CONTEXTUALIZING THE GENDERED AND INDUSTRIAL BIAS OF TECHNOLOGY EDUCATION

by

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Technology education in North America has been almost exclusively a male phenomenon. Technology education continues to be taught by males to predominantly males. In addition to excluding females, technology education excludes students from various ethnic, cultural, social and academic groups. Recent revisions of technology education curricula have attempted to address these inequities. The resulting curricula are purported to be relevant to all students and appropriate to the needs of society. This thesis analyzes the extent to which curricular revisions address the inequities and appropriateness of technology education curricula. My analysis shows that the revised curricula are neither suitable for nor relevant to the needs of most students. Revised curricula support a hegemonic devotion to the 'device paradigm' which permeates much of North American culture, and such hegemony is a barrier to the development of a form of technological literacy which may empower students to influence rather than simply participate in technological developments. The curricula examined do not explicate the paradigms in which they are situated, nor do they address fundamental questions such as: What purpose should education serve in society? and, What role should technology education play in education generally?

Paradigms of traditional and current technology education curricula are identified and elements of critical, Freirian and feminist pedagogy are proposed as promising ways of countering hegemony in education. Since other academic areas may well suffer from similar inequities, and may share the hegemony of technology education, the issues raised in this thesis may be generalizable to other subject areas in education.
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Chapter I: Introduction

A. Purpose and Problems

This thesis is an exploratory study of ‘technology’ education\textsuperscript{1} curricula, with particular reference to the conceptual frameworks of the British Columbia Ministry of Education, and the International Technology Education Association. The purpose of the study is to identify and analyze fundamental problems relating to technology education curricula and technology education, to determine the basis of those problems and to consider alternative pedagogies which might more effectively address the problems. The problems which are identified are as follows:

1. Technology education has traditionally been a course of study offered at the secondary level, appealing mainly to under-achieving boys, and with notable absences of females and a variety of other students.

2. Technology education has focused on certain industrial technologies of the public sphere (employment related technologies) to the exclusion of technologies of the private sphere, and of technologies of immediate relevance and importance to many students.

3. Technology education has been devoted to teaching

\textsuperscript{1} Technology education is now widely used to refer to the courses and programs which have been previously known as industrial education. In the public schools, industrial education has primarily included studies in shops in which students use tools and acquire skills relating to automotive, drafting, woodwork, metalwork and electronics. Common views of technology education are consistent with common views of technology as knowledge, skills, processes and artefacts associated with the commercial production of goods and services.
technical skills and knowledge related to the production of artefacts and has contributed little to the achievement of forms of critical technological literacy which would empower students to significantly influence technological developments.

Recent curricular revisions in British Columbia and elsewhere have attempted to address some of these problems. In this study, I explore several major questions with particular reference to revised curricula. The questions relating to the curricula are:

1. Do the curricula provide a basis for technology education which is appropriate for all students at all grade levels?

2. Do the curricula provide a basis for technology education which addresses the everyday private and public needs of students?

3. Are the curricula likely to help create forms of socially constructive technological literacy?

My analysis reveals several shortcomings of the revised curricula and in so doing, raises fundamental questions relating to the assumptions and values which form the context for the design and implementation of technology education curricula. The curricula are examined to determine the extent to which the underlying assumptions and values are stated or implied, and the implications of those assumptions and values are considered.
B. Background

For several reasons, industrial education curricula in many countries world-wide have recently been undergoing extensive revision. There is considerable pressure on educators to respond to corporate and economic agendas which claim to require an increasingly competent and competitive workforce. Simultaneously, there is also growing public appeal for a 'technologically literate' citizenry capable of understanding, controlling, redirecting and limiting the complex technological developments which simultaneously enhance and threaten human existence. In addition, dropping enrolments in industrial education programs, the lack of participation by a wide range of students, and a desire by industrial educators to improve their program status within education, have also contributed to a recognition that industrial education programs need to be updated.

There have been a variety of responses to these pressures for change. Recent modifications of industrial education curricula include a name change to technology education, broadening the scope of industrial education to include newer, 'high' technologies of the industrial domain, and a shift in teaching methodology from a transmission orientation to a more student-centered, problem-solving orientation.

Because the curricular changes have been made without challenging the fundamental assumptions on which the previous curricula were based, the revisions primarily address symptoms of problems rather than identifying and addressing more deeply rooted structural and philosophical problems. The curricula remain devoted to assisting in the creation of a competent and flexible
'workforce' in support of competitive production of consumer goods and services and do not address questions about the appropriate role of technology education in the establishment or maintenance of political and economic systems. Asking such questions might provide a basis for resolving some of the deeper rooted problems such as the apparent conflict between technological development and the maintenance of stable ecosystems. Similarly, a consideration of the appropriate role of technology education in addressing sexism, classism, and racism in society generally might lead to curricula which is effective in dealing with such discrimination, rather than focusing on symptoms of the problems such as the lack of participation by various groups in technology education programs. Without evaluating the underlying values and assumptions of the former or the revised curricula, there is little reason to be confident that revised curricula will address fundamental problems associated with the former industrial education curricula. Although many of the curricular changes may be legitimately viewed as improvements, the changes are primarily cosmetic and changing the name from industrial education to technology education may in itself be problematic if the tenets of the previous industrial education are obscured by the rhetoric of technology education.

Notwithstanding the attempted philosophical change from industrial education to technology education, the revised curricula fail to substantially broaden the scope of technology beyond the industrial
technologies of the

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2 Industrial technologies include primarily those technologies relating to the production of commodities.
public sphere. Many of the technologies of both the 'private' sphere and 'non-industrial' technologies of the 'public' sphere are ignored. Major emphasis of both the previous and the revised curricula is on making artefacts and systems, and the acquisition of skills and knowledge related to industrial tools, machinery, and processes of production.

Problem-solving is emerging as a recommended pedagogy, replacing the previous focus on transmission oriented learning and teaching. The problem-solving prescribed in the curriculum relates principally to solving technical problems relating to the production of goods and services. There is little in the curricula that would encourage problematizing the need for the artefacts or systems in the first place, considering alternative ways of doing things, or changing behaviour and values that could result in a decreased production of unnecessary commodities.

C. Writer’s Perspectives

(1) As a Female

As one of only three women in technology education in British Columbia,

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3 'Public' sphere technologies are those technologies which are normally associated with earning a living. They include the commonly recognized technologies of engineering, welding, robotics, etc. as well as less obvious technologies such as those associated with food production, public health, or service/repair technologies. The 'private' sphere technologies refers to those technologies which are utilized in the everyday private/family lives of individuals. Examples of private sphere technologies are the technologies of personal transportation, cooking, cleaning, sanitation, and technologies of caring.

4 Freire (1989a) uses the term *problematize* to describe a form of dialogue in which the students and the teacher/student work to identify substantial political, social, or personal problems which, if resolved will create a more equitable, humane and livable society. Such problematizing involves making decisions on actions designed to resolve the issues, and *includes* taking action to resolve the issues.
my perspectives are that of a white, heterosexual, North American, lower-class, female educator in an area of education where white, heterosexual, North American, middle-class, male experiences are taken as the norm. My perspectives vary from the norm as they are shaped by my gender experiences, as well as my lower socioeconomic experiences, particularly as a child and as a young adult. Hence, I see technology education from the perspective of one who has wrestled with the oppression associated with both gender and class. I became sensitive to the ways in which gender and class have limited my access to education and to employment opportunities. Although I have often felt disadvantaged by both my gender and my class, I feel particularly advantaged with respect to the value of those experiences in providing an important perspective from which to view technology education curricula.

(ii) As an Industrial Worker

My perspectives of technology education are also informed by over twenty years of experience working in industry. My employment history includes work as a telephone operator, draftsperson, residential designer, building inspector, provincial factory inspector, labour relations officer, human rights officer and Canada safety officer. In the last eight years of my work, I inspected a wide range of industries in a variety of workplaces, including homes.

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5 According to the British Columbia Technology Teacher Education Association, as of April 1992 there were 1100 industrial/technology educators in British Columbia. Although about two dozen women have entered the program in the past two decades, currently there are only three women in the field of technology education - two female industrial/technology education teachers and one full-time female graduate student (myself).
of women knitting Cowichan sweaters, fields tended by immigrant farmworkers, offices, retail stores, construction sites, manufacturing assembly plants, garment factories, autobody shops, foundries, pulp mills, saw mills, mines, railyards, shipyards, airplane hangars, and grain elevators.

My experience in industry has made me aware of the vast array of workplace technologies, in contrast to the relatively narrow range of technologies addressed in both the traditional industrial education curricula and the revised technology education curricula. I am particularly sensitive to the existence of important private sphere technologies such as those associated with maintaining a home and caring for children, and non-traditional industrial 'workplaces' such as those involving home-based industries and agricultural workplaces.

During my training at the British Columbia Institute of Technology (BCIT), the Industrial Education program was unofficially renamed Technology Education. The change was described by the instructors as an attempt to make the subject matter suitable for all students. The primary changes from the previous program involved the introduction of robotics and computer assisted drafting. Based on my experience, these were relatively specialized areas of 'industry' and it was difficult for me to appreciate how these changes would make the curriculum relevant to the needs of all students. Whenever I attempted to resolve my views with those of the instructors, my questions were either ignored or dismissed as 'naive' or 'unnecessarily troublesome'. I presume that my differing views of the world stem from factors which go beyond my experience in industry since many of my male instructors and classmates also
had worked in industry.

(iii) **As a Technology Educator**

> It must be odd 
> to be a minority 
> he was saying. 
> I looked around 
> and didn't see any. 
> So I said. 
> Yeah. 
> it must be.

(Yamada, 1976, as quoted in Trinh, 1989, p.79)

When I arrived at BCIT, in September of 1988, I was looking forward to a new chapter of my life. I was among forty-five classmates -- all male except for myself and one other female. Students were asked why they chose the program, and many of them stated that they were in the program because they had been injured on the job, or could no longer take the physical demands of their trades. Others stated that they were in the program because "it was good pay with lots of vacation". Because of my experience and interest in house design and building inspection, I enroled as a student teacher in the 'accelerated' program of Industrial Education Teacher Education (IETE) at the British Columbia Institute of Technology (BCIT), with the expectation of teaching architectural drafting at the high school level. My plan was to get a teaching certificate as soon as possible.

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6 In British Columbia, students with 'trades' experience are permitted to teach after two years of the IETE training in the 'accelerated program'. The first part of the program is a 'hands-on' technical component which is taught at the British Columbia Institute of Technology. This is an intensive program which can be completed in twelve months, however, most students finish the technical component after they have found teaching positions. The next phase of the program is a pedagogical component, again a twelve-month program, which is completed at the University of British Columbia. Students are then eligible to teach technology education with a Standard Teaching Certificate. My work experience was considered equivalent to a 'trades' background and I was admitted to the accelerated program.
On the first day of classes, two male colleagues took me aside and explained to me that ladies had no business being in the industrial education program and that I should not come back the next day. I was told politely, but bluntly that industrial education was a 'man's world'. I thought that this would be an isolated incident and that these reasonable men would quickly appreciate having a women in the program. However, this was just an introduction to the sexism, harassment and isolation that I faced in the program. Up to this point I was focused on becoming a teacher in my 'specialty' area and was not particularly concerned about the program's content, its relevance to the needs of students, or about its role in education generally. My experience as a lone female in a technology education teacher education program, taught exclusively by males, eventually forced me to consider such questions.

It became clear to me that women were not welcome in the program. Within two months, the other woman quit the program and she told me that she could not tolerate the sexism of her colleagues and said that her decision to quit was precipitated by an automotive teacher at a local high school telling her that a female would never be hired to teach automotive. Because much of my working experience was in non-traditional jobs where I was the only female, I had already endured similar sexism in those jobs. I had also worked as an investigator of human rights violations on others, including sexism. Although my experience helped me to endure the sexism of the teacher education program, the sexism was painful and extremely demoralizing.

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7 This other woman in the program at BCIT had considerable experience with work on automobiles. Her father and brother were also both automotive mechanics.
I had been looking forward to being in technology education, which I had presumed to be a field that would both welcome women and be sensitive to the problems of gender discrimination. However, there was so little in the program that related to my life as a woman, the only places where I felt comfortable were the drafting room and the women's washroom. Considering the attitudes of my instructors and classmates towards women, and the treatment that I experienced, I often wondered why there was a women's washroom.

The facilities included industrial drafting labs, wood, metal, automotive and electronics shops, and the equipment was primarily heavy industrial tools and machinery. The benches were high and whenever I struggled with a large piece of equipment I tried to rationalize how I could convince a little grade 8 girl or boy that using such machines and learning such skills were meaningful to their lives.

One of the projects that I worked on, taking apart and reassembling a lawnmower engine, accentuated my difficulty in seeing the relevance of the program to the needs of students. I asked myself why students should be concentrating on such types of skill development when I could see more urgent and significant technological issues which could be addressed: Could students not consider why some people live in big houses and have big lawns? Should people plant ferns, mosses or other plants that would make lawnmowers obsolete? Could some lawn space be better utilized to help provide food for the hungry? Could we be depleting the earth's natural resources and polluting the air and our lungs with toxic emissions from the fuel used to cut the grass? Other issues were going through my head as well. Would lawnmower engines
be more interesting to boys than girls, or more interesting to Caucasians than Orientals? Was this a middle-class activity? Could lawnmowers or lawnmower engines catch the attention of a student who lives in an apartment, who has been abused at home or on the street, and has come to school hungry?

I had similar feelings about my own specialty, drafting. We spent an inordinate amount of time learning to use AutoCAD, a sophisticated and expensive computer assisted drafting program. This was not what I had anticipated that teaching drafting in high school would be about. I had envisioned that at the high school level students would be learning about drafting and housing in a much broader sense than merely learning how to draw a prescribed cabin or a plan for an imaginary house. It seemed to me that students could be challenged to consider such issues as: urban planning; housing needs for singles, families, seniors, the poor; design of living spaces for children, adults, the physically challenged; design of housing as an artform; alternative methods of sewage and garbage handling; and alternative forms of housing. I envisioned that students would be encouraged to explore and critique the existing concepts of housing and use drafting as a subject area where they could create options that made sense to them and to those they may be designing for. I was learning to teach students technical hand and computer skills which I felt had only a remote connection to the real needs and aspirations of students.

Although we were constantly being reminded that technology education should be part of the general education for all students, my own experience in the IETE program led me to question whether technology education as it is
currently being taught was appropriate for any student. It seemed that I was being trained to teach male-oriented vocational skills and knowledge that might help a few boys decide on and pursue trades-related careers.

I observed a form of anti-intellectualism in many of my instructors and classmates. They demonstrated resistance and resentment to any form of philosophical issue or intellectual discourse. It became apparent to me why such a narrow range of students, primarily under-achieving boys, were taking technology education electives.

Although the technology instructors insisted that technology education was not intended to prepare students for the needs of 'industry', my experience in industry led me to believe that the skills and training that technology education offered were much too specific and narrow to achieve any other end. Routinely, we were reminded that industry needed 'critical thinkers' and 'problem-solvers'. We were introduced to a linear problem-solving process designed to solve technical problems and we were required to prepare design briefs to demonstrate our analytic and problem-solving skills. For example, a problem-solving project which took a great deal of our time and effort was to design and build a vehicle which was powered by a mousetrap. Discussion of the project focused on which vehicle looked better, moved faster, and went further. There was no consideration of how such problem-solving might lead to a process such as problematizing which might help resolve issues arising from consideration of social, political, or environmental effects of the technologies of travel. The instructors did not, however, discuss with us the type of thinking and problem-solving that might be useful for the everyday needs of students.
D. Theoretical Perspectives

My personal experiences as a female in industry, and in technology education, are neither dramatic nor isolated. Critiques of society, technology, and education, particularly by feminist writers, mirror my own experiences. As men have appropriated the positions of power in society, social consciousness is produced through men's "images, vocabularies, concepts, knowledge and methods of knowing the world" (Smith, 1991, p. 233). As a result, the concept of 'generic human' underlies much of contemporary dialogue. Speaking specifically about education, teachers and classrooms, Ellsworth (1989) argues that humans are not 'generic' at all:

The term defines a discursive category predicated on the mythical norm, namely: young, White, Christian, middle-class, heterosexual, able-bodies, thin, rational man. Gender, race, class, and other differences become only variations on or additions to the generic human--"underneath we are all the same"....There is no consideration of how voices of, for example, White women, students of colour, disabled students, White men against masculinist culture, and fat students will necessarily be constructed in opposition to the teacher/institution when they try to change the power imbalances they inhabit in their daily lives, including their schools. (p. 310)

Gaskell & McLaren (1991) suggest that "our very conception of education, of what counts as important knowledge and good pedagogy, has a male bias" (p. 222). They contend that the selection of knowledge and pedagogies have everything to do with gender power relations as "some people have more power than others to include 'their' knowledge in the curriculum" (p. 222). Since it is men who have the power in society and in curriculum development, curricula are designed by men, about men, and for men. Gaskell & McLaren (1991), in summarizing conclusions drawn by Jane Roland Martin regarding curriculum, state that:
The curriculum has been designed to prepare men for the public and "productive" spheres of work and citizenship....It has ignored the private and "reproductive" spheres of family, love, intimacy, for these [are] the domains of women. Women and women's concerns [do] not belong in the public world of the school, or if they [do], they [belong] only as long as women [are] willing to adopt a masculine stance, and give up the feminine, at least while they [are] there. (p. 225)

Smith (1991) maintains that to change the male-biased forms of thoughts and knowledge in education, requires an examination and critique of the social construction of male knowledge as valuable while female knowledge is relegated to the margins:

We are confronted virtually with the problem of reinventing the world of knowledge, of thought, of symbols and images, not of course by repudiating everything that has been done but by subjecting it to exacting scrutiny and criticism from the position of women as subject (or knower). This means, for example, claiming the right to examine literature from the perspective of women....We cannot just turn our backs...by opting for membership in an elite whose ideological forms claim spurious universality. (p. 253)

Some feminist critiques (eg. Franklin, 1990; Menzies, 1989, Rothschild, 1988; Wajcman, 1991) look at the social interests that structure the knowledge and practices of technology and technology education. Wajcman (1991) argues that:

...technologies reveal the societies that invent and use them, their notions of social status and distributive justice. In so far as technology currently reflects a man's world, the struggle to transform it demands a transformation of gender relations. (p. 166)

The selection and transmission of knowledge in educational institutions is shaped by "the social environment of individualistically oriented advanced industrial economies like our own" (Apple, 1990, p. 157). It follows that to understand the reciprocity between the 'social environment' and technology, necessitates some form of technological literacy. Technological literacy would involve examining social and political influences that determine what
technologies are developed, how they are developed, and who is advantaged and disadvantaged by technological developments. This form of technological literacy emphasizes citizenship rather than serving economic needs and underscores technological 'critique' as a significant aspect of technological literacy. Technological literacy as advocated in schools, may not have this emphasis. Rothschild (1988) states that technological literacy in general education courses is aimed at teaching non-scientific and non-technological students "requisite knowledge and skills of things mathematical, scientific, and technological to function in a technologically-oriented world" (p. 75). In current technology education curricula, notions of technological literacy include technological 'knowledge' and technological 'capability', while overlooking technological 'critique' (Down, 1986; Fensham, 1991). Adding a critical dimension to technological literacy ought to empower both female and male students to consider alternatives to existing male-biased technological structures and processes which influence almost every aspect of their private and public lives.

