or the type of society you want to live in and from there show me that your technical design is consistent with your social beliefs.

Student #7: Can I make a one wheel vehicle?
Helper: I see, why is it going to be a vehicle?
Student #7: Why not?
Helper: What is the social idea behind one wheel? You have settled on the technology but not explained a social purpose.
Student #7: Because it saves energy for other things.
Helper: What does it do?
Student #7: I don't know yet.
Helper: What are you going to make?
Student #8: A boat.
Helper: What is the social purpose?
Student #8: I haven't thought of one yet.
Helper: So you have settled on the technology but you don't know what sort of society you want?
Student #8: Correct
My diary excerpt reads:

After working with F block today it was so apparent that students are just totally dominated by the visual reality of technology. Especially the boys - the two girls were thinking more in terms of what they were going to DO with the robot than what the robot was going to BE. A different viewpoint.

Maybe I was too naive to think that the power of "maker's syndrome" could be broken! A hidden lesson I may have been teaching in socially conscious design is to find a use for existing technology when there really isn't a need. (See Appendix VI for pictures of some of the robots designed and produced.)

To end my mini-story of classroom research, I will share some perceptions of students on their overall experience with the teacher/student designed unit. These comments speak for themselves:

Interviewer: Over the last several years you have been involved in designing and making products. Should schools be involved in discussing the social values involved?

Student #4: It should be discussed in the school systems otherwise students may leave the school system thinking that technological products are simply put out by companies for their use and that they have no choice in the use or modification of the product. It's merely that they are being handed products and they can either take them or not but not change them.

Interviewer: Do you think the social aspect should be included in a tech course and if so what percentage?

Student #11: About 20%

Student #12: About 40% because what's the point of just learning how to make things? You have to be able to think about them too?

Interviewer: What problem could just teaching people to make things be?

Student #12: They would have no values. Big business is just making things for profits and not really to help people; their values are shallow and the things made not always valuable to society.

Interviewer: Do you think as many people would take the course with 40% of it social issues?

Student #12: Maybe not.
Interviewer: Should the social issues we touched upon be included in a technology course or in a socials course?

Student #9: It's not too bad, I think some should be included in a technology course.

Interviewer: Why?

Student #9: Because I don't think a socials teacher would bother with it.

Interviewer: Why do you feel that?

Student #9: I don't know, I just don't think they would.

Student #10: The socials teachers I think ignore problems with technology. Actually, it should carry a big percentage in this course because it is a problem with technology.

Interviewer: Many students take this course for the practical and making, how can a social aspect be included without turning people off; should it be included?

Student #9: So we are aware of it.

Interviewer: Did this unit increase your awareness?

Student #10: Yes it did, especially after the film and discussion.

Interviewer: Any ideas to make it interesting?

Student #9: Just make it a small unit.

Student #10: Just a few minutes at a time - spread it out over the year.

Student #9: I liked tying it in with a project so we still get to make things.

Interviewer: What are you two working on?

Student #9: An automatic blind opener - a windlass.

Interviewer: Is that good technology?

Student #10: It can help people in hospital.

Interviewer: What is bad technology?

Student #9: Bombs and school.

Interviewer: School I guess is a technology.

Here are some of my reflections at the end of the unit:

At this stage, I feel I have learned a lot. I feel even stronger that technology education must address social issues in ways so that the
technical does not dominate. It is not just a matter of teaching the
technical in a new way and adding a new bit. When you add the social
the whole dynamics of the classroom change. Its redefining the whole
thing so that the technical aspect remains but that the social aspect is
taught effectively too.

In fact there may be more effective ways to teach the social aspects than
just integrating it into better designs. These ways may not involve making
and doing.

It may in fact be more suitable to do the socials aspect separate from the
technical. Perhaps this experience is good for students to find that the
fascination with robots...that robotics sounds great but when you get to it
the technical part is kind of empty without some meaning in the social
domain. On the other hand I am not sure the enthusiasm of the kids the
last week and the dedication coming in after school was linked to the
making and doing or the rather interesting bomb disposal idea. One
particular group of grade 11 boys who have been acting as a team and
really seem to be getting a lot out of it. A lot of creative thought. And this
week I will be co-evaluating the projects according to the predetermined
criteria that they themselves suggested. I certainly have grown a lot and
the kids reflections have been quite deep.

As I began to reflect on the student interviews and work it was refreshing
to see just how far many of the students had come in their understanding
of the social aspects of technology. It struck me that three general levels of
awareness emerged. Perhaps a fifth of the class had caught the notion of
alternative ways of looking at technology. About three fifths of the class
comprehended the experience not so much as an alternative way of
viewing but rather as more objective knowledge to master. The remaining
fifth of students grudgingly participated in the activity and saw it as an
invasion into their “technical time”. Within this last fifth group 3 students
refused to complete the work.

