Introduction
Curriculum and Instruction in Technology Studies

Technology
The mere word "technology" provokes strong opinions and responses from the head, heart, hand and feet. For some, the notion of technology produces fear and feelings of insecurity. Others feel power and security. Some feel excitement and others feel dread. Many stress out over the technologies they use. Similar emotions are provoked when most of us consider the concept of design. Yet, this is what teaching design and technology is all about: excitement, dread, fears, hopes, insecurities, power and intimidations. Teaching design and technology is about dealing with the contradictions within technology itself. This is not an easy task. We have to know what design and technology are, or more specifically, what the curriculum of design and technology is, or ought to be. As well, we have to know how to teach design and technology, or more specifically, how to organize instruction in design and technology. What should we learn? How should it be organized for teaching? More than questions of content and methods, these are the primary problems of curriculum and instruction. Neither curriculum nor instruction is a given.

This book proceeds with the premise that we learn the curriculum of design and technology as we learn to teach in and about design and technology. This premise is underscored with the rejection of generic, or universally transferable, content, skills and values. This premise rejects the notion that we can learn the generic skills of instruction in one place or at one time and learn the content or values of teaching in another place or another time. This book rejects the notion that we merely apply generic skills and values of instruction to the content of the curriculum. We also reject the opposite notion that we merely apply the content of curriculum to the process of instruction.

There is no instruction without curriculum or no curriculum without instruction. No method without content, no content without method. Curriculum and instruction (C&I) are inseparable. One implies the other. We could say that C&I are dialectically related: when we study curriculum we find instruction and when we study instruction we find curriculum. Why then, you might ask, do we have two concepts for what is virtually one process? Can we actually teach without content or methods? Can we learn to instruct or teach without learning the curriculum? Can we prepare to teach technology without preparing the curriculum of
technology? And so it goes. As we prepare the curriculum of technology we prepare how to teach technology.

This book also proceeds with the premise that we learn to teach design and technology just as we learn to practice design and technology. We learn best through cycles of concrete experience—through reflective observation, abstract conceptualization and active experimentation (Kolb, 1984). Rather than an isolated text with an authoritarian style, this book is meant to participate in the cycle of experience (Fig. 1). This text plays a part in helping you to assimilate your concrete experiences into concepts, and in accommodating concepts back into your experiences. Sections in the book will help you to stand back to reflect and examine practices while other parts will help you to actively experiment with the practices of teaching.

![Figure 1. Cycle of Experience](image)

Each chapter is derived from my own cycles of experience in design and technology teacher education. Each section integrates rich traditions with current research and is tempered by over twenty five years of practice in teacher education and school-based design and technology. This experience extends from traditional practices of craft, design and industrial education to practices in digital animation, computer aided design and information technology. I appreciate the potential of new practices and standards as well as the materials-based production
of industrial practices or the information-based practices of educational technology. However, I am not so naïve as to believe that we can merely pick and choose among the best of the past and present to create an ideal amalgam. As we have learned with assessments of technology, we cannot merely create a balance sheet of benefits and problems and choose the benefits.

Change and practice in design and technology require a process of introspection into our identities, clarification of our values and discourses, candid analyses of the state of education and the world, and an externalization and internalization of what we have learned. This book will help you clarify your identity as a teacher by connecting you with a wide range of dispositions, practices and representations of practice in education. Reflective practice involves socialization, externalization, internalization and identification (Fig. 2). This is another way of saying that in the process of becoming a teacher we initially connect and empathize with certain practices and ultimately articulate and embody the practices we identify with. Reflective practice simply means that we fluctuate between immersion and reflection. We practice, reflect and re-evaluate our practice, and return to practice again. Teaching is a cycle of reflective practice.

![Diagram of Reflective Practice in Teacher Education](image)

*Figure 2. Reflective Practice In Teacher Education*
This book plays an active role in your cycles of reflective practice in teacher education. These cycles will begin with who you are, your identity and life history, and extend this knowledge to the meaning of teaching and teaching practices, to stories of teaching and the way we converse, to values and what is happening in education and the world. We will challenge you to empathize and identify with what you experience, to articulate this, and to internalize what you learn. You have already generated a wealth of experience and knowledge, and our challenge is to help you focus this into the process of becoming a technology teacher.

**Technology Teacher Education**

Welcome to technology teacher education, which includes design, technology and information technology teacher education! Our (i.e., the author and your instructors) task is to assist you in becoming a great teacher—in terms of curriculum and instruction, ethics, pragmatics, sensibility and tact. Our task is to challenge you to think through and re-evaluate some of your assumptions about education, design and technology. We will provide you with a unique outlook on technology studies; indeed, one that extends your prior understandings from observations or the media.