E. Curricula Examined

Two recently revised technology education curricula are specifically commented on: A Conceptual Framework for Technology Education of the International Technology Education Association, of the United States (ITEA, 1990); and, Technology Education, Primary - Graduation, Curriculum / Assessment Learning Guide of British Columbia (BC, 1991). These curricula are referred to as the ITEA and BC curricula, respectively. The ITEA
curriculum has particular relevance for two reasons. Firstly, the ITEA is one of the largest professional organizations for technology educators, and has an international membership. Secondly, the ITEA conceptual framework, which is an update of the *Jackson's Mill Industrial Arts Curriculum Theory* (Snyder and Hales, 1981) written a decade earlier, has been used as a model for most, if not all, North American technology education curricula. The British Columbia Technology Education Association is an affiliate member of this larger umbrella organization. The revised BC technology education curriculum, which has recently been adopted by the British Columbia Ministry of Education, is the local curriculum. The BC curriculum is to be mandated for all students, from kindergarten to grade 12 in 1995.

F. Assumptions

Several premises underlie this thesis. One is that there are no inherent qualities of technology which make it gendered. Another is that there is no significant biological basis to the notion that females are 'not technological', or that any particular technology is unsuitable for females. This thesis adds support to the view that, although technology itself is not inherently gendered, the tools and processes of technology have been socially constructed as gendered. Because technology education operates within the context of technological activity generally, the gendered nature of technology is reflected in technology education.

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8 British Columbia, for example, has followed the four-cluster content model of the ITEA curriculum with minor modifications in terminology. The similarities of the models will be discussed in Chapter 3.
Comments made about social/political issues such as classism or ethnocentricity, are also made on the basis that class related technologies or ethnic related technologies are also social constructions. In a similar vein, it is assumed that, although academic ability of the student may influence the pedagogy of education, the appropriateness of participating in technology education or the appropriateness of studying any particular aspect of technology education is not predetermined by academic ability. This latter point may be particularly relevant, considering that technology education in the public schools, when offered as an elective, has mainly attracted under-achieving boys.

G. Limitations

This thesis focuses on three issues in technology education: Gender bias, an emphasis on industrial technologies, and the lack of emphasis on a critical technological literacy. In focusing on only three problem areas, this thesis may well ignore other important problem areas within technology education. In highlighting gender bias in technology education curricula, other biases such as racial, class, and age biases are commented on, but further analyses are required to substantively address those biases. Although this thesis concludes that gender bias is a significant problem in technology education, it does not claim that gender bias is necessarily the most problematic bias in technology education.

I have used a broad brush to try to present an overall picture of several problems with technology education curricula. Because my perspectives and
views are not necessarily representative of the wide range of citizens who are affected by technology education, input from others with a multiplicity of interests and life experiences is required in order to derive a more holistic understanding of the implications of technology education curricula.

This thesis comments significantly on only two curriculum documents, and both are North American. Within North America, there may well be significant variations in curricula and pedagogy from those contemplated in the documents focused on in this study. The great diversity of cultures which exist worldwide also suggests that conclusions drawn from this study may not be relevant to technology education curricula developed in other countries. Although some of the problems identified as being associated with the technology education curricula which are examined may be generalizable, analysis of a broad spectrum of curricula may be necessary to determine the extent to which conclusions drawn from this thesis are generalizable. Such studies may also assist in determining the validity of conclusions drawn from this thesis.

Although I am critical of technology education curricula, the partisan and partial nature of technology education which I identify may not result from conscious efforts by technology educators or curriculum developers, but from unconsciousness:

[Educators] firmly believe that as long as they are not conscious of any bias or political agenda, they are neutral and objective, when in fact they are only unconscious. (Namenwirth, 1986, quoted in Lather, 1991, p. 106)
H. Significance

This thesis identifies several problems associated with technology education curricula and suggests strategies which may assist in dealing with those problems. The identification of a gender bias in technology education and clarification of the basis of that bias may help technology teachers to eliminate the bias. Although it may be obvious to technology teachers that few girls participate in technology education, it may not be widely understood that the lack of participation may have its foundation in the gender bias associated with both the design and the implementation of curricula. Elucidating and addressing gender bias in technology education curricula may also serve as a guide to addressing racism, classism, and ageism in technology education curricula.

Another practical outcome of this thesis is that it provides information which may be useful in designing technology education curricula which are relevant to the needs and interests of a broader range of students than is currently being served. This thesis may help promote the inclusion of appropriate forms of critical technological literacy in curricula. Including critical technological literacy may make the curricula more relevant, and may serve to help empower students to control and direct technology and thereby reduce the life-threatening side effects of technological developments.

In addition to its practical significance, this thesis has theoretical implications for educational studies. In identifying and critiquing the assumptions and values which underlie technology education curricula, some of the inter-relationships between societal values and technology education are
clarified. Knowledge of those inter-relationships may be a useful reference for examining the societal significance of underlying values and assumptions in other curriculum areas.

I. Overview of Thesis

This thesis includes an examination of both literature about technology and technology education, and examines two technology education curriculum documents, primarily from feminist perspectives. Feminist critiques of technology and technology education mainly focus on how gender, race, ethnicity, age, and sexual orientation are integral to the power relations of technology and technology education. These critiques query liberal democratic industrial societies' blind devotion to technology as they examine the injustices and exploitation resulting from that technology. In addition to the voices of these writers, my own voice weaves in and out of the thesis to reflect a perspective associated with my gender, class, industrial work experiences, and technology teacher training experiences.

Industrial education has historically served to convey the kinds of skills and knowledge which were developed during the Capitalist Revolution⁹. As long as industrial education focused on traditional knowledge and skills related

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⁹ Many writers use the terms Industrial Revolution and Scientific Revolution to denote the period in European history between the fifteenth and seventeenth centuries. This period in history also corresponds with the rise of capitalism. I suggest that the rapid growth of capitalism as a social structure which allowed the 'pooling of resources' in the production of materials and devices better characterizes and exposes the nature of the transformations which took place during that period. To suggest that advances in science and/or technology were suddenly mature enough to provide a basis for the mass production of goods is a construction which denies many centuries of human history and contributes to a scientific and technological elitism.
to manufacturing, it was possible to define the subject areas of industrial education and perhaps to determine what knowledge and skills would contribute to the ability to 'make things' or at least 'do things' within those subject areas. Areas like woodwork, automotive, drafting, metalwork, and later areas such as electronics, helped provide definitions of industrial education and premises upon which curriculum could be based. Commercial industries have evolved from collections of 'trades' to networks of technologies spanning a multitude of subject areas. At the same time, the extensive intrusion of technology into the personal lives of almost everyone and the threats which technology poses to the environment and to human existence have signalled a need for a 'technologically literate' population which is capable of more than simply 'making things'. There is also the recognition that traditional industrial education is serving the needs of only a limited segment of the student population. By analyzing the content of technology education curricula, I foreground an industrial-capitalist, North American, white, middle-class, male bias which parallels a similar bias in technology.

In order to understand technology education it is necessary to understand the technological world within which technology education operates. Chapter two of this thesis identifies the character of technology and highlights two disparate views of technology. On the one hand, technology encompasses the broad range of human endeavours associated with both the private and public lives of all citizens. On the other hand, technology in North American societies is also markedly masculinized and is primarily recognizable as the collection of knowledge, skills, processes and artefacts associated with
the production of consumer goods and services. The gendered nature and production orientation of technology has a strong parallel in technology education. The problems and questions raised in chapter two regarding technology provide a framework from which to explore problems and questions of technology education curricula.

Chapter three examines technology education in the context of the characterization of technology established in chapter two and highlights problems associated with the gender bias in technology education, the narrow industrial focus of the curriculum content, and the lack of emphasis on critical technological literacy.

In Chapter four, questions are raised regarding the possible role that technology education could play in exposing and challenging oppressive ideologies. Liberal approaches of integration and mainstreaming are discussed and these avowedly apolitical approaches are shown to be problematic because they fail to question and challenge the institutionalized values and assumptions of technology education. More radical alternatives such as critical, Freirian and feminist pedagogies are considered as possible challenges to androcentrism\(^{10}\), and other forms of oppression, social control, and cultural reproduction. I suggest that reclaiming and revaluing the life experiences of students, may promote the creation of technology education curricula which are democratic, equitable, and empowering rather than demoralizing, inequitable, and limiting. Technology education could be a place where

\(^{10}\) *Androcentrism* refers to "the predominance and power of the male perspective" (Briskin, 1990, p. 23).
students can make sense of their own place in the world. It could be a place for liberation. It could be a place where liberation becomes a possible human agency.

A summary of the thesis and an examination of its implications for technology education and for education generally is included in chapter five. Questions which warrant further research are also summarized.
Chapter II: The character of technology

TECHNOLOGY

Not just moving, rolling, scratching, rumbling, tumbling, wheels turning, twisty springs springing about, wire for ales to use, slimy oil on rusty chain.

Twisty belts and squeaky wheels. Pulling handles, pushing buttons.

That's what Technology is about!

By: Jessica Millar and Rachel Beattie
A. Introduction

This chapter examines current literature on technology in order to formulate a framework for analyzing the gender-bias in the ITEA and BC technology education curricula. Examining the character of technology is necessary for two reasons. Firstly, analyzing the assumptions and values on which authoritative definitions of technology are based, assists in understanding how these definitions have become male-biased. Since, technology education is based on concepts of 'technology', understanding these common meanings provides an insight into the essence of technology education curricula. Secondly, as there is a conspicuous absence of literature critiquing the male-bias in technology education, the literature critiquing the gender-bias of technology may be useful as a basis for examining gender-bias in technology education. The absence of literature regarding gender-bias in technology education may result from the virtual absence of women in technology education. Literature by technology educators has focused primarily on debates regarding the variations in interpretations of technology and technological literacy. Although these discussions do not consider the gender-bias in the interpretations of technology and technological literacy, they do provide male technology educators' perspectives on these two concepts.

B. Overview of the Literature

(i) Science, Technology and Society Literature

Much of the earlier writing about technology originated in the area of science. In 1959, the journal, Technology and Culture, was established by the
Society for the History of Technology (SHOT), to consider the interrelationship of technology, society, and culture (Rothschild, 1983). In the mid 1970s, the Science, Technology, and Society Curriculum Development Newsletter was published to encourage discussion regarding science, technology, and society. Since 1986, the Bulletin of Science, Technology, and Society has been published as the journal of the science, technology, and society (STS) movement. A cursory examination of these journals indicates that the primary emphasis is on 'science' and 'society', with 'technology' frequently depicted as little more than 'applied science'.

(ii) Industrial/Technology Education Literature

Although science has been claiming a close connection with technology for several decades, 'technology' has only recently been claimed by industrial educators to represent the subject area of their programs\(^{15}\). Until the current move by industrial educators to revise their curricula, and rename them 'technology education', the examination of the relationship between technology and society has not been included in their curricula. Society and technology issues have not been included in previous industrial education journals, and are given only minimal attention in the current technology education journals. In the writings of technology educators, the prevalent view of technology is that of a field preoccupied with the devices of 'high technology' in the industrial

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\(^{15}\) Technology has often been depicted as applied science. It is commonly held that science creates the theoretical basis for invention and technological development. Such an interpretation is inconsistent with the notion that technology preceded science as it is known today, and that technological 'development' can occur independently of science and may even provide a basis for scientific advancement.
domain of the public sphere. As an example, *The Technology Teacher*, the teacher oriented publication of the International Technology Education Association (ITEA), is filled with articles on lasers, robotics, linking the classroom with NASA, modularized technology labs, integrating industrial-technology with other subject areas, and teacher-designed, technical problem-solving activities for students.

The concept of technological literacy has received significant attention over the past few years by technology educators (Blankenbaker and Miller, 1987; DeVore, 1991; ITEA, 1991; Lewis and Gagel, 1992, Sanders, 1986). Technology educators associate technology and technological literacy with public sphere. Nevertheless, there appears to be little consensus, among technology educators, regarding both the definitions of technology and technological literacy.

(iii) General Critiques

Critiquing the historical, social, and philosophical perspectives of technology is a relatively recent undertaking (Rothschild, 1988; Wajcman, 1991). There is a growing body of literature addressing the relationship between technology and class power relations with the political, economic, and social structures in industrial-capitalist societies (Bijker, Hughes, and Pinch, 1987; Borgmann, 1984; Ellul, 1964; Grant, 1986; Heidegger, 1962; Ihde, 1990; Illich, 1973; MacKenzie and Wajcman, 1985; Pacey, 1983, 1990; Teich, 1990; Winner, 1986). However, these critiques generally do not consider other power relations, such as gender and race to be significant to understanding the
character of technology. This literature explicates concepts such as the device paradigm\textsuperscript{15}, value-neutral technology, and the promise of technology, and underscores the urgent need for technologically literate citizenry, if humankind and this planet are to survive current exponential and virtually uncontrolled technological developments.

(iv) Feminist Literature

The absence of women in literature on technology and technology education is notable. A literature review by Rothschild (1983) of the journal Technology and Culture, revealed that there were only four articles relating to women and technology within a twenty-four year period. Rothschild (1988) comments on this scarcity of women's perspectives in the current journals:

Not only have women been omitted from the literature; feminist perspectives have been missing as well. Feminist perspectives bring an approach to knowledge that is holistic, that is grounded in the experiential, seeking to draw on the total human experience and transcend the subject-object split of much of traditional Western scholarship. (p. 3)

The Journal of Technology Education (the scholarly journal of the ITEA), has not had one article relating to technology and women to date. The editor of the journal of the British Columbia Technology Educators' Association, VIEW, did consider the possibility of printing an article that I had written on the male-bias in the revised British Columbia technology education curriculum document.

\textsuperscript{15} There are many variations on the term paradigm. Borgmann (1984) uses the term interchangeably with pattern. A common interpretation is one offered by Kuhn (1970) which he uses to denote any component of the assemblage of beliefs, values and assumptions shared by any particular community. Lather (1991) cautions that defining paradigm as a discrete and definable entity may not be an adequate method of describing an ambiguous world.
Although not personally opposed to printing the article, he expressed concerns about the possible backlash to the article from other technology educators as he felt that 'they were not ready to deal with gender'. Consequently, my article was not printed in VIEW.

The form of silencing that I experienced is typical for women in non-traditional areas. Rothschild (1988) explains the absence of literature by women who enter male-dominated areas:

"...for the few women in these fields acceptance of the traditional canons and values [is] integral to their entry, even to the lowest levels. Under these circumstances, they [are] unlikely to be inclined to challenge the methods and received wisdom of the [male] fraternity. (p. 5)"

Regardless of overt and veiled forms of silencing, since the 1970s, feminists have examined the roles of women in science, mathematics, and the trades. Studies of women and technology are relatively recent (Cockburn, 1985; Corea, 1979; Faulkner and Arnold, 1985; Franklín, 1990; Kramarae, 1988; Menzies, 1989; McNeil, 1987; Rothschild, 1983, 1988; Wajcman, 1991). The few books written by women on technology are primarily edited collections and are "much less theoretically developed than those which have been articulated in relation to science" (Wajcman, 1991, p. 15). However, feminist literature presents quite different perspectives on technology from the perspectives offered by most men. There is no unified feminist voice on technology because there are a variety of different types of feminisms. Nevertheless, feminist writers do appear to be in concert in their belief that men's monopoly of technology has been appropriated by a few privileged males who exercise technology as a principal source of domination and power over other people, including other males.