These results caused me to rethink my assumptions about my original
research proposal: addressing the social questions of technology through
making and doing. So many students seemed to see the moral of the
experience was that we need to develop technology in socially conscious
and responsible ways. It was the remaining fifth of students that seemed
to be different. They somehow had been fundamentally affected by the
experience. They had somehow began to think in alternative ways. The
way they saw the world had been disturbed and they had somehow
allowed their minds to see from alternative perspectives. They had
enjoyed the experience not so much because of its challenge to the mind
but because it was out of place with their assumptions about the course.
Perhaps it was the challenging of assumptions that stimulated students in
positive ways. For these students, I believe it was a consciousness raising
experience.
I do not wish to give the impression that this is all there is to helping students develop a critical understanding of the social aspects of technology. However, for me, my students, and the courses I taught, it was a place to begin. Even in this small unit spanning only several weeks work there were signs that students increased their awareness of the social and cultural aspects of technology. When I compared the sorts of classroom dynamics involved with the inclusion of a social unit of study in technology they were entirely different to the dynamics of a technocratic classroom. The language, interactions, and focus changed. I believe we indeed do teach who we are. When a teacher's consciousness changes, so do their problems, approach, pedagogy, language, and lessons.

Pedagogies of Possibility: Addressing Technocratic Ideology

You seldom, if ever, have a new environment requiring a whole new repertoire of survival strategies. In no case is this more certain when the new elements are technological...When you plug something into a wall, something is getting plugged into you. Which means you need new patterns of defense, perception, understanding, evaluation. You need a new kind of education. (Postman and Weingartner, 1969, p. 7)

Understanding what technology is doing to us requires a new kind of education (Postman and Weingartner, 1969)

In my account of reproduction of a technocratic subjectivity and my story of an experience in softening the technocratic classroom, I do not wish to give the impression that there is an easy solution for changing the lessons of the technocratic classroom. Teknotic/technocratic culture is deeply entrenched in the interpretative frames I am conditioned to use in my teaching. It is the world of industrial/technology education that I know. Without a broadening of my frames of interpretation it is the only pedagogy that is possible. Transformation of consciousness is necessary. The dislodging of my dominant men within allowed pedagogies of possibility to emerge.
In the previous chapters, I have taken a hard line not so much on the tenets of technocratic ideology but on its predominance within the culture of technology education: teacher, technology, curricula and teaching. I have undermined some of the common sense assumptions of technocratic logic using positions based in contrary values. Such contrary positions are, in themselves, rooted in particular beliefs, values, and assumptions — ideologies. Contrary values are important ones we must not forget. A question that arises, however, is what is an appropriate way for technology education teachers to respond to an entrenched technocratic culture? What sorts of activities can we create? What role can teachers play? One possibility for teachers would be to attack technocratic values with contrary ideology. Students may align themselves with the contrary values and beliefs, reject them, or be caught in a binarism.

The possibilities I suggest do not take this route. Being critical should not be confused with being anti-technological. Lewis (cited in Lewis, et al., 1995) points out that the "question of 'knowing'—cannot be divorced from the question of capability — one of 'knowing how to'" (p. 5). "'Technological citizenship' as an end has two dimensions—critical literacy or knowing, and capability or competence" (ibid, p. 5). Two possibilities may contribute to a critical literacy in technology: a contextual approach to studying technology and the notion of cultural literacy.

1. A Contextual Approach

In Chapter Three, I described the ideas behind a contextualist approach to understanding technology. A contextualist approach offers possibilities for technology education to move beyond its focus on a single context: the technical, design and developmental context (Bush, 1983). Contextualism does not dichotomize society on one hand and technology on the other. Rather, technology is seen as a mix of techniques and social responses. An advantage of a contextualist approach for technology education is that it enables the study of technology from a multiplicity of perspectives.
Context-sensitive accounts of technology draw attention to the less visible, but very real, political, economic, moral, and social aspects of technological development. The wider range of reference points for understanding technology, provided by a contextualist approach, can enrich the technical aspect focus provided by industrial/technology education. "Amazing ignorance" (Bush, 1983, p. 157) about the contexts of technology is precisely what I have observed in my social construction as a male technical specialist and industrial educator. I believe the contextual ignorance Bush (1983) speaks of is difficult, but nevertheless very important, to address in technology education.