Technology teacher education consists of three components: Liberal studies, pedagogical studies and technology studies (Fig. 3). One component reinforces the other two. All three are crucial and timely, and not merely "hoops to jump through." All three provide dispositions, knowledge and skills in design, technology, education and teaching. This book aims to assist you in drawing out the interrelationships among the three components. We cannot merely add the three components to your experience and create a technology teacher. There has to be translations and transformations along the way. These come through a series of cycles of experience and reflective practice depicted in Figures 1 and 2. One of the most difficult of these is the transition from teacher education to the schools. We tend to overlook the difference between the way we are taught in teacher education and the way we teach in the schools. We develop assumptions about the symmetry of teacher education and school practices. For example, the technology studies component of teacher education is typically skills-based, justified by the notion that technology teachers should have a general breadth of skills and depth in one or two technical areas (e.g., information and communication). In most labs and
workshops of teacher education, the focus is on skill development, whether it be problem or project driven. Pre-service teachers are often quite tempted to model this practice in the schools, overlooking the fact that the technical preparation of a technology teacher is designed to be different that the technical preparation of students in the school. The philosophies are different by design.

![Diagram of Technology Studies Preparation](image)

*Figure 3. Preparation for Technology Studies*
You will be called on to play various roles throughout the book. Your roles as observer and teacher will vary in degrees throughout the text. When called upon to observe, you will be cast in a role of an "ethnographer" of the classroom, laboratory and workshop. Like ethnographers in anthropology, you will be asked to "make strange" that which is familiar. At times, when observing someone teach, you will be challenged to observe as though you have never seen someone teach. You will be challenged to do the same when observing classrooms and labs. During other times you will be challenged to observe with an acute eye for detail and critical incidents of behavior. This will help you to drop some of your assumptions about design, technology or teaching. But when called on to teach, you will assume the role of teacher in its richest sense. This will entail an exhilaration along with the ethical responsibility of teaching.

One intention of this book is to frame your professional preparation with an overarching theme of knowledge and language. We will call on you to pay attention to your knowledge and language as both a teacher and student of education and technology. We will assist you in developing pedagogical knowledge and tact, along with a language for constructing and talking about this knowledge and tact. We see ecological-natural, ethical-personal, socio-political and technical-empirical knowledge of technology as equally important, and will help you to develop a language for addressing these areas of knowledge. We view practical and technical knowledge as unique and warranting special attention to the language of teaching practical and technical content. Indeed, we have to pay close attention to our language of technology because of the importance of technology to boys and girls, men and women. Gender was built into technology through language and it is our job to help convert exclusion into inclusion.

The positions on design and technology in this book are wide-ranging and inclusive. We describe design and technology as a multifaceted practice, as a practice with ecological-natural, ethical-personal, socio-political and technical-empirical dimensions (see Chapter 6). Whether we are learning to teach design, technology or information technology, there are fundamental commonalities that are shared. In a common definition, design education, technology education or information technology education, or technology studies is a subject that deals with knowledge in designing, creating, using, maintaining, managing, regulating, and recycling technologies (information, products, processes and services). This includes a concern for deliberately balancing the technical-empirical dimensions of technology, or technique, with its ecological-natural, ethical-personal and socio-political dimensions. Another way of stating this
is that we value and balance knowing, caring, feeling and doing, or the head, the heart, the hand and the feet. We value learning about, through and for technology. The mission of technology studies, from this perspective is to provide experiences for young people to develop and question feelings, knowledge and skills that empower them to participate in all facets of technological endeavor—from the practical to the political. This means constructing and sustaining a vision for inclusion, ecological sensitivity and justice for the common good in leisure and work. This mission means that we demystify technology and its applications as well as resensitize students to the implications of their technological decisions and surroundings. This means that we balance the head, heart, hand and feet in our lessons, activities, projects and courses.

To meet the mission of technology studies, we differentiate between small 't' or plural 'technologies' and big 'T' or singular 'Technology.' We also stick to technologies that we use in the schools. Rather than overwhelming students with the impacts of big 'T' Technology, we concentrate on the implications of the small 't' technologies that we use everyday in the laboratories and workshops. Think about a technology that you will be dealing with in the schools, such as a hammer, microprocessor or a specific piece of hardware. Are you prepared to teach both the applications and implications of this technology? Can you demystify it and resensitize your students to its implications? Are you familiar with the history, politics, sociology or psychology of this technology? Are you prepared to deal with the ecological issues or the role of this technology in workplace innovation? How will you prepare resources that deal with the specific technologies? This book will play a significant role in assisting you to deal with the new challenges of technology studies.