Although much of the feminist literature addresses debates about the
effects of technology on society (particularly on women in society),
contemporary literature by feminists is turning the debate around to look at
some effects of society on technology (McNeil, 1987; Wajcman, 1991). Feminist
critiques, as well as some male critiques, have inquired into: the history of the
gendering of technology; the gendered definitions of technology; the gendering
of tools, machines and skills; the assumed value-neutrality of technology; and,
the gender power relations of the institutional structures that support
technological developments. Examination of these issues, discloses that
technology is socially constructed, and that the social construction of
technology has a strong male bias.

Analyzing the gender power relations that define the prevailing
knowledge and practices of technology, identifying what has been omitted, and
recovering what has been excluded, ought to assist in broadening definitions of
technology. In addition, the notion of value-neutral technology may illuminate
the 'device paradigm' that Borgmann (1984) suggests we have been lulled into
accepting. Unmasking the power and interests of the few who control
technology should provide a basis for social action towards a more equitable
society:

Rather than seeing technology as the key to progress or, more recently, the road
to ecological or military destruction, the social shaping approach provides scope
for human agency and political intervention. (Wajcman, 1991, p. 163)

Such critiques of technology challenge us to rethink and question assumptions
about technology, technology education, and society. Including female
experience in considerations of technology widens current perspectives from
*male perspectives* to *human perspectives*. Such broadened perspectives may be
synergistic in creating an understanding that is greater than the sum of its female and male 'parts'. Including other voices that have also been excluded from the dialogue on technology (e.g. students, impoverished people, people in developing countries, aboriginal people) would further enhance the dialogue on technology.

C. Correcting the Record

The history of technology portrays men's history. Like much of the early literature about women and science, recovering women's history in technology has been the focus of much of the early feminist literature on technology. The emphasis has been primarily to add to the record the achievements of outstanding female technologists. According to Wajcman (1991), although there is documented evidence that women in all walks of life have made significant contributions to technological development, much of their contributions have been subsumed by men:

[Women]...invented or contributed to the invention of such crucial machines as the cotton gin, the sewing machine, the small electric motor, the McCormick reaper, and the Jacquard loom...this sort of historical scholarship often relies heavily on patent records to recover women's forgotten inventions. It has been noted that many women's inventions have been credited to their husbands because they actually appear in patent records in their husbands name. This is explained in terms of women's limited property rights, as well as the general ridicule afforded women inventors at that time. (p. 16)

Regardless of the recovery of contributions by exceptional women, reclaiming women's history has been problematic. The examples highlighted above by Wajcman illustrate that technology is perceived as consisting of male activities, with the exclusion of technologies associated with women. Consequently, many inventions designed by women, are overlooked as they are not considered to be
technology. Cowan (1979) underscores this point in a discussion about the absence of the invention of the baby bottle from historical records:

Here is a simple implement...which has transformed a fundamental human experience for vast numbers of infants and mothers, and been one of the more controversial exports of Western technology to underdeveloped countries—yet it finds no place in our histories of technology. (p. 52)

To unearth the history of women and technology, requires that authoritative definitions of technology be expanded to include technologies of the private sphere—those technologies associated with women’s activities. It is therefore necessary to uncover the historical and cultural shaping of technology that located women in the private and reproductive sphere, while placing value on technologies of the public and productive sphere associated with men.

D. Construction of 'Femininity' and 'Masculinity'

(i) Division of Labour

Many feminist writers maintain that the delineation between female/male, private/public, reproductive/productive, emotion/reason, non-rational/rational, body/mind assumed particular significance during the Capitalist Revolution. These dualisms were likely necessary constituents for the development of science and capitalism (Bush, 1983; Keller, 1985; Merchant, 1983). Elsentstein (1979) explains how vernacular Protestantism16 also played a major role in establishing these dualisms. In her historical examination of the advent of printing, specifically Bible-printing, she describes

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16 By 'vernacular' Protestantism Eisenstein is referring to the interpretations of scripture that were printed so that the lay people could have access to Christianity. Since the Catholic realms had few printing presses, the Protestants became the main publishers of scientific publications.
altruism and self-serving motives of the Baconian, Protestant, and scientific interests during the *Capitalist Revolution*. She contends that vernacular Christianity and Baconian ideals were fundamental ingredients that were necessary for the mercantile mechanistic worldview during the *Capitalist Revolution*.

During the *Capitalist Revolution* an "organically oriented mindset" was replaced by one of "mechanism and the domination of nature" (p. 99). The morals and ethics of the former mindset conflicted with industrial-capitalists' endeavours. Bacon's ideals of technological *mastery over nature*, combined with sanctioning of *domination over nature* by the church, justified industrial-capitalist's desire to *exploit nature for profit.*

According to this new *liberal thinking*, the world was seen to work rationally, according to mathematical, 'natural' laws. Donovan (1988) comments that these perspectives left out basic areas of reality. It neglected the subjective world, the world of emotions and nonrationality. Inherent in the position of the liberal thinkers was the notion that since men were *rational*, every male was assumed to have 'natural' abilities for work in the public and productive sphere. Women were deemed to be *non-rational*, and therefore were 'naturally' more suited to be housewives and mothers, as well as caretakers of the emotional and psychological realms of personal relations (Donovan, 1988). As a result, women were denied ownership of property, denied access to public sphere occupations, and denied access to the world of science, mathematics and technology—this world was reserved for *technological man*.

The social construction of *technological man*, as well as *essential woman*
and non-technological woman, were (and still are) necessary for the assignment of women to their 'natural' roles in industrial-capitalist societies. Women must not only enter areas of science, mathematics, and technology, but they must also resist biological determinism and deficit theories as they work towards the social transformation of these areas into areas that are equitable and just. This requires questioning the premises on which these areas are founded, and if these areas are inappropriate for women, perhaps they are not appropriate for anyone. One place to begin such resistance and reconstruction is by understanding how the concepts of essential woman, non-technological woman, and technological man have been constructed.

(ii) Non-homo technologicus\textsuperscript{17}--Essential Woman

Some feminists accept and celebrate the nature symbolism which associates motherhood, nurturing, caring, responsibility with women (e.g. Belenky et al, 1986; Gilligan, 1982). Women are believed to naturally be more peaceful and caring, and men are believed to naturally be more aggressive and detached.

There are debates about how the universal features of women influence their relationships with technology. There are calls for redefinitions of technology based on these feminine values (Pacey, 1990; Rothschild, 1983). Pacey (1983) suggests that there are three sets of values associated with

\textsuperscript{17} Menzies (1989) uses the term Homo technologicus to describe "the so-called universal male form....He is the offspring of industrial and scientific man, Homo faber and Homo sapiens....he becomes nothing more than an embodiment of technique endlessly optimizing itself, its living expression and instrument" (p. 45).
technology: virtuosity values, economic values and user values. He depicts women as exemplifying the user values because they are presumed closer to nature, while males want to dominate nature.

However, there are feminists who oppose this essentialist position, arguing that these universal female values originated with the subordination of women (Cowan, 1979; McNeil, 1987; Wajcman, 1991). McNeil (1987) argues that "the creation of childhood--the extension of the period in which children were considered dependent and in need of nurturing--helped to fill the so-called domestic void" that is created by taking men out of the home to participate in industrial production (p. 166). Women’s role in the production and reproduction of labour was deemed to be a labour of love. Many feminists maintain that this ideology encourages the myth of the 'natural woman' as well as the exploitation of women’s labour (eg. McNeil, 1987; Stanley, 1983).

Wajcman (1991) argues that there are no identifiable, 'universal' women's values, as values reflect experience, and women's experience is divided by class, race, culture and other aspects of socialization. She suggests that an examination of how the concepts of 'masculinity' and 'femininity' have been constructed may inform understanding of the basis of gendered value systems. Wajcman also traces the origins of much of the contemporary gendered value differences back to the division of labour resulting from the Capitalist Revolution, which restricted women to a narrow range of experiences within the private world of the home.

Considering the overwhelming historical and cultural oppression of women, women who want to break from the notion of biological determinism,
must undergo some sort of gender adjustment to be accepted as *technological humans*\(^\text{18}\):

This approach...locates the problem in women (their socialization, their aspirations and values) and does not ask the broader questions of whether and what way [technology] and its institutions could be reshaped to accommodate women...[it] asks women to exchange major aspects of their gender identity for a masculine version without prescribing a similar 'degendering' process for men. (Wajcman, 1991, p. 2)

Considering the tragic history of attempts to identify and act on biologically-based, 'social' differences between groups of humans, as evidenced by the annihilation of Jews and homosexuals during World War II, I question the advisability of searching for some mysterious and subtle biological basis for the perpetuation of sexism. There are a wide range of human competencies from technical competencies, such as those associated with child rearing, exploring the structure of the atom, planting a garden, performing laser surgery, to social competencies such as those related to compassion, cooperation, individualism, aggression, kindness, and love. Believing that such competencies have any significant biological basis is as potentially and actually destructive as are forms of racism.

(iii) **Homo non-technologicus—Non-Technological Woman**

The social construction of 'woman' as outlined above plays a significant role in the gendering of the workplace and the performance of work itself. Women and women's work are generally perceived as non-technological (Karpf, 1987, p. 26).

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\(^{18}\) This was/is my experience in technology education. I was/am expected to become 'one of the boys'. My refusal to become 'one of the boys' results in alienation from my peers.
Women's technological achievements are not socially recognized and have been hidden from history. "Again and again, we find that the very definition of what technology is problematic, reflecting the gendered values of the definers" (Karof, 1987, p. 160).

Wajcman (1991) comments that women's work is often deemed inferior simply because it is women who do it. An example from my own experience in the workplace illustrates this point. In the late 1960s, I was a drafting clerk for a major telephone company. I worked in an office with about twenty male draftsmen who had the same experience and educational background as I had. My duties were identical to those of the draftsmen, except for the fact that I was often asked to do drawings that required extreme precision. Comments were often made by the males in the office that women were much better suited for such fine-detailed work. The fact that the skills of a drafting clerk were of lesser value than those of a draftsman was evidenced by my salary being approximately 60% of that of my male counterparts.

The concept of 'skill' is not simply a matter of learning how to perform a certain technical task. Wajcman (1991) argues that 'skilled' status has everything to do with 'masculinity' and 'femininity':

Definitions of skill can have more to do with ideological and social constructions than with technical competencies which are possessed by men and not by women. It is a question of workers collective efforts to protect and secure their conditions of employment--by retaining skill designations for their own work and defending that skill to the exclusion of outsiders. These efforts have been predominantly by and on behalf of the male working class...men's resistance has...operated against women's interests. Defending skill, preventing 'dilution', has almost always meant blocking women's access to an occupation. (p. 36).

That males may rely heavily on the relationship between 'man', 'power', and 'machine' is supported by my experience as a student at BCIT. The males
in the technology education program were intensely competitive and possessive regarding their tools and performance—even among themselves. They were openly disappointed that I was able to learn the skills with reasonable ease.

On one of my first metalworking projects (making a tool gauge) the instructor displayed my project as an example of excellent work. As a result, I received a great deal of ridicule, and later projects done on a metal lathe and on a hydraulic trainer were sabotaged. It was clear to me that at least some of my classmates were disappointed that a woman could learn 'their' skills. The skills learned in the BCIT program were considerably less complex than the technical skills required when I worked in health and safety, which in turn, were less sophisticated than the skills that I used to make ballet costumes for my daughter and other dancers.

As computers are becoming a recent technology to be appropriated by men, the proliferation of literature which intimates that girls have essential psychological differences that keep them at a distance from computers, is also increasing\(^\text{19}\). Wajcman (1991) challenges these most current forms of blocking female access to technological endeavours:

These arguments are reminiscent of two views that are by now somewhat discredited. One is the old sexual stereotype about women being too emotional, irrational and illogical, not to mention lacking visual spatial awareness, to be good at mathematics: the other is the 1960s and 1970s belief that working-class and black children were naturally suited to less abstract and more concrete forms of learning. (p. 156)

\(^{19}\) It is interesting to note that when typewriters were the main 'tool' for word processing, they were not considered technology, and very few men had typewriters on their desks. However, although often used for the same purposes as typewriters, many an executive has this 'tool' on his desk. This phenomenon could be due to the fact that computers are equated with control and power, while typewriters were not. It is also noteworthy that much of the terminology associated with computers is masculinized (e.g. executing files, hardware, hard drive).
Not only do these arguments described by Wajcman perpetuate sexual stereotypes, but they also ignore prominent social factors. Bush (1983) argues strongly that it is not women's inexperience with technology that is the problem, but, men's ignorance of the contexts in which technology is located. The notion that women as *naturally deficient* or *naturally non-technical* is a convenient social construction and not a biological or psychological reality.

(iv) **Homo technologicus—Technological Man**

The majority of feminist writers appear to agree that technology is viewed as masculine because of ideological and cultural processes. As explained above, the ideological processes are strongly tied to industrial-capitalism. Wajcman (1991) points out that not all men are technically competent and that it is the *ideology of male competence* that is allied with technology.

One aspect of the *culture of masculinity* is the close association between men and war technologies. Easlea (1983) presents one of the most ironic explanations for this phenomenon. He refers to 'womb envy' as the reason for men's obsession with war and competition in order to compensate for the fact that men can't give birth to babies. Wajcman (1991) refers to this as "giving birth to the bomb" (p. 138)\(^2\). Discussing the recent changes in the political situation in the Soviet Union and the possible consequences on military

\(^2\) Hidden behind this masculine ideology, women are increasingly on the production end of military technology although it is men who primarily control the design and end uses (Wajcman, 1991).
technologies, Franklin (1990) comments that:

...the social and political needs for an enemy are so deeply entrenched in the real world of technology (as we know it today) that new enemies will quickly appear, to assure that the infrastructure can be maintained. (p. 78)

Wajcman (1991) and Menzies (1989) both perceive technology to be an issue of control and power. Wajcman (1991) relates the control of technology to 'hegemonic masculinity'. She suggests that hegemonic masculinity is "a core of dominant masculinity...[which] is strongly associated with aggressiveness and the capacity for violence":

The cult of masculinity which is based on physical toughness and mechanical skills is particularly strong in the shop-floor culture of working-class men. All the things that are associated with manual labour and machinery--dirt, noise, danger--are suffused with masculine qualities. Machine-related skills and physical strength are fundamental measures of masculine status and self-esteem according to this model of hegemonic masculinity. (p. 143, emphasis added)

Wajcman wonders whether men's preoccupation with this 'machismo' and 'technical competence' is an expression of having power or lacking power, as trades people generally are not in control of their jobs. However, they do have a monopoly over their tools and their machines. She suggests that this type of masculinity is more common in working-class men:

The exaggerated masculinity found amongst working-class cultures must be viewed against the background of their relative deprivation, their low status and their comparative powerlessness in the broader society. (p. 145)

Wajcman contends that as the need for the trades diminishes, men are now appropriating a different type of masculinity for themselves--'analytical power' needed for 'high technologies'. As society is perceived as moving from an

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21 Was Franklin's prophecy realized with the controversial USA invasion of Iraq in the name of 'democracy'?
'industrial age' to an 'information age'\textsuperscript{22}, this analytic power is needed to control the new computerized technologies.

E. Gendering of Technology

(i) Gendering of Definitions of Technology

The assignment of women to the private sphere since the Capitalist Revolution, the gendering of work and tools, the omission of women's perspectives and women's contributions to technology in historical records, and the blurring of the concepts of science and technology, have added to the difficulties of defining technology. A frequently quoted definition of technology is the one advanced by Pacey (1983): technology is "the application of scientific and other knowledge to practical tasks by ordered systems that involve people and organizations, living things and machines" (p. 6, emphasis added).

Wajcman (1991) observes that technology is routinely represented in current literature as variations of these three layers of meanings offered by Pacey and are usually described as: technical knowledge; human activities and practices (know-how); and, hardware. She points out that these meanings are constructed by men, for men and about men's knowledge, activities and hardware, and ignore technologies associated with women's experiences.

\textsuperscript{22} Naming reinforces control over those who accept the naming without question. Admittedly, due to advances in microelectronics those who have the high technologies can have access to more 'information'. These technologies are often referred to as 'communication' technologies. However, we are hardly communicating as we 'talk' to each other by holding a piece of plastic to our ear or by looking at text on a video display terminal. The human dimension has been lost as we substitute 'contact with people' for 'contact with machines'. Franklin (1990) refers to this information age as an age of non-communication.
Kramarae (1988) maintains that the history of North American technology is basically men's history and that "technology consists of devices, machinery, and processes which men are interested in" (p. 5).

Goldman (1984) says that many of the current definitions describe technology as types of artefacts, systems of production, or bodies of knowledge and claim that such definitions are hollow as they avoid dealing with the principles on which the definitions are based. He offers a definition which invites examination of technological structures in society:

"Technology" should be understood as referring today to a particular social process, to a form of action that is decision-ruled, one in which specific, "captive" knowledge based in engineering and science (primarily and craft skills (secondarily) are put at the disposal of people who in general are not themselves competent in those knowledge bases and who wield them on behalf of ends reflecting a parochial interpretation of prevailing personal, institutional, and social values. (p. 121)

Technologies valued in North American societies are those associated with men, and the public and productive sphere, while technologies associated with women, and the private and reproductive sphere are devalued, and often are not considered as technologies. People view devices such as computers, robots, lasers, cars, kidney machines, and production machinery as significant technologies, while seeing child care, cooking, sewing, and gardening as insignificant or non-technologies. As well, technologies associated with men are generally of greater economic value.