2. Critical Literacy

We believe that schools must serve as the principal medium for developing in youth the attitudes and skills of social, political, and cultural criticism. (Postman and Weingartner, 1969)

Examination of the social complexity of technology is essential for people to become critical readers of technology. When technology is contextualized new questions emerge. Winner (1990), for example, points out that it is important to examine the social contract linked to each technology. A technology education that reinforces orthodox, uncritical, common sense accounts of technology is very different from one that might teach students to formulate critical questions. Such questions may rupture dominant depictions of technology:

They would ask, How well do the proposed conditions match our best sense of who we are and what we want this society to be? Who gains and who loses power in the proposed change? Are the conditions produced by the change compatible with equality, social justice, and the common good? To nurture this process would require building institutions in which the claims of technical expertise and those of a democratic citizenry would regularly meet face to face. (Winner, 1990, p. 410) [emphasis added]

The growth of a critical intelligence in technology is stultified by the dominance of conventional views. Winner (1979) believes that the way we think about technology
is "governed by a powerful, thoroughly stultifying orthodoxy" ... "which seldom has been subjected to the light of critical scrutiny" (p. 75). Winner (1986) points out that the conventional notion of technology is based on taken-for-granted ideas rooted in "accepted wisdom" (p. 6). Conventional ideas of technology must be transgressed if a critical intelligence is to develop:

The crucial weakness of the conventional idea is that it disregards the many ways in which technologies provide structure for human activity. Since, according to accepted wisdom, patterns that take shape in the sphere of "making" are of interest to practitioners alone, and since the very essence of "use" is its occasional, innocuous, nonstructuring occurrence, any further questioning seems irrelevant. (p. 6)

Designing and making artifacts and learning how to use technology are cardinal tenets of industrial/technology education. Focusing on "making" and "using" technology, as well as teaching technology as if it were a value neutral activity, industrial/technology education is an agent for perpetuation of conventional ideas regarding technology. Orthodox approaches do not subject technology to critical questions. Increasingly, technology education is mandated as part of every student's education. Is it possible for technology education to overcome its technocratic orientation in order to help students to critically examine technology?

Popular culture, the media, education, industry, as well as the workplace, focus too sharply on the concept of technique and in doing so ignore the social complexity of technology. In revealing the social complexity of technology, rather than the simplified portrayal of orthodox accounts, Bush (1983) maintains that

What may be surprising is not the depths of women's ignorance — after all, women have, by and large, been encouraged to be ignorant — but the extent to which men in general, inventors, technocrats, even scholars, all share an amazing ignorance about the contexts in which technology operates. (p. 156, 157)

The development of critical thinking is presently one of the current trends in education. Programs that attempt to develop "generic" critical thinking skills are problematic since "one cannot apply the abstract rules if one does not understand the
form that they take in particular kinds of discourse; and ...one cannot reason logically about subject matter concerning which one is ignorant" (Barrows, 1990, p. 84). It is therefore important to ask the question, "what do we want students to think critically about?" In technology, what sorts of things are worth thinking about? Clearly, the social questions about technology, questions of ethics, morality, justice, and assessment, are important questions. Programs in technology education cannot expect students to think critically in these areas if they don't provide opportunities to do so. The argument that students need to be technically informed in order to think critically about social implications of technology is valid only inasmuch as such understanding provides a certain basis for understanding technical arguments that involve social issues. It can also be argued, however, that the really important questions regarding technology revolve around issues such as what sort of community we desire, human values, and employment: questions that are largely philosophical, moral, sociological, and political. Thinking critically in such domains, is thinking critically in particular social and cultural contexts, not technical ones. We must remember that thinking critically is context bound (Barrow, 1990). Technical knowledge is of only limited help in critiquing important issues in technology. The technocrat would have us think otherwise. Recognizing that critical thinking is context specific, it is also important to say that, taken together, the development of critical thinking abilities in the technical and social aspects of technology are complementary and possibly synergistic goals for technology education.

The power of citizens to critically distance themselves from the rhetoric of dominant depictions of technology, reinforced by the media, government and business, may be severely handicapped if a critical social education in technology is omitted from their schooling. Schooling becomes mere indoctrination in the contemporary orthodoxies and mythology of technology. It is a traditional idea that the role of schools is to make young people compliant: "to condition young people to believe what they are told" (Postman, 1988, p. 22). A traditional focus for education does not consider
education "as a defense against culture" (Postman, 1988, p. 23). Accepting the exaggerated claims of the "pro-technology paradigm" (Mander, 1991) is to ignore the very real social, human and environmental costs of technology. "In the context of the machines of power which technology has created, the human community must, as it were, educate itself against itself" (Hopper, 1991, p. 24). To attempt to question dominant beliefs that hold together common sense accounts of technology, a diversity of views must be valued. "It is important to remember that issues of complexity, absence, difference ...constitute a threat to monumentalism, cultural homogeneity, and master narratives" (Giroux, 1992, p. 23). Unthinking the dominant views regarding technology reveals a multiplicity of perspectives. Iannone (1987) suggests that participation in critical discussions about technology helps in "developing habits of mind that will enable them to deal better, not only with these moral controversies in technology, but with other such controversies they might face in the future" (p. xi).