**A Matter of Definitions**

To ask the question 'what is Design, Educational Technology, Information Technology, Technology Education or Technology Studies?' is to wonder directly into the politics of education and technology. Subjects are defined against each other, and transgressions are often met with hostile responses in education. A fair amount of boundary maintenance is accomplished though subject definitions. Indeed, subjects cannot be simply defined in isolation. The definitions provided address these politics while accurately describing the current discourse.

**Technology** refers to "the systematic, purposeful manipulation of the material world. It has four components: materials, technique, power, and tools or machines. Thus technology is the
The process of applying power by some technique through some medium of some tool or machine to alter some material in a useful way. These components are necessary and sufficient to describe any technology at any time, but they are static; they do not address technological change” (Roland, 1992, p. 83).

Technology can also be defined as "the means and processes through which we as a society produce the substance of our existence. Specifically, technology consists of five items" (Bernard, 1985, p. 8):

- tools (hammer, presses, typewriters)
- energy forms (steam, electricity)
- materials (plastics, metals, fiber optics)
- techniques (weaving, annealing metals)
- organization of work (assembly line, craft production, batch processing)

Technology, as product and service, or as activity and as knowledge, pervades every economic sector. Think comprehensively when you think of labor and technology (Fig. 4).

Figure 4. Economic Sectors in Technology
As we will explain in Chapter 8, the way that we define technology determines the scope of the technology studies curriculum. Narrowly define technology and the scope of the curriculum will be limited. Broadly define technology and the scope will be expansive. Philosophers of technology have been interested in the definitions of technology at least since the ancient Aboriginal, African, Chinese, Greek and Egyptian philosophers began to make sense of their worlds. Currently, technology is divided into eight branches (Bunge, 1999) (Fig. 5):

**Figure 5. General Branches of Technology**

**Technology studies** refers to subjects that at one time or another were collected under technical education (i.e., design, educational technology, engineering, industrial education, information technology, technical education, technology education or vocational education). This interpretation of technology studies, as a collective of disciplines, is represented in the *Journal of Technology Studies* and *Technology Studies*. Technology studies has recently come to refer to an even wider range of subjects. In Alberta for example, "Career and Technology Studies" includes subjects that range from agriculture to design and digital design, enterprise and

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innovation, fashion, information processing and marketing to tourism and wildlife management. This collection includes twenty-two subjects and is probably the most comprehensive interpretation of technology studies.

**Technology studies** also refers to the anthropology, economics, history, philosophy, politics, psychology and sociology of cyberculture, technology and technoscience (Petrina, 1998, 2002a). Work in this interdiscipline continues a tradition of both celebratory and critical studies. Over the past two decades, technology studies has challenged traditional understandings of technology, and has been working to undermine problematic technological practices in Australia, Britain, Europe and North America. For example, technology studies informs empirical questions of interrelations between science, technology and capitalism, or between human agency and social process in the design of new technologies. Research in technology studies deals with issues such as cyberculture, design and the media, or technological threats to freedom, labor or privacy. Questions of how participation in technology is mediated by class, disability, gender, race, and sexuality are of prime importance.

Most consider technology studies (TS) to be a necessary check on science studies, hence the TS in STS (Science & Technology Studies). This interdiscipline came neither from physical science nor from engineering, but was a hybrid constructed out of the humanities and social sciences. The major tenet of Technology Studies is that technological practices, such as information technology (IT) and cyberculture, can be studied and not merely promoted as one might find in many educational institutions, IT proper, engineering, computer science or other scientific disciplines.

Technology studies, then, refers to the spectrum of formal ways that we learn about, through and for technology— from disciplinary to interdisciplinary approaches, from applications to implications. The operative theme of technology studies is **technological pluralism**— the study of (but not the celebration of) all technologies and orientations to technology (alienation, instrumentalism, technoenthusiasm, technophilia, technophobia, luddism, technocriticism, etc). This range or this spectrum is what makes this field so interesting and important. In technology studies, technology is taken as a serous subject of study. Technology is central to technology studies. Technology is incidental to a large range of other disciplines, as well. Rather than the primary subject of interest, technology is infused into the practices of disciplines. And, since technology is ubiquitous, meaning it is everywhere, we also learn about
and through technology by immersion and interacting with it on a daily basis. Our movements and minds are shaped by technology, through media, mass media, rules, cyberculture or infrastructure. We learn about, through and for technology whether we want to or not (Fig. 6).