Wajcman (1991) suggests that the male-bias in current definitions of technology may be moderated by:

...broadening the definition of technology, and tracing the origins and development of 'women's sphere' technology that have often been considered beneath notice...technology still suffers from a male bias that is largely interested in manufacturing... (p. 162)
Broadening the definitions of technology would mean that the "classification of many women's inventions would change" and that identification of what is considered significant technologies would also change (Stanley, 1983, p. 6):

...hunting and its weapons to gathering and its tools...from war and its weapons, industry and its machines, to healing and its remedies, fertility and antifertility technology, advances in food production and preservation, child care, and inventions to preserve and keep us in tune with our environment... (ibid)

Stanley (1983) suggests that a revised history of technology would mean that the definition of technology would change from what men do to what people do.

(ii) Gendering of Tools

Griffiths (1985) analyzes the gendering of tools and the differentiation between the trades of women and the trades of men resulting from the separation of male and female occupations since the Capitalist Revolution. Her examination discloses that gendering of work and tools was fortified by the rise of capitalism. Prior to the Capitalist Revolution much of the production of goods was located in the home where women had considerable opportunities to acquire technical skills. Within the Capitalist Revolution, female-dominated trades such as spinning, bleaching, and brewing were relocated to the factories where women were assigned only deskillled jobs in the production processes. The male-dominated skills, particularly those associated with woodworking and ironworking crafts, remained male-dominated and became less deskillled, as these crafts were transformed into trades such as wheelwright or foundry worker.

During the Capitalist Revolution, as machinery began to make some of
the jobs less skilled, adult male workers were replaced with the cheaper labour of women and children. To protect their jobs, craftsmen fought to reserve their skills for themselves by forming craft guilds and controlling access to them.

Cockburn (1985) condemns those historical events:

> It is the most damaging indictment of skilled working-class men and their unions that they excluded women from membership and prevented them gaining competencies that could have secured them a decent living. (p. 39)

This gendering of tools during the Capitalist Revolution has changed very little since that time. Benston (1988) contends that women and men in contemporary North American societies experience very different gendered lives, and that these gendered experiences are reflected in the "gender-typed" technologies that men and women use:

> There are machines and tools 'suitable' for men--saws, trucks, wrenches, guns and forklifts, for example--and those 'suitable' for women--vacuum cleaners, typewriters and food processors. Even on assembly lines, men make cars and women assemble electronic components or pack fish. (p. 16)

The tools, machines and technological processes that are traditionally used by one sex are usually seen to be associated with that sex and are usually considered to be inappropriate for use by the other sex (Franklin, 1990). The gender identified with a tool, machine or technology is often related to the power and control arising from it. These powerful and controlling tools, machines, and technologies are generally dominated by men (Cockburn, 1988; Franklin, 1990; McNeil, 1987; Wajcman, 1991). Regardless, there are those who still argue that tools have no gender identification--those whose interests are served by maintaining the valuing of male tools, machinery and
technologies.

(iii) **Fragmentation of Technology and Society**

Franklin (1990) points out that the fragmentation of technical work into specialized areas of expertise is in contradiction to "women's historical experience of situational and holistic work...[that] depends strongly on personal judgement, on knowledge of the total work process, and on the ability to discern what the essential variables are at any one time" (p.104). Fragmentation of technology results in the isolation of workers from each other and from decision-making. Workers are often little more than a component of the machines or subsystems which they operate.

Feminists attribute some of the isolation of capitalist technology to a mechanistic world view, combined with a fragmented, reductionist Cartesian perspective, which supports the separation of knowledge from experience, general from particular, and abstract from concrete. People and the universe are understood as 'mechanical systems' made up of 'separate parts'. For example, someone can design a house without knowing how to build that house, or even without knowing what it would be like to live in that kind of house. When I was a building inspector, it was not unusual for me to have architects request approval for plans of a beautiful, artfully designed house

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23 When I was trying to explain to a member of the technology education curriculum writing team that he should consider technologies associated with women in the design of his technology lab, his response was, "I don't see the word 'male' written on the metal lathe." Similarly, I have never seen the word 'female' written on a sewing machine or a vacuum cleaner but most people are aware of which genders are associated with lathes and vacuum cleaners.
that was structurally inadequate\textsuperscript{24} and functionally questionable. Structural considerations were to be dealt with separately by other 'specialists' - engineers and building inspectors. Similarly, the needs of the end users were often misunderstood or ignored, particularly with respect to the interests of children. Children's bedrooms were often designed with window sills taller than the children, as if children did not really exist or did not need to look out the windows.

The separation of knowledge from experience, and packaging knowledge into discrete components has profound effects on human behaviour. Franklin (1990) suggests that our \textit{vernacular reality}, which is our everyday experience, is being replaced by an \textit{extended reality}, which consists of others' experiences and artefacts. She suggests that these imposed realities become so much a part of our behaviour that we begin to believe that they are real. 'Experts' are defining who we are, what we believe, and how we live. Franklin concludes that a pivotal feature of the current technostructure is the "downgrading and the discounting of personal experience...and the glorification of expertise" (p. 40).

From my experience as a provincial factory inspector and as a national safety officer, I observed that the majority of new jobs being created by technological developments were deskillled, atomistic, and routine. Few of the newly created jobs required technological skills or post-secondary education although the employers were often asking for these qualifications. "While it is

\textsuperscript{24} The training for architects at the University of British Columbia does not include a course on the British Columbia Building Code. This code contains the rules and regulations that every built structure in the province must comply with in order to ensure the health and safety of the occupants.
usually assumed that workers will need computer programming and other sophisticated skills because of the greater use of technology such as computers in their jobs, the ultimate effect of such technology may be somewhat different" (Apple, 1988, p. 158). As technologies become more and more like 'black boxes', the knowledge and skills needed to use them decreases.

F. Transforming Technology: Critical Technological Literacy

Gendering of society and gendering of technology, places women and women's contributions to technology on the margins, while allowing men to monopolize power over technology. This power is both a medium and a reflection of wider historical, social and political ideologies. In North American cultures, males are perceived as *Homo significans*, with the power to spin their own webs of significance (Trinh, 1989). Rather than having the freedom to spin webs of their own, women are caught in the male webs. Sharing power and transforming technology into a liberating force from the oppressive force that it is may be a way for women to disentangle themselves. Men, however, have been reluctant to share their power base. Lorde (1981) contends that "the masters's tools will never dismantle the master's house" (p. 99). Sharing the tools is only one of many steps required to transform gender power relations of technology. According to Bush (1983), for equitable technology and equitable societies we must 'unthink' technology as we know it and that we "should strive for a holistic understanding of the contexts in which it operates and should present an unflinching analysis of its advantages and disadvantages" (p. 168).
The 'Promise of Technology'

Many technological developments have come under increasing scrutiny in recent years, and a number of prominent writers have begun to critically analyze the 'promise of technology' (e.g. Borgmann, 1984; Ellul, 1964; Franklin, 1990; Menzies, 1989; Pacey, 1983; Wajcman, 1991). Technology has contributed to the improvement of the material quality of life for many people, such as those who live in North American societies. Nevertheless, the benefits of technology are being questioned in the light of substantial detrimental effects of technological developments on humankind and this planet. There is a growing awareness that, left in the hands of the technologically illiterate and socially immoral, technologies are endangering all forms of life as we know it.

Borgmann (1984) argues that citizens are blinded by 'the promise of technology'. "We have tentatively and formally defined technology as the characteristic way in which we today take up with the world" (Borgmann, 1984, p. 35). Borgmann argues that because technology is so much a part of our everyday lives, we are not conscious of the paradigm (pattern) of technology. He suggests that technology prevails "as common sense, as the obvious way of doing things which requires no discussion and, more important, is not accessible to discussion" (ibid). Borgmann explains that although technology has been so consequential, particularly in 'modern' society, much of the paradigm of technology, have been concealed. He refers to this paradigm as the 'device paradigm'. He writes, that it is the 'promise of technology' that has both fed and obscured the enormous transformative endeavours that characterize contemporary Western societies:
The promise of technology was first formulated at the very beginning of the Enlightenment. It was not at the center of attention but rather put forward as the obvious practical corollary of intellectual and cultural liberation....The main goal...seems to be the domination of nature...the desire to dominate does not just spring from a lust of power, from sheer human imperialism. It is from the start connected with the aim of liberating humanity from disease, hunger, and toil, and of enriching life with learning, art and athletics....In the second half of the eighteenth century the [Capitalis] Revolution began to employ new machines and more efficient methods of production, it at first increased the common toil and misery. But, gradually in the nineteenth century and even more dramatically in the twentieth century, the citizens of the advanced industrial countries began to reap the fruits of the new order. (p. 35-36)

The 'promise of technology' is even more seductive today with the exponential growth in technological development, largely as a consequence of microelectronics. A common belief is that 'experts' will find solutions to most of the world's problems, including 'tech-fixes' to existing societal and environmental abuses resulting from technology. Borgmann doubts whether technology can make good its promise in a socially just way, the creation of a more equitable and humane society:

One may ask not just whether the promise is worth keeping, but whether the promise is not altogether misconceived, too vaguely given at first and harmfully disoriented where technology is most advanced. ....The general obtuseness is not due primarily to the program of technology but arises from its execution...the initial genuine feats of liberation appear to be continuous with the procurement of frivolous comfort. Thus the history of modern technology takes an ironical turn. We can shed light on the force and the consequences of the irony of technology by first delineating the pattern of technology more sharply and by showing then how the pattern has informed our understanding of the world and the world itself. (p. 39)

Kramarae (1988) suggests that technologies should be considered as social relations and not simply as tools, machines, and processes. She argues that women are:

...influenced by the architectural designs of their homes, and neighbourhoods, local and national transport systems, household appliances, public service supports, their clothing, food preservation, infant formulas, heating and electrical resources...and by the values
Although the designers and producers of technologies are primarily men, women use technologies without having control of the design, production, or application of the technologies. As such, women may be at a greater risk in the context of the canon of the 'promise of technology'.

According to Borgmann (1984), the 'device paradigm' disconnects us from persons, things, and practices that could engage and grace us in their own right. For example, it is not uncommon to consume purchased, pre-packaged food while sitting in front of a television. This in-activity conceals realities of how, where, and by whom the food was produced; cheats us of community and family events of meal-making; and, isolates us to the pseudo-realities of communication which denies contact with real people. Borgmann comments that:

The promise leads to the irony of technology when liberation by way of disburdenment yields to disengagement, enrichment by way of diversion is overtaken by distraction, and the conquest makes way first to domination and then to loneliness... (p. 76)

If we compare the social and political forces that advance the 'device paradigm' against the way we 'take up with our world' we may be better able to familiarize ourselves with the salient features and veiled values of technology.

(ii) **Value-ladenness of Technology Disguised**

A significant factor preventing citizens from acknowledging the 'device paradigm' is the common belief that technology is value-neutral. Goldman (1984) believes that the main obstacles to the revelation of the paradigms behind the production of artefacts and systems of technological activity are "the
proprietary interest in the value structure of its decision apparatus, and the institutionalized vested interests it commonly involves and its interest in masking both by a claim of value-neutrality" (p. 142). He maintains that technology is value-laden and that the portrayal of technology as value-neutral and amoral absolves the technocrats of responsibility. The burden of dealing with the repercussions of technological activity is placed on social institutions and individual users as attention is diverted from the "subjective, parochial, and ideological character of technology, from the convergence behind the artifacts and knowledge bases of special interests, and from the political character of technology" (ibid, p. 135).

According to Christians (1989), values are an integral part of every aspect of technological processes:

Any technical object...embodies decisions to develop one kind of knowledge and not some others, to use certain resources and not others, to use energy in certain form and quantity and not some other. There is no purely neutral or technical justification for all these decisions. Instead, they arise from conceptions of the world, themselves related to such issues as permissible uses, good stewardship, and justice. (p. 125)

The values of those who have power over technology in society determine the values in society. In liberal democracies, societal values are enacted through economic, political and educational systems.

Macpherson (1977) maintains that liberal democracies are "[societies] striving to ensure that all [their] members are equally free to realize their capabilities" (p. 1). He points out contradictions in this ideology as liberal democracies are also committed to a capitalist market society. He suggests that equality can only be accomplished through "the downgrading of the market assumptions" (ibid). Borgmann (1984) is in agreement with Macpherson as he
suggests that:

We might be concerned to secure equality of education, or of political power, of moral excellence, aesthetic sensibility, of skill and responsibility..., but it is clear that in general we have no such concerns. Substantive equality is measured solely by wealth and income. It is controversial whether wealth or income is a better measure of equality or inequality. (p. 110)

With wealth comes power—the power to possess the commodities of technological production. "Income is a measure of equality that is consonant with technology, and so it has become the standard of living in a technological society" (ibid, p. 111). As income determines the number of commodities, equality in liberal democracies has everything to do with oppressions associated with race, class and gender.

Borgmann (1984) suggests that the reform of contemporary technology can be achieved by returning to the initial hope of the promise of technology. Restructuring the inequity of power, by articulating the distinctions between the standard of living and the quality of life, requires restructuring the wealth and power bases of capitalist societies.

Transforming technology requires that citizens question and open the mysterious 'black boxes' of technology, and think critically about the societal, environmental and political implications of technological development (critical technological literacy). Borgmann (1984) insists that "an important part of genuine world citizenship today is scientific and technological literacy...metatechnological practices" (p. 248). It is necessary to foreground gender power relations and other power relations as part of any critique of technology.
G. Summary

The emphasis of this chapter has been to delineate the discussion of the character of technology in contemporary North American societies. By examining current literature on technology, as well as including my own experiences, discloses that technology is strongly male-biased, that it is located in the public and productive sphere, and that citizens do not exhibit forms of technological literacy that may help them to counter the pervasive intrusion of technology in their everyday realities. As men have power in North American societies, what are considered 'significant' technologies basically reflect the interests of men. As men's endeavours are primarily located in the public and productive sphere, technologies of the private and reproductive sphere are overlooked. In capitalist societies, such as those in North America, public sphere enterprises are closely affiliated with commodity production, and consequently technologies are also predominantly identified with commodity production. The constructs of technological literacy to support industrial-capitalism are connected to technical expertise and knowledge. Technological critique conflicts with efficiency, productivity, and profitability.

As the authoritative concepts of technology have informed the basis for current technology education curricula, critiques of technology raised in this chapter are used as a context for examining technology education curricula. In chapter 3, three major questions are addressed: 1) Is there a male-bias in current technology education curricula? 2) Is the emphasis of the curricula commodity production rather than citizenship? 3) Do the notions of technological literacy in the curricula include technological critique?
A. Introduction

Recent curricular revisions in North America have attempted to re-examine and redefine the purposes, content and methodology of industrial/technology education. This chapter examines elements of two conceptual frameworks for technology education: *A Conceptual Framework for Technology Education* (ITEA, 1990); and *Technology Education: Primary through Graduation Curriculum/Assessment Framework* (BC, 1992). These documents represent two North American conceptions of technology education curricula: a perspective of the International Technology Education Association (American-based); and, a local perspective (BC-based). The character of technology education is considered in the context of the character of technology developed in the previous chapter.

This chapter evaluates the extent to which these curricula provide a basis for technology education which is appropriate for all students, at all grade levels, the extent to which the curricula address everyday private and public needs of students, and the likelihood that the curricula will promote the creation of socially constructive forms of technological literacy.

Although the ITEA and BC curricula are claimed to be appropriate for all students at all grade levels, analysis of the documents suggests that the curricula remain sexist, ageist, racist, and classist and that they may be unable to provide a significant improvement in their appeal or relevance to a broader range of students. Although designed for boys and girls at all grade levels, the content and outcomes prescribed are better suited to secondary education,
vocationally-oriented males. The gendered nature of technology as described in chapter 2 is mirrored in technology education. These curricula perpetuate the emphasis on similar masculinized technologies to those of the former industrial education curricula. Token references in the curricula to technologies appropriate for women, various ethnic groups, and young children do not provide a substantive basis for concluding that the curricula are likely to be relevant to the needs of all students at all grade levels.

The revised curricula are found to support the underlying assumptions that the primary purpose of technology education is to prepare students to become compliant and adaptable workers in support of industrial-capitalism. The focus on the manufacture of commodities overshadows technologies which may be important to the private and family lives of students. A significant shortcoming of the revised curricula is their lack of emphasis on the promotion of socially meaningful forms of technological literacy.

In chapter 4, I consider the social, economic and political structures which prevent technology education from becoming more socially constructive, and contemplate strategies for countering those structures.

B. Content of Curricula

The ITEA conceptual framework for technology education incorporates the knowledge base identified in its forerunner, the Jackson's Mill Industrial Arts Curriculum Theory (Snyder & Hales, 1981). In the ITEA curriculum document, domains of knowledge are classified as: (1) sciences, (2) humanities, (3) technologies, and (4) formal knowledge. The domains of knowledge are
described as "[enabling] humans to adapt to their environment" (ITEA, 1990, p. 8). The 'technologies domain' is described as including "all recorded knowledge relating to the types of technology" (ibid). The writers propose a model which relates the technologies domain to three 'human adaptive systems': (1) technological, (2) sociological, and (3) ideological.