Gardner (1991) stresses that the particular view(s) of technology assumed, determine the particular vision used in constructing technology education curricula: "these differing views about the meaning of the term may lead to differing views about the nature of technology education" (p. 14). In light of this chapter’s discussion, it is apparent a critical and social education in technology cannot be achieved solely through approaches emphasizing the technical, design and developmental context of technology. Such approaches hold students so tightly to the technical aspects of technology that they do not provide opportunities for students to establish a critical distance. It is important to emphasize, technology education that perpetuates conventional ideas of technology, involves conveying things that society "knows". A critical and social education in technology involves understanding many things that society generally "does not know". Gouldner (cited in Bowers, 1977) describes the public "unconsciousness" as consisting of "those shared concerns of persons from which ideology systematically diverts attention, systematically rejects and will not express, and hence represses,
suppresses, and distorts" (p. 49). Robins and Webster (1989) in discussing Spender's examination of knowledge and control point out that:

A formidable obstacle in the way of the reconstruction of human society is that schools can teach only what society knows. What is now of paramount importance, however, is what society has forgotten or denied. Spender's fundamental point is that schools cannot teach what society does not know. But that is precisely what will be needed. (p. 276) [emphasis added]

3. A Cultural Literacy

Can "the classroom be used to foster a more explicit understanding of the values and assumptions underlying our technocracy culture"? (Bowers, 1976, p. 59)

It is clear from my research and teaching experience that students in industrial/technology education are being socialized in the script of technocratic culture. Because our society can be regarded as a technocracy, many would say that a technocratic culture for schooling is appropriate. However, our society also struggles to be a democracy. "Educators have a public responsibility that by its very nature involves them in the struggle for democracy" (Giroux, 1992, p. 15). At issue here is the concern that teachers and students may be unaware of the degree to which they are involved in technocratic socialization. Students are particularly vulnerable to being socialized to unquestioning acceptance of technocratic values. Teachers and students are conscious that they are teaching and learning technology. However, they may not be aware that whole areas of study are omitted. Early educators, who envisioned industrial arts as including a social study of industry, were responding to the need to offset a purely technical approach. However, many of those who advocated this position also saw a social reconstructionist mission for the field. I agree with Bower's (1976) position on social reconstructionism:

The public schools cannot take on the mission of reforming society as some of Dewey's followers proposed, but they can equip students with the necessary skills for decoding their own cultural experience. To escape
from being unconsciously swayed by the technocracy culture is the first step that must be taken if there is any hope of reforming it. (p. 64)

Cultural literacy in technology is not to be confused with a reconstructionist vision for education. Helping students understand the culture of technology is helping students understand much of their own cultural experience. How can students decode their experiences in a culture that is increasingly technocratic? Bowers (1976) explains that cultural literacy must involve

...making explicit what gets communicated about the culture. It is simply a matter of altering the way in which socialization has traditionally been carried on in the classroom. This involves shifting the emphasis from transmitting to students a consensus view of reality shared by adults to focusing directly on the assumptions which underlie and hold that world view together. It would also involve greater emphasis on openness and questioning, as opposed to reinforcing students for accepting the explanations to which adults were socialized a generation earlier. (p. 64)

Teaching for cultural literacy in technology education is a form of transformative teaching (Miller and Seller, 1990). Such teaching involves the infringement or transgression of orthodox beliefs about technology. Teaching for cultural literacy also opens spaces where students can become familiar with "repressed, suppressed and subjugated knowledges" (Spender, 1982). Teaching for cultural literacy requires that the teacher become a critical helper (Brookfield, 1994):

Central to developing critical thinkers must be some minimal level of consent on the part of those involved. Trying to force people to analyze critically the assumptions under which they have been thinking and living is likely to serve no function other than intimidating them to the point where resistance builds up against this process. We can however, try to awaken, prompt, nurture, and encourage this process without making people feel threatened or patronized. These are the skills of critical helpers. (p. 11)

The teacher, as a critical helper in cultural literacy, must be very caring and sensitive to students. Teachers who help students question their own cultural assumptions of technology must let students come to their own conclusions. "This is how critical helpers function; they are mirrors who help us interpret and question our ideas and actions from a new viewpoint" (ibid, p. 29).
A Few Concerns

Although I may persist in teaching in ways of male specialist man and industrial/technology education man, I can never again do so without the realization of the deeper issues discussed in this thesis. As Bloom (1972) points out, schools look very different to us when we begin to develop more skill in examining the latent or hidden curriculum and its relationship to the manifest or overt curriculum. After examination of technology education from the perspectives of my own interpretative frames, broader conceptions of technology, and classroom experiences; industrial/technology education looks very different to me. Over a period of two years and a process of constant reading, writing, and reflection, my conception of my work as a teacher has changed radically. The following accurately describes my experience as a:

...traumatic awakening into a scream of consciousness where suddenly familiar daily routines of professional practice become discordant symbols of the conflicts that exist between articulated (surface) and unarticulated (deep) levels of knowing. For many in teaching this can be an unresolved conflict that creates stress in professional life. (Sanger, 1990, p. 175)

I enter my classes with a different consciousness. I am no longer the same. Through the process of researching and writing I have changed. Although throughout the disruption of comfortable frames of reference I have had the support of close friends and colleagues, the process has been rather a lonely one. There is a definite stress for a teacher who undergoes such disruption. For me, a technical, analysis of technology education would have been incredibly less stressful, but of course, less significant. I recommend that teachers who wish to begin an examination of this sort, have a research support group to help them deal with the change constructively. This view is supported by Sanger (1990).

I do not suggest that other teachers attempt precisely what I have. It is important for each teacher to do what makes sense within the context of their their life and their classroom. Technology education teachers have a track record of creating some very
clever technical activities for students. It is important not to forget to address the social and cultural responsibilities of their work.
This thesis investigated four cultural dimensions of technology education: teacher, understandings of technology, curricula, and teaching. Through a social and cultural examination of each of these dimensions I have provided a sense of the entrenchment and problems of the technocratic culture of technology education. I have addressed several areas that are lacking in technology education curriculum research: the experiences and beliefs of a teacher, the examination of technology education curriculum from sociological and cultural perspectives, and ingrained technocratic ideology.

Conclusions

The questions addressed by this thesis are:

1. How is entrenched technocratic ideology manifested?
2. What is problematic with entrenched technocratic ideology?
3. What possibilities exist for transgressing technocratic ideology?

I will summarize my findings and conclusions to these questions in reference to each of the four cultural dimensions of technology education examined in this thesis: teacher, technology, curricula, and teaching.

1. Socialization of Industrial/Technology Education Teachers.

This thesis does not suggest that all industrial/technology education teachers are rigidly technocratic. Rather, I have described my own process of socialization and
explained how a strong technical orientation was formed. Due to a process of common socialization (Trumbull, 1990), my socialization experience as an industrial/technology education teacher is not entirely idiosyncratic. My experience shows, from life-history reflection, that industrial/technology education teachers bring with them into teacher education a technical predisposition. Such a predisposition is typically a requirement for entry to pre-service education. In addition, the majority of industrial/technology education teachers in North America are males who have been socialized in male technical cultures. Teacher education programs emphasize technical understanding and capability and largely ignore the growth of understanding in social and cultural contexts of technology. Teachers are socialized to conform to technical/industrial ways of thinking, knowing, feeling, doing, and being. Such emphases further reinforce a predominately technocratic, or technically focused, orientation in teachers.

Technocratic orientations of industrial/technology education teachers form a part of an invisible curriculum. A technocratic orientation leads to particular ways of conceiving and teaching technology. My experience within the culture of industrial educators indicates that the locus of energy deals with trying to reproduce in students the modes of reason, beliefs, and values of the male technician experience: experiences infused with industrial technique, technical knowledge, systems, and products. Such understanding of technology is technical and partial and provides little opportunity to develop a heightened social consciousness concerning technology. The growth of a critical intelligence in technology is overshadowed by the dominance of a technical intelligence. Since a technology education that reinforces technical accounts of technology is very different from one that teaches students to formulate critical questions, a purely technical approach to studying the practice of technology is detrimental to the growth of a democratic citizenry.

It is difficult for technology educators to help students develop a critical consciousness of technology if they themselves are immersed in a technocratic one. Since a technocratic orientation is largely unreflective of its own interpretive frame,
technology education teachers may be unaware of the extent to which they are involved in a reproduction of technocratic subjectivity in students. Teachers' lives and consciousness are intertwined with their work. A technical consciousness of teaching does not problematize the cultural scripts of the hidden curriculum and the re/production of social practices. Teachers need to take responsibility for both the technical and social effects of their work. Without a heightened social and cultural consciousness, they will be unable to critically interrogate the social/cultural aspects of both technology and teaching. If they are willing to learn other ways of knowing, seeing, and being it is possible for technology education teachers to dislodge from dominant technocratic orientations. For example, when teachers begin to explore new meanings of something they assume they know, like technology, opportunities emerge for gaining a heightened consciousness of their own subjectivity. Teachers are capable of becoming transformative intellectuals and informed cultural workers.

2. Narratives of technology.

In the sense that they are informed by the particular interpretative frames of the observer, all understandings of technology are socially constructed "stories". Common sense understanding of technology typically focuses very tightly on the term "technology". Consequently, a technical meaning for technology is predominant. The underlying values of technology are not made explicit in a technical view. When technology is viewed from a technical perspective it appears that technologies are value-neutral tools and that the outcomes of technology are not a product of social forces. On the other hand, conceiving the practice of technology (Pacey, 1983), situates technical processes, products, and knowledge as only one component within a wider frame of social and cultural interpretation. Understanding what technology means can never be gained through narrow definitions and technical understanding. Common sense views of technology make it difficult to engage in a contextual understanding.
Common sense accounts of technology do not reflect critically on technocratic metanarratives. Since the dominant interpretive frame in Western society is technocratic, the dominant stories of technology that are constructed and socially accepted, fit within a larger technocratic story. One such dominant story is the tale of technological determinism. Technological determinism suggests that people have little influence over technological development and are destined to receive inevitable positive and negative impacts of technology. Technological determinism perpetuates the dichotomy of technology as liberator and technology as threat. Such dichotomization traps people into postures of optimism and faith on one hand, and pessimism and fatalism on the other. Technological determinism does not foster a critical questioning attitude toward technology.