The *Jackson's Mill Industrial Arts Curriculum Theory* writers identify four "universal" technical systems—communication, construction, manufacturing, and transportation—technical systems that are basic to every society" (Snyder and Hales, 1981, p. 16, emphasis added). The ITEA document essentially mirrors this earlier curriculum model, including the human adaptive systems noted above. The ITEA document also divides the study of technology into four content areas, referred to as the "content reservoirs of Bio-related... Communication... Production... and Transportation Technology" (ITEA, 1990, p. 17, emphasis added). They describe these content areas as follows:

*Bio-related Technology* applies biological organisms to make or modify products... (ITEA, 1990, p. 17)

*Communication Technology* focuses on the processes and techniques of encoding, and decoding graphic and electronic messages... (Ibid)

*Production Technology* uses technological means to construct resources into goods, standard stocks, and structures... Production technologies are used to prepare or modify material resources by mechanical or chemical means so they become direct consumer products... (Ibid)

*Transportation Technology* is used to move people and products within society. (Ibid, p. 18)

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1 Pannabecker (1991) is critical of technology educators' persistence in categorizing and limiting technology to 'universal' systems. "[The] current curriculum and standards of technology education suggest that technology is a phenomenon with a particular form, content, and direction resulting in impacts that can be studied objectively. For example, the notion of universal technical systems such as communications, construction, manufacturing and transportation implies particular form and content" (p. 45).
The major changes from the Jackson's *Mill Industrial Arts Curriculum Theory* are the combination of construction and manufacturing into one content area called production, and the addition of a new classification called bio-technology.

The BC conceptual framework for technology education also identifies domains of knowledge: (1) technical, (2) social, and (3) intellectual, and uses a four-component model, similar to that of the ITEA, to identify the content of the curriculum. These four content areas are: information, materials and products, power and energy, and systems integration technology (BC, 1992). They closely resemble the Jackson's *Mill Industrial Arts Curriculum Theory* content areas of communication, production, transportation, and manufacturing technology. Bio-technologies are not included in the BC document. The BC writers describe their four content areas as follows:

*Information Technologies* relate to the production, transmission, receiving, and analysis of information through visual and electronic media... (BC, 1992, p. 24, emphasis added)

*Materials and Products* involves the study and use of tools and materials to make things... (ibid, p. 26, emphasis added)

*Power and Energy Technologies* embrace energy sources and conversion, power development and transmission, and the resulting impacts on natural resources and the environment... (ibid, p. 28)

*Systems Integration* is the bringing together of systems and managing them for a specific purpose...the integration of systems includes input, processing the resulting information to make a decision, and using the decision to effect a response or output. (ibid, p. 30)

These content areas are described in the context of the production of commodities, primarily in the industrial domain of the public sphere.

Although the ITEA and the BC curricula have been renamed 'technology education' from 'industrial education', and there has been an attempt at a
philosophical shift, the content of the curricula primarily reflects what can and has been taught by specialist industrial educators in specialized 'industrial shops'. The four content areas of both curricula require the tools, machinery and facilities of the former drafting, electronics, metal, wood and automotive shops with the addition of more sophisticated, 'high' technology equipment. Many industrial education shops already have computer assisted drafting, computer numerical control, video and photography equipment to meet the outcomes promoted in the ITEA and BC curricula.

An examination of the ITEA and BC curriculum indicates that attempts have been made to broaden the scope of technologies studied, beyond those included in previous industrial education curricula. The ITEA document contemplates consideration of a range of 'new' technologies, such as bio-related technologies important in medicine and agriculture. The document also suggests studies of modern communications technologies such as those involved in global communications and coded information storage, as well as a broadening of the traditional manufacturing technologies to include the production of food and chemicals. Although the ITEA curriculum document does comment on such technologies, it neither recommends particular student activities relating to the potential broadening of scope, nor claims that broadening the scope is a significant change from previous curricula. The ITEA curriculum proposal emphasizes that changes in pedagogy constitute the thrust of the changes from previous curricula. The document states that: "the new departure for technology education is 'process education' using the technological method" (ITEA, 1990, p. 30).
The description of the content areas in the proposed BC curriculum may similarly be viewed as broadening the scope of the technologies included in technology education. The sample activities suggested for each content area suggests a rather limited expansion of the scope of technologies which students might explore. Table 1 lists sample activities for each content area. The list of sample activities primarily retains a focus on making artefacts of the same types that were made in the context of industrial education. Perhaps making a whirligig and researching and publishing a list of nearby oil recycling stations are exceptions.

Table 2 lists the outcomes\(^2\) from each of the four content areas of the proposed BC curriculum. Translating, acting, and theatre appear to depart from typical 'industrial' applications of industrial education. Consideration of the range of sample outcomes illustrates that the scope of technologies envisioned by the curriculum writers may not differ significantly from those traditionally included in industrial education.

It is arguable that the sample outcomes and activities do not limit the scope of the technologies which may be studied within each content area. However, in the absence of convincing arguments, substantive direction from curriculum documents, as well as considerable support and initiatives from school boards and teacher education institutions, it is not likely that technology education teachers will be able to effect a significant broadening of the scope of technologies beyond those that are presently taught.

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\(^2\) In the BC curriculum document, outcomes are stated as "field applications that encompass avocational, community, and career opportunities..." (BC, 1992, p.26).
### Table 1. Sample Activities Specified for BC Technology Education

(BC, 1992)

<table>
<thead>
<tr>
<th>CONTENT AREA</th>
<th>ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>- discover information from a database</td>
</tr>
<tr>
<td></td>
<td>- research and word process a report</td>
</tr>
<tr>
<td></td>
<td>- design a &quot;tin can and string&quot; telephone</td>
</tr>
<tr>
<td></td>
<td>- conduct telecommunications with students in other schools</td>
</tr>
<tr>
<td></td>
<td>- design a fibre optic system to transmit sound</td>
</tr>
<tr>
<td></td>
<td>- design graphics for a theme</td>
</tr>
<tr>
<td></td>
<td>- design playground layout and equipment</td>
</tr>
<tr>
<td></td>
<td>- produce an action video</td>
</tr>
<tr>
<td></td>
<td>- design and make a laser levelling device</td>
</tr>
<tr>
<td></td>
<td>- design and produce board game pieces using computer</td>
</tr>
<tr>
<td></td>
<td>- aided manufacturing processes</td>
</tr>
<tr>
<td>Materials and Products Systems</td>
<td>- design and build a locker organizer</td>
</tr>
<tr>
<td></td>
<td>- design and make a wood plaque</td>
</tr>
<tr>
<td></td>
<td>- design and make a family game</td>
</tr>
<tr>
<td></td>
<td>- design and make a project from scraps</td>
</tr>
<tr>
<td></td>
<td>- design and make a toy for daycare</td>
</tr>
<tr>
<td></td>
<td>- design and build a prototype of a water container</td>
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<tr>
<td></td>
<td>- mass produce a student-designed lamp, clock, etc.</td>
</tr>
<tr>
<td></td>
<td>- design and build a tourist information booth</td>
</tr>
<tr>
<td>Power and Energy Systems</td>
<td>- wire a light switch</td>
</tr>
<tr>
<td></td>
<td>- design and build a whirligig</td>
</tr>
<tr>
<td></td>
<td>- design and build a windmill to aerate a pond</td>
</tr>
<tr>
<td></td>
<td>- research and publish a list of nearby oil recycling stations</td>
</tr>
<tr>
<td></td>
<td>- troubleshoot and repair a utility engine</td>
</tr>
<tr>
<td></td>
<td>- design and build a model space station</td>
</tr>
<tr>
<td>Systems Integration Technology</td>
<td>- model a hydraulic system using syringes</td>
</tr>
<tr>
<td></td>
<td>- design and make a steering system for a soap box racer</td>
</tr>
<tr>
<td></td>
<td>- design and make an electronic system to sound alarm</td>
</tr>
<tr>
<td></td>
<td>- design and build a pop can crusher</td>
</tr>
<tr>
<td></td>
<td>- design and make a device to move heavy articles</td>
</tr>
<tr>
<td></td>
<td>- design and make an automatic shut-off device for something at home</td>
</tr>
<tr>
<td></td>
<td>- troubleshoot and service a hydraulic system</td>
</tr>
<tr>
<td></td>
<td>- use computer interfaced robot to separate items or load a machine</td>
</tr>
</tbody>
</table>

The knowledge selected in the ITEA and BC curricula reflect the partial and partisan interests and experiences of those traditionally responsible for teaching industrial education. The technologies selected for technology
education curricula are problematic not only because they present narrow and distorted views of the technological world, but also because of the implications of the selection of knowledge for pedagogy of technology education.

Table 2. Sample Outcomes specified for BC Technology Education (BC, 1992)

<table>
<thead>
<tr>
<th>CONTENT AREA</th>
<th>OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>translating, acting, communications, photography, CAD, drafting, graphics, theatre</td>
</tr>
<tr>
<td>Materials and Products</td>
<td>jewellery making, upholstery, boat building, furniture making carpentry, fabrication, tailoring, stagecraft</td>
</tr>
<tr>
<td>Power and Energy Systems</td>
<td>automotives, domestic appliances, marine, heavy duty equipment (earth movers), home and utility machines</td>
</tr>
<tr>
<td>Systems Integration Technology</td>
<td>computer aided manufacturing, computer integrated manufacturing, robotics, security fire systems, automated stitchery and embroidery, computer numerical control, home entertainment systems</td>
</tr>
</tbody>
</table>

The content of former industrial education curricula has primarily been dedicated to teaching industrial tool and machine skills. Illich (1973) criticizes such education in schools:

Present institutional purposes, which hallow industrial production at the expense of convivial effectiveness, are a major factor in the amorphousness and meaninglessness that plague contemporary society.

(p. 11)

He believes that educators should be teaching tools for conviviality, not tools for industry. "Tools foster conviviality to the extent to which they can be easily used, by anybody, as often or as seldom as desired, for the accomplishment of a purpose by the use" (ibid, p. 22). Illich's concerns of two decades ago appear

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3 By conviviality, Illich (1973) means "the opposite of industrial productivity" (p. 11).
to have gone unheeded as the selection of knowledge for technology education curricula does indeed continue to be devoted to industrial production.

Illich refers to schools as industrialized institutions where the "assembly-line production of knowledge" (ibid, p. 18) produces a "commodity called 'education'" (ibid, p. 19). This assembly-line metaphor is especially appropriate for technology education, particularly in light of the fact that the writers of the BC curriculum state that "the original spirit of Industrial Education has been retained: to provide students with relevant hands-on training in technical skills, knowledge, and attitudes appropriate to the world in which they live" (BC, 1992, p. 13).

C. Achieving Curricular Intents

The 'mission' of technology education according to the writers of the ITEA document is "to prepare individuals to comprehend and contribute to a technologically-based society" (ITEA, 1990, p. 20). However, no definition is presented to clarify the writers' interpretation of technologically-based society. The BC curriculum document has an instructive commentary on the purpose of technology education in the Aim statement:

The aim of Technology Education is to enable learners to become confident and responsible in solving technological problems and striving for product excellence, social consciousness, and creative lifelong learning. (BC, 1992, p. 35, emphasis added)

The 'problems' to be 'solved' are technological, the end result may be a product, and students will presumably create such products with a social consciousness. There is no clarification in the document of what the writers believe to constitute social consciousness.
(i) **Problem-Solving**

Problem-solving, described as "technological method model" in the ITEA curriculum (ITEA, 1980, p.13), and as "technological methods" in the BC curriculum, (BC, 1992, p. 22) are presented as the methodology to achieve the stated purposes of the curricula. In addition to the **universal systems** of technology which represent the selection of knowledge for the curriculum, the delivery of that content is prescribed by **universal methods**. The BC document, for example, explicitly states that: "Students need to be taught universal methods for finding technological solutions" (ibid, p. 21, emphasis original). As described above, these universal systems and methods are problematic as they imply that technology has a certain form and content, thus limiting the breadth of technology.

The *first* goal of the ITEA curriculum is to "[utilize] technology to solve problems or meet opportunities to satisfy human needs and wants" (ITEA, 1990, p. 20). Similarly, the BC conceptual framework identifies problem-solving in its *first* 'curriculum intention'. "The learner will have opportunities to develop the ability to solve technological problems" (BC, 1992, p. 36).

The ITEA and BC curricula identify problem-solving both as a method of acquiring some form of 'technological literacy' and as a skill that is of special

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4 According to the ITEA (1990) document, "human wants and needs lead to the to the identification of technological problems and opportunities. Problems are questions or matters involving doubt, uncertainty, or difficulty. They deal with choices of action which might ameliorate unsatisfied human needs and wants. Opportunities, on the other hand, are future-oriented. That is, they can be planned and, in fact, created" (p. 15).

Neither the ITEA nor the BC curricula address: the criteria used to determine 'needs and wants'; who determines the 'needs and wants'; and, whether or not students are solving technological problems for human 'needs', 'wants'...or 'greeds'.
value for future employment as a participant in the production of goods. The problem-solving skills may represent a significant advancement in industrial education pedagogy. Although the curriculum documents do not provide a substantive basis for using problem-solving to empower students to critique the social and political implications of technology and technological developments, problem-solving may help create a learning environment which places more value on student thinking and initiatives and thus contribute to a more interactive and meaningful learning atmosphere. The experience of a local technology education teacher may help illustrate this point:

Problem-centered activities have been successful in helping students develop critical thinking skills and have met with a great deal of satisfaction and interest from them. Students ownership has had a profound effect on motivation and interest levels especially in many lower ability students. Students more effectively learn the "big ideas and connections" not only within technology but with other subject areas. I believe this more student-centered approach leads to higher levels of student achievement, retention, satisfaction, and self-confidence. Technical content is still taught but is introduced as required in the process of solving the problem, rather than as an end in itself. (Bastone, 1992, p. 2)

Problem-solving implies student involvement and a sense of ownership which will make the learning activities more meaningful. It also provides a basis for developing technological thinking skills that will have a more lasting value than learning to use particular tools or machines. From extensive teaching experience and research in Britain on the role of problem-solving in learning, Kimbell (1982) suggests that "one design problem of direct personal relevance to the child will elicit more thinking than three to which he [sic] cannot relate" (p. 32).
Making 'things or systems' for 'human needs and wants' are principal objectives in both the ITEA and the BC curricula. "Developing the ability to make things and explore technology" is the second highlighted curriculum intention of the BC document following problem-solving as the first curriculum intention (BC, 1992, p. 36). In the Introduction of the BC document, the writers emphasize that students will be able to demonstrate their technological knowledge, skills, and attitudes "by making high-quality articles, systems, and environments through effective and safe work practices" (ibid, p. 13).

Explaining the activities in which students of technology education will be engaged, the writers submit that "[students] will often make and perhaps market their final product" (ibid). The ITEA document emphasizes that technology education is primarily about the production of goods as it states that technology education should be devoted to "creating technology for human purposes...and using appropriate technological knowledge, resources, and processes to satisfy human wants and needs" (ITEA, 1990, p. 20). The philosophy statement of the ITEA conceptual model, as quoted above, as well as the Recommendations for Implementation, explicate the need to graduate students who can contribute to productivity and competitiveness in the public sphere:

A technologically literate population is essential for economic vitality....Technology education can provide a foundation for an increasingly technologically capable work force. (ibid, p. 30)

The BC conceptual framework is ambiguous in its acknowledgement of the interdependence of industry and technology education at the primary and
intermediate levels. The relationship is, however, quite explicit at the graduation level. In the Rationale of the document, the writers state that students need technology education "to meet the challenges of future work and leisure" and that "careers of the future" will require the "hands-on problem-solving" skills learned in technology education (BC, 1992, p. 15). In a discussion of technology education for the intermediate years, the writers again comment on preparation for future 'work':

As the complexity of their work increases, so must the scope of tools, materials, and techniques. The exploratory experience in a technical environment improves psychomotor skills, sensory awareness, and the commitment to produce quality products. (ibid, p. 17)

The dedication to producing workers for industry is exemplified in the section of the BC curriculum which focuses on the final two years of a student's secondary education, defined as 'the graduation years':

...Technology Education provides specialized learning opportunities for students intending to enter technological or vocational career fields, as well as more general opportunities for students choosing other options. The ability to adapt to a changing technological society and accept social responsibility is paramount for all citizens in the pursuit of new careers and lifestyles. (BC, 1992, p. 17)

Both the ITEA and the BC curricula visualize technology education as the principal means by which students can gain the skills and knowledge necessary to maintain a productive, efficient, creative, adaptable and flexible workforce--attributes needed to support market economies. Although notions such as social responsibility, are occasionally mentioned, attributes for democratic citizenry such as tolerance, generosity, respect, sense of justice, compassion and love are not among the attributes listed above.
D. Economic Needs vs Citizenship

Both the ITEA and the BC curricula emphasize the fact that they are moving from a teacher-centered orientation to a student-centered orientation in which the students will be solving technical or technological problems for the 'workplace'. The workplace appears to be the industrial domain of the public sphere where students, in the future, will be employed for wages to make commodities for consumer markets. For example, the BC writers explain that "the workplace of the 1990s is seeking skilful, innovative people who are able to adapt to change, tackle problems, and create new, exciting solutions" (BC, 1992, p. 21).

From the characterization of workplace throughout both documents, it appears that the home, which has for centuries been the location of women's work (almost always unpaid), is not considered a workplace by the curriculum writers. This observation is reinforced again in the BC document which describes three human contexts: individual, community and world of work. Sub-titles, for others and entrepreneurial, are supplied under the heading world of work. The corresponding sample activities supplied by the writers all coincide with the industrial workplace. Examples of the activities are as follows: information technology--design and make a laser levelling device; materials and products technology--mass produce a student-designed lamp, clock, etc.; power and energy technologies--troubleshoot and repair a utility engine; and, systems integration technology--troubleshoot and service a hydraulic system.

The invisibility of the work customarily performed in the home, by
females, is evident in the ITEA conceptual framework for technology education as well. ITEA curriculum writers, in their *Philosophy* statement, purport that:

> Technology education should allow for the interaction of the business and industrial community with students, and encourage programs to enhance skills and understanding regarding occupational productivity, personal responsibility, and career opportunities in the community and world society. (ITEA, 1990, p. 27)

Interaction between the students and their homes, programs to enhance skills and understanding in their homes, personal responsibility in their homes, and opportunities in their homes are notions which are again not addressed. Both curricula treat technologies of the private sphere as though they are inconsequential or non-existent.