Different stories of technology, not consistent with a technocratic view, are obscured by dominant stories of technology. Dominant portrayals treat technology as value-free and people as problematic and lead to a compliant uncritical citizenry who willingly adapt to technological change. Such understanding is in the interests of business and industry. It obscures the underlying social processes of technology from public attention and helps continue the dominant social control corporate institutions have over the consumer culture and the creation of technologies. Ignorance of the value-laden nature of technology must be overcome if a critical intelligence is to be fostered. Such intelligence must be able to address all contexts of technology and not just the design and developmental context (Bush, 1983). A critical question arises from this aspect of the study: "Is there sufficient desire on the part of the public to be awakened from a technocratic consciousness?"

3. Technology education curricula.

Technology education curricula, as all curricula, are socially shaped and are engaged in the re/production of particular ideologies. Investigation of underlying
curricular values, assumptions, and world views is an exploration of the hidden curriculum. Underlying all curricula are particular ideologies or beliefs. Underlying technology education curricula is a firmly entrenched technocratic ideology. A milieu of technocratic influence is, in part, responsible for such embeddedness. This milieu includes the general culture of schools, the direction of school reforms, and the interests of business and industry. This environment helps perpetuate a technocratic orientation for technology education curricula. In turn, such curricula helps perpetuate the myth of technological determinism, common sense understanding of technology, a technical as opposed to critical intelligence in technology, and an instrumentalist conception of pedagogical practice.

Technocratic ideology is also inherited from the practices of industrial arts and manual training and maintained through the current research practices of technology educators (Zuga, 1995). In the transition from manual training historical research reveals political reasons why social ideals for industrial arts were not realized. A pattern of technocratic transference and the subordination of social ideals are repeated in the transition from industrial arts to technology education. In technology education curricula, there is common reference to the social and cultural significance of technology. In practice, however, critical examination of technology from social and cultural standpoints is largely omitted from student activities. Even though it claims the social, contemporary technology education privileges the technical. Currently in technology education, emphasis is placed on integration of the study of technology with mathematics and science, "tech prep", "high tech" skills, human inventiveness, technical competition such as "Odyssey of the Mind", modular approaches to technology education (MATE), and "Principles of Technology". Such programs do little, if anything, to address the growth of a social and cultural understanding of technology and are very much implicated in the intensification of technocratic consciousness.

4. *Industrial/technology education teaching.*

162
My experience indicates that industrial/technology education teaching emphasizes a technical understanding of technology. Common sense understandings of technology are reinforced in students through the repetition of technical activity. Such activity can lead to technical fixation and "maker's syndrome". For men in particular, fixation with technical doing may become a place of emotional attachment and a means of learning to control. The compulsion to express oneself technically may draw attention from important growth in other ways of knowing, seeing, and being.

Research into softening the technocratic classroom indicates that while students primarily take technology courses for practical experience and making, they will tolerate, and even enjoy the inclusion of activities that encourage them to think socially and critically about technology. A social and cultural education in technology is something that must be viewed as taking place over the course of a student's education. Teachers need to learn the role as a critical helper in assisting students with the formulation of their own critical questions regarding technological culture. Since the growth of a critical intelligence will increasingly disrupt common sense pictures students have of technology, themselves, and the world, teachers must exercise great sensitivity and care in this area. A place to begin is the examination of the consequences of technology and socially conscious design. Slowly, students may come to understand technology as a value-laden activity. However, the research also indicates that the technical aspects of design and making can overwhelm social consideration of technology. In order to establish a critical distance, a social and cultural examination of technology may have to take place outside the activity of design and making.

A socially critical education in technology will aim to provide much more than technical understanding. Education has a democratic responsibility to foster a critical social and cultural intelligence in technology. A critical education in technology may provide opportunities for male students to see technical activity in a contextualized manner and invest emotional and intellectual energy into sociotechnical issues. For
females, a social examination of technology may be a more meaningful activity than adapting to male technical ways of knowing.