The ITEA and BC curricula focus on potential 'future needs' which are some blend of students' future needs and the future needs of industry. There seems to have been little consideration of relevance to the current public and private needs and interests of students such as that proposed below:

> Relevance is not a matter of adapting a subject to the apparent interests of a pupil or to the apparent fashions of the moment. Relevance is achieved by assuming that a pupil or students has something to contribute to the subject. Relevance at its deepest has nothing to do with subject matter; it has to do with the status of the learner in relation to what is being learned. (Mason, 1977, as quoted in Osborne, 1991, p. 190)

Lather (1986) maintains that educators' assumptions of their role as privileged possessors of expert knowledge mislead them into regarding that what they 'know' is relevant for students. To suggest that school should prepare young children for 'future' careers invalidates their immediate experience.

Meeting economic needs rather than educating students as citizens appears to be the primary goal ITEA and BC curricula. For example, the ITEA document has an entire section entitled, *Addressing Student Needs*, yet the
conclusion of this section emphasizes the need to meet capitalist agendas:

If we do not tap the potential of all learners, we fail to develop and utilize a substantial portion of our human resources. Our society's continued economic growth and national security depend upon the intellectual development and productivity of all citizens. Therefore, it is imperative that technology educators ensure that every student is prepared with the skills necessary to make a meaningful contribution to society and self. (ITEA, 1990, p. 25)

Consistent with the industrial focus and lack of concern for students as citizens evident in the ITEA curriculum, "technological problem solving and striving for product excellence" is the primary emphasis in the BC curriculum (BC, 1992, p. 15).

The notion that schooling has been responding to the appeals from corporate executives for a more flexible, more adaptable, and more creative workforce has come under scrutiny. For example, a report from the CAW Education Department (1992) makes the following observations:

Underneath this corporate rhetoric is a training program that is almost exactly opposite of what it says it is. This kind of thing used to be called the "big lie"--a lie so flagrant, that it seemed impossible that someone could really be telling it....These people are not concerned with our education. Their purposes are not centered on improving our skills and our knowledge, though that may happen sometimes along the way. They are focused instead, as they have always been, on corporate profit-making and management control....The new skills the corporations are now demanding have little to do with what we think of as real skills at all. In most respects they really amount to a show of commitment to management, who can then direct their [workers] toward faster and more efficient production. (p. 118-119)

From my experience in industry, I saw jobs becoming redundant as plants automated and restructured. Jobs which required physical strength and specialized intensive labour skills were being replaced by computers and robots. Workers were not getting dirty, the workplace became cleaner, and workers were sitting in front of computers or pushing buttons to operate
robots. "Management insists that these are 'higher skills' because workers are now using their 'minds' rather than their bodies" (CAW Education Department, 1992, p. 120). However, these jobs are often mindless and extremely boring. Unfortunately, technology educators appear to have bought the 'big lie'. Both curricula state that their aim is to produce 'educated citizens' with the corporate attributes requested by business and industry. Industrial education was essentially a skills-oriented program. The revised technology education curricula boast that the programs are now hands-on/heads-on programs. However, the curricula are focused on thinking about how to solve technological problems and to make more and better commodities. These curricular frameworks incorporate requisite training for corporate agendas:

What [business and industry] want [are] young people to...fit their minds into an intellectual framework which they didn't help create and which does not touch any human reality they know. Just as workers are to fit their minds into the logic or corporate machinery. (CAW Education Department, 1992, p. 129)

Several writers have exposed the contradictions and fallacies of our present liberal democratic education systems in Western society (Apple, 1982; Giroux, 1981; Illich, 1973; Osborne, 1991, Willis, 1977). They see schools as puppets and reproducers of capitalist ideologies. For example, Willis (1977) argues:

Capital requires it, therefore schools do it! Humans become dummies, dupes, zombies....This will not do theoretically. It will certainly not do politically. Pessimism reigns supreme in this, the most spectacular of secular relations of predeterminism. (p. 205)

Illich (1973) considers schools responsible for the inculcation of materialistic, mechanistic values in students. Rather than promoting 'conviviality', he views schools as training centres where students are 'acculturated' to meet the needs
of industry:

Educators define how people are to be trained and retrained throughout their lives—shaped and reshaped until they fit into the demands of industry. (p. 76)

As such, technology education curricula do not meet the requirements of general education for all students. The curricula do not provide a basis for addressing the everyday private and public needs of students.

E. Curricula for All Students?

Both the ITEA and BC curricula state that the conceptual frameworks for technology education are intended to meet the needs and interests of all students. The writers of the ITEA document go so far as to say that:

"...historically...[the curriculum has] been responsive to meeting the unique needs of a variety of learners", and they continue by commenting that their conceptual framework "must mirror a commitment to diversity and dedication to a full and informed life for all students (ITEA 1990, p. 25). The BC writers echo a similar belief that the scope of their document includes the interests and needs of all students, and they also offer a 'reason' why all students are now being considered for technology education:

The reorganization of our school system determines that the clientele of Technology Education will include all students from primary to graduation—girls as well as boys, university-bound as well as vocational, special needs as well as mainstream students—every student. (BC, 1992, p. 14, emphasis original)

Both curriculum documents also suggest that they are designed for all grade levels. However, both curricula reflect primarily the interests, experiences and training of secondary educators. The lack of input from
educators with expertise and experience at the primary grades is apparent in
the documents. For example, as listed in Table 2, the BC document identifies
sample outcomes, in the content area of *systems integration technology*, that
are to apply to students from primary to graduation: computer aided
manufacturing; computer integrated manufacturing; robotics; security fire
systems; automated stitchery and embroidery; computer numerical control;
and, home entertainment systems. These activities reproduce the traditional
interests of secondary education, industrial educators who developed this
curriculum, but are unrealistic with respect to the needs and interests of young
children. Neither curricula seriously addresses the question of what represents
appropriate content or pedagogy for the younger children.

Another serious shortcoming of the ITEA and BC curricula is the failure
of both documents to make the curricula relevant and appropriate for the wide
range of students in the public school system. A number of writers have
commented on reasons why females have not participated fully in industrial
education. (e.g. APU, 1990; Bruce, 1985; Catton, 1986; Farris, 1980; Grant,
reasons include: a lack of female role models, social and cultural conditioning
inside and outside schools, teaching methodology, context of the learning,
teacher expectations, counselling, sexist language in written and verbal
communications, heavy industrial facilities and equipment, and the focus on
industrial technologies to the exclusion of technologies of immediate and
historical importance to women.

In both the ITEA and BC documents, attempts are made to attract
female students by the inclusion of a *human context* to the curricula by using a *fabric* analogy. The analogies between people, technology and textiles are both misleading and inappropriate as people are objectified and equated with technology. Technology and people are depicted as harmonious, symmetrical *threads* of the *fabric* of society. It is noteworthy that the ideas of a *human* dimension are advanced by capitalizing on vocabulary generally associated with women. The BC document states:

> If we take human contexts as the *warp* of society and technology as the *woof*, the resulting weave becomes the *mesh of the two*: people both direct technological development and live life patterns influenced by it. (BC, 1992, p. 19, emphasis added)

The ITEA (1990) framework uses similar *fabrication*: "Throughout the history of civilization, the *social fabric of humans* and their enterprises has been *interwoven* with the *thread of technology*" (p. 7, emphasis added). It appears that both groups of curriculum writers may be 'spinning the same yarn'.

The technologies included in the ITEA and BC curricula relate to public and productive sphere technologies and overlook technologies of the private and reproductive sphere which is usually associated with women. One way of understanding the male-bias in technology education curricula is to ask questions such as: For what purpose? What knowledge has been selected? For whom? By whom? Asking such questions, contextualizes technology education curricula and assists in ascertaining if the curricula truly represent the multiple realities and needs of a diversity of students. By examining the production of knowledge for technology education, "It makes visible ways in which privilege and power are invisible in the mainstream curriculum" (Warren, n.d., p.46).
The voices of aboriginal people were not included in the development of the curricula, yet the writers of the BC document appear to presume that they can speak on their behalf. In a diagram explaining themes of technologies, *First Nations Culture* is given as an example theme, and *models of totems* is suggested as an activity. This tokenism exemplifies the trivialization of, insensitivity to, and ignorance of aboriginal people, and might leave an unenlightened reader with the impression that serious consideration has been given to the needs and interests of aboriginal students. Significantly more consultation and deliberation is required if these curricula are expected to become meaningful to aboriginal students.

The middle-class activities and content prescribed in the curricula are a consequence of the absence of voices from different socio-economic backgrounds. The choices of tools and sample activities in the BC curricula in particular, demonstrate insensitivity to poorer communities, schools and students. This reinforces middle-class/working-class dichotomies. The emphasis on commodity production will do little to encourage the learning of students who have no resources to buy such commodities, and may do more psychological damage than good. In my own high school experience, I was not permitted to take industrial education but was required to take home economics. It was very difficult to be enthusiastic about creating beautiful pastries when my family often did not have bread; it was very difficult to be enthusiastic about making a cotton blouse when I could not afford the fabric. Relevance is determined by the knowledge, experiences and immediate needs of students, and cannot be determined by those with different knowledge.
experiences and needs.

F. Critical Technological Literacy

The concept of 'technological literacy' has received significant attention over the past few years by technology educators. Although debates about technological literacy have resulted in considerable contradictions in the interpretations, there appears to be consensus regarding the inclusion of technological literacy as a goal of technology education:

...having set forth its commitment to technological literacy so unambiguously, the field of technology education has had the problem of trying to communicate just what technological literacy means, and how it could [or should] be measured. (Lewis and Gagel, 1992, p. 132)

There may be conflicting sets of values underlying the interpretations of technological literacy. For example, one may be based on the economic values of materialism, efficiency and profitability while another may be more closely attuned to basic needs and human well-being. The interpretations put forward in both the ITEA and BC documents appear to embrace economic and materialistic values. The ITEA document includes the statement that:

A technologically literate population is essential for economic vitality. Business and industry are encouraged to join technology educators in developing and delivering programs in technology education. (ITEA, 1990, p. 30, emphasis added)

The BC writers define technological literacy in terms of what is learned through problem solving. They say:

Technological literacy is effectively achieved through people solving practical problems using critical analysis, design, production, testing, and evaluation. These activities are the essence of Technology Education. (BC, 1992, p. 15, emphasis added)

To become 'technologically literate' means more than being able to solve
technological problems or to manipulate tools and machines. Fensham (1991), in reviewing technology education in a variety of countries, suggests that technology education is generally viewed as consisting of three components: **technological awareness/understanding; technological capability; and technological critique/literacy.** By **technological awareness/understanding,** Fensham means acquiring knowledge about technologies. Such understanding requires considerable factual and conceptual knowledge about the vast array of technologies which influence all aspects of our lives. By **technological capability,** he means the ability to develop and implement solutions to human needs and problems. Fensham describes **technological critique/literacy** as the ability to operate independently and to be a critical decision-maker within a technological society. Such critique/literacy provides the means to critique the individual, social, political, and environmental implications of technological development. Because every technological development has potential for benefit and for harm, it is important that students learn to critically evaluate all aspects of technology. In a discussion of the British Craft Design Technology (CDT) curriculum, Down (1986) identifies similar components of technology education as those described by Fensham, and concludes that making students critically aware of the social issues of technology must be a priority of technological education:

The aims, then, of a technological education must be primarily that of preparing children, morally and politically, for understanding and being critically aware of the social issues of technology. Secondly it must involve learning how to employ technological devices, wherever appropriate. Thirdly, in relation to CDT, it must include some involvement in and understanding of the areas of technology that can be related to designing and making. (p.128)

Neither the ITEA nor the BC curriculum stresses the importance of
technological critique as an aim of technology education. For example, in the BC document:

The aim of Technology Education is to enable students to become confident and responsible in solving technological problems, and striving for product excellence, and creative lifelong learning. (BC, 1992, p. 35)

The aim of achieving 'social consciousness' may imply some form of critical understanding of technology, but there is little indication as to how such understanding might be achieved. Technological literacy is referred to in the Rationale of the BC document which states:

Technology, whether traditional or advanced, is the dominant force of this century. It is as basic to education as language and numeric literacy. The roots of technology will always be people using tools and materials, and thinking, and thoughts to modify and create articles and environments to enhance the quality of life. Only a technologically literate person can combine the practical use of tools and materials with systems and processes in an informed and ethically responsible way. (ibid, p. 15)

It might be understood from the Rationale statement that technological literacy is the ability to use tools and materials in an informed and responsible way. If this is the intended meaning, it is not an adequate description of technological literacy that is required of all citizens, whether or not they are active in developing, or implementing technologies. The writers do not expound on the notions of informed or ethically responsible. There is no mention of students critiquing technology, as the assumption has been predetermined that students are to combine the use of tools and materials with systems and processes. The ITEA document suggests that students will become technologically literate (and capable) by using technology in a variety of ways such as using technology to satisfy human needs (ITEA, 1990). Some form of critique may be implied in such goals as "evaluating technological ventures according to their positive and
negative, planned and unplanned, and immediate and delayed consequences (ibid, p. 20).

Although the definitions of technological literacy are not clearly articulated in the ITEA or BC curricula, it is clear that technological literacy is not intended to encourage students to question the assumptions that technology and technology education should be devoted to the support of commodity production and economic growth, in the context of a capitalist market economy. DeVore (1991) comments that one of the major errors made by technology educators is their attempt to define technological literacy without examining the paradigmatic foundations for the definitions. Without substantive clarification of the meaning of technological literacy and identification of its underlying paradigms, the reverent inclusion of technological literacy as a goal of technology education is essentially rhetorical.

Neither the ITEA nor the BC curricula comment on the possibility of critiquing and exploring the principles of a 'technological society', and the possibility of debating what sort of moral, ecological, economic, and political societies we might wish to establish. Consequently, they do not examine the roles that technology and technology education might play in fostering such considerations. In the context of the narrow view of technological literacy expressed in the ITEA and BC curricula, the characterization of society as technological, represents a device which is likely to impede students from countering the indoctrination resulting from the promise of technology. The ITEA and BC curricula are not likely to be helpful in creating forms of socially constructive technological literacy.
G. Summary

Both the ITEA and BC documents propose concepts of technology which focus on things, information and practices associated with male endeavours in the industrial domain of the public sphere. The significant concentration on problem-solving of technological problems and making things is oriented to preparing students to become adaptable, flexible, enterprising, compliant workers for their future careers in industry and business.

The curricula reflect only the interests and experiences of secondary educators. Historically the curricula accommodated primarily under-achieving boys, and in the recent curricular revisions, attempts to attract other students, display a lack of understanding of students' social position, oppressions, economic status, interests, values and technological needs. Needs of impoverished students are not addressed as the curricula deal with middle-class activities, as they might be taught by middle-class teachers, in middle-class schools. Technocratic problem-solving, and the focus on making more and better things and systems, serves industrial-capitalism. This vocational bias attends to a limited range of students, primarily boys who are interested in pursuing projected vocational or technical careers, to the exclusion of academically-oriented students. The technologies of the public sphere, beyond the industrial domain, as well as technologies of the private sphere are given little attention, while technologies of peoples of other nations and cultures are ignored or trivialized. Problematizing technological issues that may address the everyday needs of all students have not been considered.

Historically females, aboriginals and various ethnic and racial groups
have been excluded from the development of industrial education curricula. Voices that may question, redirect and enhance the selection of knowledge, that celebrate cultural, political, or religious differences, and that work to resist sexism, racism, and classism are not reflected in the revised curricula. Dialogue that encourages a *polyphony of voices* and values differences of perspective, may effect a transformation of technology education curricula by challenging the dominant discourse of the voices of power. The voices that influenced both the ITEA and the BC curricula predominantly represented the interests and experiences of white, male, industrial educators. The curricula have been designed *for others*, with little effort directed at designing curricula *with others*.

Neither the ITEA or the BC curricula are appropriate for all students, address the everyday private and public needs of students, or are likely to promote forms of socially constructive technological literacy. The revisions have resulted in curricula which do little more than *paint over the rust* of the former industrial education curricula. Therefore, transformation, not revision, of the premises of current technology education is essential. As technology is 'the way we take up the world', technology education could play a pivotal role in creating democratic education. This would mean asking some very fundamental questions and would require addressing the structural and relational interconnections between educational institutions and the larger economic and political institutions.
A. Introduction

This exploratory inquiry of technology education began by asking some fundamental questions about recent curricular revisions of technology education curricula. The answers are not reassuring. Revisions to the curricula are cosmetic, cliché, partial and partisan. The inherent sexism, racism, and classism of former industrial education curricula have not been dealt with in the revised technology education curricula. The revisions are not relevant and appropriate because everyday private and public needs of students are treated as ancillary to the social reproduction of human resources with compliant dispositions, in order to serve industrial-capitalist needs. Significant outcomes of the curricular modifications are technological problem-solving and commodity design and production capabilities.

Technology educators have neither acknowledged nor articulated the paradigms in which technology education are located. Because the paradigms have not been explicated, the authentic goals of technology education are obscured. The curricula contribute to, rather than overturn technological exploitation of people and this planet, because they overlook the contradictions between liberal educational goals and schooling for democracy.

The shortcomings of technology education curricula in creating critically technologically literate citizens invite the question of what can be done to transform the curricula to achieve that end. The principal weakness of technology education curricula arises from its failure to recognize the hegemony associated with the technological world in which humans operate.
This chapter introduces pedagogies which may be worthy of consideration as appropriate and potentially effective methodologies to counter hegemony and thereby facilitate socially constructive technology education. Current solutions, such as integration of subjects and mainstreaming of others, are shown to be deficient in their ability to effect such transformative curricular changes. Critical, Freirian, and feminist pedagogies are shown to offer possibilities in problematizing the reproduction of social inequalities in schools and may point the way to more equitable and just education, and to the creation of equitable and just societies.

B. Could Technology Education Contribute to Transformative Education?

Based on the problematic nature of technology education identified in this thesis, it would be conceivable to conclude that technology education should not be taught at all in schools. This critique, however, does not suggest that technology education is necessarily any more problematic than any other subject area. If this same kind of inquiry was applied to other school subjects, similar concerns may also be identified for those subject areas.

Rejecting technology education as a subject area worthy of study is inappropriate for other reasons as well. Because technology is so much a part of our lives, being anti-technology is in effect being anti-human. However, there is justification for unthinking and rethinking technology education in its present forms. This may require deconstructing the very premises of current technology education curricula and reconstructing curricula which are just, equitable and dedicated to social transformation.
Although, all of education may warrant such restructuring, it may be reasonable to start with technology education for the following reasons:

1. Technology is integral to our very being as "the world of technology is the sum total of what people do..." (Franklin, 1990, p. 123).

2. Technology education is an area where students and teachers can combine theory with practice, thought with action, and, knowledge with experience. Technology education can be a place where students and teachers do, as well as understand.

3. Technology education could be a catalyst for a more holistic education, which connects knowledge from other subject areas, as well as connecting learning in the classroom with the world outside of the classroom.

4. Technology education is a subject area where students and teachers could learn together to be critical of technology, technology education, and the 'outside' world, so that they are empowered to create a more humane world.

We are deluged with technology in almost every aspect of our day-to-day experiences: brushing our teeth; preparing a meal in the morning; transporting ourselves to school; communicating with someone across town; lobbying against deforestation, chemical spraying, damming of our rivers; and intrusion of educational technology into classrooms. Schools historically have ignored the everyday and political aspect of our lives, and students are expected to
mysteriously know how to *take up the world* once they leave home and school. Viewing technology as 'black boxes' of technological paraphernalia, rather than as part of our everyday, and believing that 'experts' are in control of technology in political and economic spheres, creates a sense powerlessness, indifference and political apathy typical of citizens of liberal democracies.

Technology education could be an area where genuine education for the needs of the students and of society could occur. Maxwell (1984) maintains that the world needs an intellectual revolution instead of a scientific or technological revolution. Rather than devote our efforts to the construction of new 'knowledge, skills, and attitudes', he suggests that what we ought to be doing is committing our efforts towards enhancing personal and social wisdom. This wisdom should guide us to behave in new and appropriate ways:

> This new kind of inquiry gives intellectual priority to the personal and social problems we encounter in our lives as we strive to realize what is desirable and of value—problems of knowledge and technology being intellectually subordinate and secondary. (p. v)

The tragedy of current social and environmental conditions on our planet is testimony to our lack of wisdom, when we act and then think about the consequences after the fact. Our short term wants and needs supersede concerns about the longer term effects of our actions. An intellectual revolution may be needed if life on this planet is to be saved from annihilation. Students and teachers, together, can realize and develop capabilities and strategies to look ahead and change the direction of technology education and technology. For example, through collective deliberations and actions, people may find ways to make unnecessary, dam construction, nuclear energy production, military spending, exploitation of workers, hunger, pollution,
accumulation of wealth by the few, and inadequate education.

C. Understanding Hegemony–Key to Educational Transformation

Apple (1990) maintains that schools "create and recreate forms of consciousness that enable social control to be maintained without the necessity of dominant groups having to resort to overt mechanisms of domination" (p. 3). Understanding how this is accomplished may be useful if technology education is to be transformed into an equitable and just subject area. One step towards understanding is to acknowledge "that the current and emerging organization of a large part of our economic, political, and cultural institutions is neither equal nor just" (Apple, 1988, p. 178). Technology educators must "school" [themselves] about the unequal realities of this society [so they] can make it possible for the students, teachers and others with whom [they] work to have the resources for recognizing and acting on these realities as well" (ibid, p. 179). They must also comprehend the correlation between societal and educational inequalities. To do this, Apple (1990) suggests that schools, knowledge, and educators must be 'situated' in the larger whole of which they are a part:

The key word here, obviously, is situated....we need to place the knowledge that we teach, the social relations that dominate classrooms, the school as a mechanism of cultural and economic preservation and distribution, and finally, ourselves as people who work in these institutions, back into the context in which they reside....in a complex, stratified, and unequal society. (p. 3)

According to Apple (1990), the key is understanding the 'structural relations' of schooling in the light of the concept of hegemony. He argues that
societal, economic and educational ideologies\(^1\) are secondary to hegemony as ideologies change with the interests of the day, but that:

...hegemony acts to 'saturate' our very consciousness, so that the educational, economic and social world we see and interact with, and the commonsense interpretations we put on it, becomes the world *tout court*, the only world....Hegemony...refers to an organized assemblage of meanings and practices, the central, effective and dominant system of meanings, values and actions which are lived....[These] meanings and practices still leads to, and comes from, unequal economic and cultural control. (p. 5, emphasis original)

Dale (1989) suggests that hegemony does not simply maintain the status quo, but that it prevents "rejection, opposition or alternatives to the status quo" (p. 43). Hegemony is in effect what most people sense as *reality* or *commonsense*. This reality, nonetheless, is generally not of our own making. Commonsense ways of looking at the world are permeated with meanings that sustain our powerlessness. Ideological saturation permeates our everyday experience and we use these ideological frameworks to help us make sense of the world in which we live. We come to believe that we are neutral participants in society as economic and ideological interests are often concealed. We seldom question the interests being served by dominant ideologies.

Apple (1990) comments that schools act as "agents of cultural and ideological hegemony...as agents of selective tradition and of cultural 'incorporation'" (p. 6). He states that general education is aimed at:

\(^1\) Smith (1991) interprets *ideology* as more than political beliefs. She comments that based on Marx and Engels' definitions, ideology is "a means through which the class that rules a society orders and sanctions the social relations which support its hegemony. The concept of ideology here focuses on social forms of consciousness (the ways in which people think and talk with one another) which originate outside the actual working relations of people going about their everyday business and are imposed upon them" (p. 234-235). She reminds us that these social relations reflect men's relations as it is men who are in the position of authority in North American society.
...the production of agents to fill existing economic roles and reproduction of dispositions and meanings in these agents that will ‘cause’ them to accept these alienating roles without too much questioning. They become aspects of hegemony. (ibid, p. 10)

The dispositions of student 'agents' have been referred to in earlier chapters as corporate attributes--obedient, creative, adaptable, problem-solvers, cooperative, critical thinkers. These dispositions are considered exclusively in behavioral terms and teachers are "to observe students displaying the identified appropriate behaviour(s)" (ibid, p. 9). Apple (1990) contends that "unquestioning acceptance of authority and of the vicissitudes of life in institutional settings are among kindergartner's first lessons" (p. 57). Schooling therefore plays a pivotal role as a mechanism for social control. Freire (1985) contends that "it is not hard to find educators whose idea of education is 'to adapt the learner to [their] environment" (p. 116). As described in chapter 3, both the ITEA and BC curricula make several references to the notion that students are to learn to be 'adaptable'.

The ideology of technology education reflects the liberal democratic ideology in North American society as it is closely affiliated with technological developments:

[Firstly],...,schooling critically affects the level of economic growth and progress though its link with technology. The level of technological

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Apple (1990) suggests that these attributes are a part of the social control of students which centres around consensus ideology. For example, for the behavioral attribute of critical thinker, "what one is 'critically reflecting' about is often vacuous, ahistorical, one-sided, and ideologically laden" (p. 7). This is mirrored in technology education curricula where 'critical thinking' is related to technological problem-solving and commodity production. Students ought to be encouraged to critique the very 'education' that is being 'transmitted' to them. For Freire (1973), critical thinking is in contrast to naive thinking which tries to conform to what is normal, commonsense. Freire contends that critical thinking "constantly immerses itself in temporality without fear of the risks involved" (p. 81).
growth is taken to determine the level of economic growth and is itself seen to be dependent on the level of schooling. Secondly, the education system is seen as providing a ladder and an avenue for social mobility, in which the only qualification for personal advancement is 'ability'. Finally, education and the culture it both produces and transmits are viewed as independent and autonomous. The idealism within liberal tradition present both culture and schooling as politically neutral forces for social change. (Dale, 1976, as quoted in Apple, 1990, p. 18-19)

Osborne (1991) emphasizes that "this very linkage between technical knowledge and schooling helps generate, not reduce, inequality" (p. 19):

This system of structured inequality is integral to capitalism, and its strength and stability rest upon the fact that most people see it as natural and inevitable. The victims of the system tend to blame not the system for its inequalities, but themselves for their failure to "make it". In this way, the dominant groups in society maintain their hegemony. They do not have to use coercion or physical force. They persuade those they dominate that this is simply the way the world works. Indeed, they probably believe it quite sincerely. As a result, awkward questions are not asked. The status quo is maintained. (ibid, p. 47, italics original)

The notion that we live in a technological society is widely accepted as implying that there is little anyone can or should do to control or direct technological developments. Technology education curricula pay unquestioning homage to the technological society, and maintain a stance of adapting to that 'reality', rather than questioning that 'reality'.

Osborne (1991) suggests that "it is the interplay between curricular knowledge--the stuff we teach, the 'legitimate culture'--and the social relation of classroom life" that helps us to see the inequity of schooling (p. 40). Apple stresses that this is not a plot but a result of economic and political principles that affect our everyday lives. Inequality occurs as specific knowledge is selected and ideological hegemony is transmitted through the hidden curriculum. The legitimate knowledge is selected from a much larger universe of possible knowledge, based on the value-decisions of those in positions to
choose. For example, what is selected for knowledge in technology education curricula, and what is excluded, is closely tied to liberal democratic principles of industrial-capitalism. The knowledge selection, a form of cultural capital, reflects the doctrine of those in power. In industrial-capitalist societies, much of what is considered important knowledge in technology education and in all of general education, is determined by males.

The selection of knowledge for current technology education curricula necessarily reflects the interests, values and life experiences of those controlling curriculum design. Additionally, it must be noted that for the present, this knowledge is also filtered through male teachers who have been trained as industrial educators--many with trades backgrounds. Bias in the selection of knowledge for technology education may not have been intended, as the selection may be based on ideological and economic presuppositions which provide their commonsense\(^3\) rules for their thoughts and actions.

Another factor which contributes to hegemony in technology education is the common belief that technology and education are value-neutral. By not explicating the paradigms in which schools, knowledge and educators are situated, prevailing ideological hegemony remains entrenched. Freire (1989a) is critical of those who claim that education is value-neutral: "Those who talk of neutrality are precisely those who are afraid of losing their right to use neutrality to their own advantage" (p. 149).

\[^{3}\text{As a member of recent BC Ministry of Education technology education curriculum revision teams, whenever I questioned the assumptions of my male peers, not only was I treated with intolerance and anger, but I was frequently told to use my commonsense. My commonsense differed radically from the commonsense of most male members of the committee.}\]
Counter-hegemony which problematizes the structural and relational connections between liberal democracies and education is essential if schooling is to be democratic. This involves a major critique of all aspects of education that includes "reinventing the world of knowledge, of thought, of symbols and images, not of course by repudiating everything that has been done but by subjecting it to exacting scrutiny and criticism from the position of women [and others] as subject (or knower)" (Smith, 1991, p. 253).

D. Current Solutions

(1) Integration of Subjects

Technology educators are beginning to recognize that education, as it is, is not appropriate or relevant for all students. Integration of subject matter and/or inclusion of others into mainstream curricula are approaches that have been implemented in some schools.

In the USA in particular, there has been a move to integrate technology, science and mathematics into 'mini-engineering' courses. These efforts at integration do not address interests of others, social and environmental issues, aesthetic concerns, or technologies of the private sphere. It should be noted that mathematics and science, like technology are subject areas which are also male-dominated.

Integration of technology education with subject areas traditionally associated with females has been attempted in the United Kingdom. Technology education has become an umbrella for five subject areas: craft, design and technology (CDT) (industrial education); home economics; business
education; art education; and, information technology (computer studies). On a recent British Council sponsored tour of technology education programs in the United Kingdom, the 'technology education' that I observed was essentially CDT except for the fact that about half of the teachers were female. The emphasis was similar to the commodity design and realization of the former CDT curriculum. The materials range had expanded to include textiles and foods, and the integration of art and design helped ensure that the commodities were aesthetically pleasing and marketable. Critiquing technological development was not included in the curriculum. Students' activities and examinations revolved around lock-step 'design briefs', which demonstrated analytical problem-solving capabilities and highlighted final products. The female teachers that I talked with expressed concern that the male CDT teachers had taken control of technology education and that important 'social' aspects of art and home economics were lost.

Integration with other subject areas might help to incorporate knowledge traditionally ignored by industrial education and technology education, but it may do little to challenge the premises of the subjects being integrated. Integration of male-oriented and female-oriented subject areas such as technology and home economics is susceptible to defaulting to a form of men's studies.

(ii) Mainstreaming of Others

Recent research by Eyre (1991), in British Columbia home economics education and technology/industrial education classrooms, shows the
inadequacies of addressing gender inequity by balancing enrolments of female and male students in coeducational classrooms:

... gender equity involves more than questions of access, sex stereotyping, and gender bias in student-teacher interaction. As Rich (1985) says, it means taking women students seriously. It means understanding the inequities that result when traditional power relations enter into our daily lives in classrooms. It means re-examining the taken-for-granted experiences we have as women and men, girls and boys. It means recognizing the diversity of human experience, revaluing women's knowledge and women's work, and changing traditional ways of relating. It means placing gender relations on the agenda in the classroom. (p. 217, emphasis added)

Feminists maintain that, along with gender power relations, other unbalanced social relations such as race and class, must also be placed on the agenda in the classroom.

Technology educators have endeavoured to make the curricula girl-friendly by appending a people context (BC, 1992). In the United Kingdom, studies on the performance of male and female design and technology students designing and making artefacts within three different contexts: industry, environment⁴, and people, showed that girls perform better if the artefacts are for real people rather than for a real or imagined community or industrial setting (APU, 1991). Nevertheless, problematizing the realities and everyday experiences of these real people in order to assist them in transforming their lives is not part of their studies. The emphasis of the curriculum is on making and designing commodities.

One approach employed by some British Columbia school districts to

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⁴ By 'environment' the writers are referring to activity relating to the 'community' which consists of public service areas and public spaces (APU, 1991). The BC (1992) document essentially duplicates these three contexts: world of work, community, and individual.
make industrial education more attractive to females has been to install high-technology packaged-learning technology labs, that are cleaner, brighter and less intimidating than the former industrial shops. These facelifts, ignore the origin of the exclusion of others from technology education.

But adding women means re-examining the rules that determine inclusion in the first place. The omission of women is not just a question of oversight. Our very conceptions of education, of what is worth knowing, and of the disciplines are challenged by the process of including women. (Gaskell & McLaren, 1991, p. 224)

Technology educators have not attempted to re-examine the rules and to question why others have sidestepped industrial education and technology education. Based on notions of a deficit-theory, the common perception is that girls need to learn male-oriented technologies. However, there is no corresponding thinking regarding males learning female-oriented technologies.

McIntosh (1984) has developed a five phase model to describe levels of integration of females into mainstream curricula. She characterizes these phases as follows:

Phase 1, Womanless History; Phase 2, Women in History; Phase 3, Women as Problem, Anomaly, or Absence in History; Phase 4, Women as History; Phase 5, History Reconstructed, Refined, and Transformed to include us all. (p. 26)

Phase 1 ignores females. Phase 2 includes the contribution of exceptional females (add females and stir). Phase 3 raises the questions of gender, race, class inequity as issues for discussion. Phase 4 draws on the experiences of

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5 In a discussion with a BC technology education writing group member, regarding mandating females into male-biased technology education, he stated that it was imperative that girls learn male-oriented technologies, and that by suggesting otherwise that I was doing a "great disservice" to females. He dismissed the idea of males needing to learn female-oriented technologies, as he reasoned that these technologies were/are "relatively unimportant" to the economic viability of the student and society.
those traditionally excluded, resulting in a radically altered knowledge base. *Phase 5* "completes the epistemological transformation so that all humanity is included, an achievement that is still far off" (Rothschild, 1988, p. 40). Analysis of the ITEA and BC curricula indicates that they are between *Phase 1* and *Phase 2*, because they attempt to add some girl toys to the boy toys.

The McIntosh integrative model, in addition to being applied to females, could be applied to others who have been excluded from technology education. Rothschild (1988) cautions that "if feminist educators concentrate only on 'mainstreaming', female-defined scholarship will be overwhelmed by the traditional and still powerful disciplinary canons" (p. 4). Adding females and others without articulating and challenging the paradigms which previously excluded them, is not likely to effect transformation of inequitable and unjust mainstream curricula.

E. Possible Pedagogies for Counter-Hegemony

Recently, faculties of education have been training teachers to provide a more student-centered learning. In my own training, the emphasis was on the inquiry/discovery model which concentrates on 'individual' learning within the parameters of the classroom. Although, this method of teaching may be an improvement on the former transmission-orientation of schooling, this model is perceived as apolitical because students are not encouraged to question the education that they are receiving.