Implications of This Study

For Technology Education Teacher Education

Unless technology education teacher education programs address the dominance of technocratic consciousness, there is little hope for the profession to do anything but compulsively repeat technical portrayals of technology. The issue here is not one of changing content but of addressing ingrained technical fixation and technocratic ideology. Teacher education programs need to educate teachers in a broad understanding of technology in order to enable them to educate students similarly. Teacher candidates need to be sensitized to broader meaning of technology both in theory and teaching methodology. The inclusion of social and cultural education for technology education teachers may be helpful. However, it is also possible that such a change in teacher education will only be at the level of overt curricula. The hidden technocratic ideology of technical training may be left intact.

The assumption that a technical predisposition is a highly desireable quality for technology education teacher candidates is offset by the notion that dominance of such a predisposition may be problematic in acquiring a social/cultural understanding of technology. Technical specialists from male technical cultures may be likely to have only common sense understandings of technology. Such candidates may already be deeply committed to a technician's perspective of technology and education. The culture of technology educators needs to be diversified, especially by others than male technical specialists. Accelerated programs that fast-track tradespeople and technicians
into the ranks of teaching may need to be replaced with full term teacher education programs.

**For Future Research**

This thesis has only begun to examine particular dimensions of technocratic culture in technology education. The problems of technocratic dominance in industrial/technology education teachers, common sense accounts of technology, cultural scripts of technology education curricula, and technology education teaching practice are enormous, long-standing, and deeply ingrained. Many problems are a result of technocratic entrenchment in society and the school system. Although the technocratic condition of these larger social structures may remain or even intensify, this thesis has argued that technology educators have a responsibility to engage the study of technology in socially transformative ways. Technocratic hegemony within technology education will be intractible to reform unless a critical consciousness and culture is formed within technology educators. Through understanding and transgressing technocratic ideology, a new consciousness can emerge within the culture of technology education.
REFERENCES


168


Appendix I: Sample Contextual Equity Analysis

An equity analysis of a technology would examine the following:

The Developmental Context
- the principles of science and mechanics applied by the tool or technique
- the resources, tools, processes, and systems employed to develop it
- the tasks to be performed and the specific problems to be solved

The User Context
- the current tool, technique, or system that will be displaced by its use
- the interplay of this innovation with others that are currently in use
- the immediate personal competitive advantage created by the use of technology
- the second and third level consequences for individuals

The Environmental Context
- the ecological impact of accepting the technology versus the impact of continuing current techniques

The Cultural Context
- the impact of sex roles
- the social system affected
- the organization of communities
- the economic system involved and the distribution of goods within this system

(Bush, 1983, p. 164,165)
Appendix II: Ten Recommended Attitudes About Technology

1. Since most of what we are told about new technology comes from its proponents, be deeply skeptical of all claims.

2. Assume all technology "guilty until proven innocent".

3. Eschew the idea that technology is neutral or "value free". Every technology has inherent and identifiable social, political, and environmental consequences.

4. The fact that technology has a natural flash and appeal is meaningless. Negative attributes are slow to emerge.

5. Never judge a technology by the way it benefits you personally. Seek a holistic view of its impacts. The operative question is not whether it benefits you, but who benefits most? And to what end?

6. Keep in mind that an individual technology is only one piece of a larger web of technologies, "megatechnology". The operative question here is how the individual technology fits the larger one.

7. Make distinctions between technologies that primarily serve the individual or the small community (e.g. solar energy) and those that operate on a scale outside of community control (e.g. nuclear energy). The latter kind is the major problem of the day.

8. When it is argued that the benefits of the technological lifeway are worthwhile despite harmful outcomes, recall that Lewis Mumford referred to these alleged benefits as "bribery". Cite the figures about crime, suicide, alienation, drug abuse, as well as environmental and cultural degradation.

9. Do not accept the homily that "once the genie is out of the bottle you cannot put it back", or that rejecting a technology is impossible. Such attitudes induce passivity and confirm victimization.

10. In thinking about technology within the present climate of technological worship, emphasize the negative. This brings balance. Negativity is positive.

(Mander, 1991, p. 49,50)
Appendix III: Technology Education Advisory Council (TEAC) Members

of the International Technology Education Association (ITEA), 1990.

Dr. Walter Waetjen
TEAC Chairman
President Emeritus Cleveland State University

Dr. Kendall Starkweather
Executive Director
International Technology Education Association

Dr. James Bensen
Dunwoody Institute
Minneapolis, Minnesota

President Gary Taylor
Board Chairman, Essential Technologies, Inc.
Long Beach, California

Dr. Joyce Winteron
National Council on Vocational Education
Washington, D.C.

Dr. Daniel Malenka
Manager, Learning Center, MEAD Coated Board
Atlanta, Georgia

Mr. Joseph Oakey
Manager, Education Dept., Autodesk, Inc.
Sausalito, California

Mr. Russ Hamm, Dean
College of the Lake County
Grayslake, Illinois

Mr. Chris Bastone
Technology Teacher
N. Vancouver, British Columbia

Mr. Robert Brown
Director, Educational Affairs, NASA-LBR4
Washington, D.C.

Mr. Brad Thode
Technology Teacher
Hailey, Idaho

Dr. F. James Rutherford
Chief Education Officer
American Assoc. Advancement of Science
Washington, D.C.

Dr. Darrell Piersol
Director, Governor’s Development Program
Lyndon B. Johnson School of Public Affairs
University of Texas, Austin

Mr. Foster A. Boyle
Vice President, Human Resources
Honeywell, Inc.
Minneapolis, Minnesota

Steve Witzel
ACCESS Software, Inc.
Bountiful, Utah

Dr. Franzie Loepp, DTE
Distinguished Professor
Illinois State University

Mr. Larry Manly
Vice President, Operations
Rockwell International Corp.

Mr. Y. B. Williams
Community Affairs
Newport News Shipbuilding

Mr. Ivan Charner, Director
Int'l Institute for Work & Learning
Washington, D.C.
Appendix IV: Conference Session: 1994 B. C. Technology Education Association


(By title analysis, 47/60 workshop session focus specifically on technical knowledge and skill)

Facility and Success in Woodwork
Elementary Tech Ed - Science & Tech Wheel
(demo of power mac)

Managing a Macintosh Local Area Network
Alldata Automotive Information System

Native Indian Carving
On-Board Vehicle Diagnostics

BC High School Drag Racing
Apprenticeship Training

Screen Printing in the Classroom
Furniture Finishing

Super Mileage Challenge ‘95
Electrathon ‘95 (electric powered racer)
(fuel efficient vehicles)

Applied Technology and Science 9
Emerging Technologies (CD ROM, LCD panels)
(forensics, power, aerospace, manufacturing)

From Electronics to Systems Integration
Mega Enrollment (Wood 9-12)

CAD/CAM In Your School
Ignition Systems

Skills Canada
AutoCAD Release 12-1

AutoCAD Release 12-2
3D Studio 1

3D Studio 2
CAD/CAM/CNC -1
<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD/CAM/CNC -2</td>
<td>CNC Mill and Lathe</td>
</tr>
<tr>
<td>CAD/CAM For The Next Millennium</td>
<td>Introduction to Plastic Technology</td>
</tr>
<tr>
<td>Plastics - Science and Technology</td>
<td>Plastics - Materials and Moulds</td>
</tr>
<tr>
<td>A Grade 8 Electronics Project</td>
<td>Building Big Amplifiers in Electronics</td>
</tr>
<tr>
<td>Electronics (Curriculum) Content</td>
<td>Electronics Technology and Computer Aided</td>
</tr>
<tr>
<td>Electronics Technology in the Classroom</td>
<td>Robotics in Technology Education</td>
</tr>
<tr>
<td>Introduction to Video Communications</td>
<td>Lights, Camera, Sound</td>
</tr>
<tr>
<td>Grab That Frammel (computer/video)</td>
<td>Tech Ed and the Single Computer</td>
</tr>
<tr>
<td>Multi Media for Macintosh</td>
<td>Control Lab Using Lego Dacta</td>
</tr>
<tr>
<td>Control System Using Lego Dacta</td>
<td>Lego Dacta Manufacturing System</td>
</tr>
<tr>
<td>Managing the Technology Lab</td>
<td>Building Your Own Technology Manager</td>
</tr>
<tr>
<td>Basic Fire Fighting</td>
<td></td>
</tr>
</tbody>
</table>
Appendix V: Conference Tours: 1994 B. C. Technology Education Association


(9/10 tours specifically on industrial technology and skill; the 10th tour focuses on consuming the results of technique)

Queenship Yacht Work Inc.  design and manufacture
Hart & Sons  prefab log homes
Pelton Re-Forestation  seedling nursery
International Submarine Manufacturers  high tech submersibles
Esco Ltd.  metal manufacturing, machining, foundry
CP Rail Engine and Car Shops  locomotive repair/maintenance
Webb Printed Graphics  computer plate making, colour presses
BC Hydo Power House  “technical” tour of plant operation
Rogers Cablevision Production Center  video production
Spousal Tour  shopping (consuming)
Appendix VI: Socially Conscious Robots

My research indicates that a design and making approach to understanding social and cultural aspects of technology is limited. So much energy goes into designing and making that it is difficult to establish a critical distance from the "design and developmental context" (Bush, 1983). Nevertheless, such activity is a place to begin in technology education courses that have a traditional making component.

Fan-Me-Bot (personal fan)

Traybot
Bombadu (Bomb Diffusing Unit)
Porta-Garbage

Fred the Plow (used to explore and retrieve things from small spaces)
Wire Walker (to entertain and encourage muscular activity hospitalized children)

The Ladybug (an entertainment toy for girls aged 6-10, "it is designed for a girl because most remote control devices are cars!")
Robo-Brush (rotary dog brush - it really works! (on students and teachers too!)}