Alternatively, critical, Freirian and feminist pedagogies are explicitly political pedagogies. They may offer more possibility of problematizing the
reproduction of social inequalities in schools. As they are focused on social transformation, they give possibility to more equitable and just education. Critical pedagogy opens up for discussion, the contradictions and illusions of liberal democratic education, in order to create more equitable social and economic relations in schools and in society. Freirian pedagogy is based on 'collective' participation of students and teachers in understanding and solving local problems in ways that relate the process to larger structural issues. Feminist pedagogy is directed towards ending the unequal social position of females by including both females and female experiences in education. Any one of these pedagogies, or combinations of them, may encourage resistance to social control and reproduction and thus contribute to counter-hegemony.

(i) Critical Pedagogy

Apple (1988) recounts the goals of The Public Education Network, an organization committed to democratic schooling and critical pedagogy. They have established three requisite elements for democratic schooling:

The first is 'critical literacy'. The emphasis here is on both of these terms. Not just the ability to read and write, but particular kinds of dispositions are important—e.g., 'the motivation and capacity to be critical of what one reads, sees, and hears; to probe and go beyond the surface appearances and question the common wisdom'. The second element includes 'knowledge and understanding of the diverse intellectual, cultural and scientific traditions.' This is not limited to the traditions of high or elite culture and the academic disciplines. It needs to go beyond these to 'the histories and cultural perspectives of those people, including women and minorities, traditionally excluded from formal study.' [Thirdly], a democratic curriculum must include the 'ability to use knowledge and skill' in particular ways to create and 'pursue one's own interests; to make informed personal and public decisions; and to work for the welfare of the community. (p. 189-190)

Osborne (1991) explains that critical pedagogy is not uniform and that "by the
very word *critical* indicates its commitment to criticism and constant reassessment of its assumptions" (p. 50). He outlines elements for critical pedagogy:

1. Critical pedagogy...must be philosophically informed and it must draw its theory not merely from the world of education...but from the social and political realms also....Teachers must realize that all education is political education in that it is intended to give special status to some views of the world and to condemn others, either by negative critique or by simple omission....

2. Critical pedagogy....consists of an analysis of the role and functions of schooling....[that view] schools as arenas of conflict where differing agendas meet and which thus contain the possibility of genuinely educational work....

3. Learning must be based on and arise from what students already know....Critical pedagogy...Insists that pedagogy that ignores students' experience and culture is not only doomed to failure but, much worse, represents a form of ideological imposition which, in turn reflects and enhances a particular balance of political and social power....

4. Critical pedagogy insists upon classrooms that operate on humane and democratic principles, in which there is an open and equal relationship between teachers and students, and in which there is a heavy reliance on discussion and dialogue....

5. Critical pedagogy [emphasizes]...student empowerment leading to action for social change. Students must learn to think and to act. They must become personally reflective and socially conscious. (ibid. p. 50-54)

Osborne believes that if we wish to establish societies which foster democratic citizenship, "we must pay attention both to curriculum and to pedagogy, to what we teach and how to teach it" (ibid, p. 119). He defines citizenship as "the way we see the world around us, local, national, and global, and by the part we choose to play in it" (ibid, p. 118). Osborne maintains that education for democratic citizenship, requires that educators clearly articulate their philosophy so that they can understand that education is socially and
politically situated\(^6\). However he cautions that:

...it must be intellectually and morally defensible. A racist could have an extremely clear vision of society and education, but it is a vision that should not be allowed to influence education. A vision of education must be able to meet the tests traditionally associated with education. Intellectually, it must respect factual evidence, be open to critical revision, and incorporate the principles of reasoned inquiry and debate. Morally, it must meet the tests of fairness and justice, respect the rights of individuals and promote democratic principles. (p. 122).

For technology education, critical pedagogy could mean that students and teachers could critically examine technology with respect to its political and social consequences. It could also mean questioning the purpose of technology education, and could insist on student empowerment where students could make a difference. Students and teachers could mutually create their own learning. Kreisberg (1992) maintains that this type of learning requires power with rather than power over students.

(ii) Freirian Pedagogy

Freire is considered to be a major contributor to critical pedagogy (Osborne, 1991, Weller, 1988). "Freire is committed to a belief in the power of individuals to come to a critical consciousness of their own being in the world" (Weller, 1988, p. 17). Freire's work is dedicated to 'praxis', which he describes as the combination of reflective thought and action to 'transform' the world. Freire believes that to be fully human is to take part in the world rather than being a passive recipient of the dominant ideology. "If teaching does not

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\(^6\) When discussing the need for a clear philosophical basis with one of the chief participants of the BC technology education writing team, the response was that, "We should leave our philosophy at home and just get on with designing classroom activities and facilities."
empower students to understand their world in order to transform it for the better, then it is not worth pursuing" (ibid, p. 56)

Dialogue is essential for Freire's vision of democratic pedagogy. Three features are necessary for effective dialogue where students and teachers collaborate as 'knowers' and 'learners': love, humility and faith (Freire, 1973). "Dialogue cannot exist...in the absence of a profound love for the world and for [people]....Because love is an act of courage, not of fear, love is commitment to....the cause of liberation" (p. 77-78, emphasis added). For teachers, humility means relinquishing their position as 'knowers' and becoming partners in learning. Without faith in people "to make and remake, to create and re-create...to be more fully human....dialogue is a farce which inevitably degenerates into paternalistic manipulation" (ibid, p. 79, emphasis added).

Freire (1989b), Giroux & Simon (1989), and others recognize that the source of knowledge comes from questioning. Educators must, themselves, learn how to ask questions. Freire (1989b) maintains that "the basic questions...arise out of everyday life, because that is where the issues are" (p. 37). He insists that we must never refuse to answer students' questions:

I believe...that this repression of questioning is only one dimension of a greater repression--the repression of the whole person, of people's expressiveness in their relations to the world and with the world. (ibid, p. 36)

This means questioning the everyday commonsense both outside and inside the classroom. For technology education students, this could mean questioning the selected content and delineated pedagogies for technology education, questioning the assumptions and beliefs of their teachers as well as themselves, and perhaps asking other questions that technology educators
have been reluctant to ask.

(iii) Feminist Pedagogy

There are many different feminisms and resulting feminist pedagogies. Mainstreaming, as explained above is an approach of liberal feminism. Briskin (1990) offers a conception of feminist pedagogy which may be more effective than liberal feminist notions, in creating social transformation:

Feminist pedagogy is about teaching from a feminist world view; from a perspective on the world which is in favour of sharing of power, privilege, property and opportunities; which recognizes the systematic and systemic oppression of women (or any human being); which believes in the possibility of change; and which understands the need to organize collectively to make change. By definition, feminist pedagogy challenges what is seen to be the obvious, the natural, the accepted, the unquestioned. (p. 22)

Although, feminist pedagogy has common goals with critical and Freirian pedagogy, it places not only gender, but other inequities in the foreground:

...the experiences of women (and of First Nations people, working-class people, visible minorities and other disadvantaged groups) must be incorporated into the curriculum. Children from all these groups must come to feel that the schools are for and about them, not just for and about privileged white males. The purpose of schooling must be to "empower"...them, to give them the ability to participate fully in struggles, large and small, to gain respect, dignity and power. (Gaskell, McLaren & Novogrodsky, 1989, p. 41)

Additionally, feminist pedagogy emphasizes: 'subjective' experience as well as 'objective' experience; 'emotion' as well as 'reason'; and, 'private sphere' knowledge as well as 'public sphere' knowledge.

Feminist pedagogy, based on shared power with students, could challenge everyday experiences of domination. This could mean transforming the gender power relations, as well as other power relations of technology and technology education. This could involve the inclusion of female-oriented
technologies, and relating technology to the everyday experience of students rather than to the public sphere. This would require open dialogue and questioning of the current male and industrial biases of technology education. Sharing of power could be the beginning of equitable and just technology education.

F. Summary

Technology education is an essential component of the general education of students. Although both traditional and revised curricula may promote rather than counter hegemony, it may be possible to create counter-hegemonic curricula. Integration of subjects and mainstreaming of those traditionally excluded from technology education represent two common ways in which some of the inequities arising from hegemony have been addressed. These approaches may reduce some inequities, but do little to either acknowledge or challenge hegemony which underlies the inequities.

Critical, Freirian, and feminist pedagogies are radical alternatives to current transmission-oriented technology education. A brief consideration of these pedagogies suggests that they may be worthy of consideration as models for effecting transformative, counter-hegemonic technology education. A critical factor in implementing such pedagogies is the teachers themselves. Teachers must be committed to human dignity, social equality and liberation. Such teachers would have to examine their own experiences so that they could unlearn their previous teaching experiences. This means examining their commonsense notions about technology, technology education, and society. It
also means questioning what education and technology education is for and
means examining how technology education contributes to gender, race, class,
and other oppressions.

Critical, Freirian, and feminist pedagogies could empower technology
education students through participation and decision-making in technological
matters that are real, and within their capability to act on. Democratic
classrooms could lead to democratic citizens, who could create democratic
societies, that in turn could maintain democratic classrooms. This process can
begin through the daily interactions within technology education classrooms,
critiquing and acting on technological issues of immediate relevance to
students, teachers, and society.
A. Thesis Questions

For many years, technology education (previously called industrial education) operated as a program of study which mainly taught, to underachieving boys, knowledge and skills that were primarily intended to be useful for future production-oriented technological employment. This thesis identified several problems relating to the narrow range of students participating in technology education, the appropriateness of the content, and the social implications of technology education. Recent revisions of technology education curricula by the International Technology Education Association (ITEA, 1990) and the British Columbia Ministry of Education (BC, 1991) were examined to determine the extent to which such problems were addressed. The questions raised, and the conclusions drawn regarding these questions, are as follows:

1. *Do the curricula provide a basis for technology education which is appropriate for all students at all grade levels?*

A consideration of the content and pedagogy of the revised curricula indicates that the curricula are no more suitable for a broad range of students than were the previous industrial education curricula. The content of the curricula mirror the content organizers of the previous industrial education curricula and were designed without the benefit of significant input from a range of interests which may be necessary to achieve a broadly relevant curriculum. The revised curricula have attempted to address problems associated with low participation by females, certain ethnic groups and
students of varying abilities and social status. However, rather than address
the problems in a substantial way, they have been dealt with superficially.
Sexism in the revised curricula is dealt with by stating that the curricula are
suitable for all students (i.e. girls as well as boys) and by suggesting that
'feminine' technologies such as those associated with fabrics might be included
as materials of interest to students. Racism has also been dealt with by stating
that technology education is for all students and by suggesting activities
associated with culturally significant items such as the making of totem poles.
Similarly, classism is dealt with by declaring that the curricula are appropriate
for all students at all grade levels and by including a problem-solving pedagogy
which may enhance the thinking component of technology education. The
revised curricula continue to focus on the traditional future-oriented
employment expectations of North American white, under-achieving male
students, and consequently undervalue the needs and interests of a variety of
students of differing ages, sex, class, and ethnicity.

2. Do the curricula provide a basis for technology education which
addresses the everyday private and public needs of students?

The content of revised curricula do not expand significantly on the
technologies relating to drafting, woodwork, metalwork, automotive, and
electronics. These areas represent the content areas of traditional industrial
education curricula which focus on certain public needs relating to the mass
production of some consumer goods. The technologies of the public sphere
which are not oriented to industrial production, and technologies of the private
sphere, are given little consideration. The limited range of technologies suggested in the curricula result in studies which are not relevant to the everyday private and public needs of students.

3. **Are the curricula likely to help create a form of socially constructive technological literacy?**

The revised curricula state that a goal of the curricula is to effect technological literacy. Although clear definitions of technological literacy are not provided in either the ITEA or BC documents, it is clear that the curricula see technological literacy as including knowledge and skills that would enable students to become adaptive technical workers in a technological society. The curricula do contemplate promoting social consciousness in the applications of technology, however, in the context of a strong emphasis on acquiring knowledge and developing skills which focus on *making things*, critical aspects of technological literacy are minimized.

Neither the ITEA nor the BC curricula consider critiquing the principles of technological societies, which, through their social, political, and economic structures create a world which is socially and environmentally threatened. Consequently, the ITEA and BC curricula do not provide a basis for empowering students to question the industrial-capitalist ideology of North American societies so that they may help construct societies whose purposes transcend the ideologies of mass production and mass consumption. I conclude that the revised curricula do not contribute significantly to the development of forms of technological literacy which are likely to be socially
In considering the basis of deficiencies and problems associated with technology education curricula, I suggest that technology education is a reflection of the hegemony which locks society into the dominant ideologies of those with power, and I invite inquiry into what can be done to counter that hegemony. Although technology education must share with other curriculum areas, responsibility for promoting and maintaining hegemony, technology education may contribute less to hegemony than do other curriculum areas. Technology education has primarily served under-achieving boys, whereas hegemony is characteristic of most members of a society, including a majority who have not participated in technology education at the secondary level.

B. Implications of This Study

(i) For Technology Education

Analysis of technology education curricula suggest that the curriculum revision process itself is problematic. It is appropriate that technology education teachers play a significant role in the revision of technology education curricula, however, because the previous industrial education programs were sexist, racist, and classist, and because the teachers within that system may be insensitive to its nature, it is essential to also include a broad spectrum of voices in the curriculum revision process. Although it may not be easy to determine the appropriate mix of 'stakeholders' who should have input into the curriculum revision process, it is clear that such considerations are an essential component of curriculum revision. It may also follow that teachers in
the specific field of study under revision should not necessarily have the
dominant voices in the curriculum revision process.

Consideration of critical, Freirian, and feminist pedagogies leads me to
conclude that one of the major problems with curriculum development is that
*teachers do it for students.* It is appropriate that curricula be developed *with*
students rather than *for* students. Such an approach may be significant in
beginning to recognize children as *real people,* whose experiences and interests
are as valid as those of the teachers. Such pedagogies may also assist in
transforming education into a socially constructive enterprise, rather than
maintaining education as a means of indoctrinating students into the ideologies
of those with power. Although this thesis is critical of technology education,
consideration of the societal context of technology education suggests that
technology education may be no more problematic than other curriculum
areas. What emerges from my critique is that general education, and not just
technology education, ought to be transformed into a more socially constructive
activity.

Considering the traditional focus of technology education on *making*
*things,* and the inclusion of student-centered problem-solving thinking skills in
student *actions,* technology education is particularly well oriented to the forms
of cooperative and socially constructive learning and action that is
contemplated in critical pedagogies. Countering hegemony is an important
issue for society, and schools may be a place to begin. Technology could well
be an appropriate focal point and potential model for that beginning.
(ii) **For General Education**

The problems and issues raised regarding technology education curricula and the curriculum revision process may be generalizable to other areas of education. Other subject areas ought to be critically examined with respect to the extent to which they promote hegemony. Countering hegemony ought to be a focus throughout all areas of education.

(iii) **For Further Research**

Several questions relating to technology education curricula which arise from this are deserving of further consideration and research. They include:

1. What is an appropriate collection of voices that ought to determine technology education curricula?
2. What pedagogies for a socially constructive technology education are suited to technology education at various grade levels?
3. What are the essential components of a teacher education program which contemplate educating teachers who are capable of animating transformative and socially constructive education?

C. **Beginning of a Dialogue**

Working for democratic schooling means going against the grain. Democratic schooling is contrary to current liberal democratic schooling and to the messages in our everyday lives from such sources as parent, teachers, friends, employers, politicians and media. Democratic schooling requires a great deal of commitment and may be difficult:
Sometimes seeing the connections between our curricular, pedagogical and evaluative action and the inequalities in the larger society does require something of a wrenching experience, a conscious attempt to step outside our everyday language and commonsense thought. And often this requires hard and disciplined work. Examining our institutions relationally, see them as being constructed in a context that has clear relations of domination and exploitation, is a labour process itself. (Apple. 1988. p. 201-202)

The reasons for explicating and supporting democratic schooling are multifaceted as they endeavour to depict the complexity and ambiguity of society. Writing this thesis has presented me with similar complications. The diversity of problems and issues of technology education, and education generally, complicated decisions about where to begin or how much to cover. As my observed and lived experience of sexism in technology education has been a major factor in my decision to do graduate work, my initial intent was to address gender inequity. Because of my life experiences, I was also interested in examining classism as well. Looking at the symptoms of sexism and classism led to an awareness of a more fundamental problem with technology education and education generally--structural and cultural hegemony in the larger society and its relationship to power and knowledge in the schools.

Questioning the inequalities of our social, economic, political, and cultural arrangements in our society and discussing the inequalities of these arrangements may help us to understand the roles of schools in reproducing inequality. This may lead us to consider and take action to create the kinds of societies in which we wish to live. Collaboration with others, particularly other educators and students, can only enhance this action:

It is only in shared belief and insistence that there are practical alternatives that the balance of forces and chances begins to alter. Once the inevitabilities are challenged, we begin gathering our resources for a journey of hope. If there are no easy answers there are still available
discoverable hard answers, and it is these that we can now learn to make and share. This has been from the beginning and the impulse of the long revolution. (Williams, 1983, quoted in Apple, 1988, p. 205)

The development of a 'critical' community can originate in schools—a community committed to questioning the commonsense of the corporate 'technological/scientific' logic which permeates society and education.

Technology education is an appropriate subject area to serve as a focus for that beginning.
Bibliography


Lather, P. (1986). Issues of validity and openly ideological research: Between a rock and a soft place. *Interchange*, 17(4), 63-84.