**Figure 6. Formal and Informal Ways of Learning Technology**

**Engineering** is a discipline and professional practice that deals with the design of dynamic and static devices, materials and structures. It consists of chemical, civil, electrical, genetic, and mechanical subdisciplines as well as others more specific to practice such as acoustics, aeronautics and synthetics. Except for the few prep schools that focus on engineering, the presence of engineering as a school subject has been limited in North America. In the early 1970s, the Engineering Concepts Curriculum Project was initiated as way providing students in the US a basic understanding of engineering and a form of technological literacy (Chapter 7).
Since the 1970s, there was a rapid growth of industrial technology programs in post-secondary colleges and many of these programs were transformed into engineering technology programs during the 1990s. **Engineering technology** is an applied practice established in response to the theoretical emphases of engineering in the universities. Many proponents of engineering technology claim that this ought to be the main discipline of technology studies.

![Diagram of Engineering](image)

**Figure 7. Engineering**

**Industrial education** (IE) or **industrial arts** (IA) is a school subject that deals "experientially with technology— its evolution, utilization and significance; with industry— its organization, materials, processes and products; and with the benefits and problems resulting from the technological and industrial nature of society" (Fig. 8). IA was introduced into the schools during the 1910s, following three decades of **manual training** (MT) or **technical education** which were introduced into the schools during the 1880s and 1890s. IA expanded MT from handicraft with wood to include production with industrial machinery during the 1920s. IE was an expansion of IA in the 1960s. From the 1960s through the 1990s, IE and IA were commonly recognized by material and process-based workshops: automotive mechanics, drafting, electronics, graphics, metalworking, power mechanics, plastics and woodworking. Technical production was emphasized in IE and IA and the cultural intent of these subjects was reduced to little more than check and balance sheets. However, there was a fundamental cultural intent in this subject from its inception in the 1920s. The subject's most articulate advocate in
the 1920s and 1930s, defined IA as "the study of sources of materials, methods of changing materials, factory organization, inventions, employer and labor cooperation, distribution of products, and regulative measures to secure justice alike to producers and consumers" (Bonser, 1930, p. 2).

Figure 8. Industrial (Arts) Education (AAIA, 1982)

**Industrial technology** refers to the industrial sectors of the larger field of technology and to a subject. For example, the industrial technology sector serves economic functions that differ from the domestic or health sectors. Most limit the industrial technology sector to goods and services within construction and manufacturing. Industrial technology also refers to the postsecondary field of study that was organized in the 1960s as a complement to engineering, as a field to prepare people who knew the techniques of production as well as the practices of management. The field was positioned at the point that intersects engineering, the trades and management. Hence, it is often described as a field with an ideal balance of practice and theory.
The same has been said of engineering technology, a more recent field that is linked to industrial technology. While there may be a balance of practice and theory, industrial technology and engineering technology are well out of balance in their overemphasis on applications and neglect of implications (Fig. 9).

Figure 9. Industrial Technology

Technology education (TE) is a school subject concerning knowledge in designing, creating, using, maintaining, regulating, and recycling technologies (products, processes and services) (Petrina, 1998). In 1991, Donald Maley defined the subject like this: "That phase of general education that deals with the study of technology, its; evolution, utilization and significance; and with the technologies associated with the many diverse elements of construction, manufacturing, communications, energy, and their economic, political, social and environmental impacts." The subject is identifiable by its organization of subjects in biotechnology, communications, energy and power, production (construction and manufacturing) and transportation. Referred to as "post-Industrial education" or "technology education" in countries like Canada, Jamaica, Taiwan and the USA, or "design and technology education," in Australia, England and Ireland or "technical education" in Kenya, Malaysia and Nigeria, this school subject is in flux, yet supports a loose network of international educators. Diversities among technology educators are united through commitments toward the "general education" of children and adolescents in the subject of technology. Good TE deals with animation, computer
aided design, information technology and digital video and there is little reason to differentiate between technology education and what has been called educational technology.

**Educational technology** (ET) has a wide range of connotations and generally refers to any use of technology for teaching and learning (e.g., books, computers, projectors, etc.) (Petrina, 2003). This practice derives from the tradition of Audio-Visual Education where artifacts such as AV materials, projectors, and teaching machines constituted the discipline. In universities, educational technology continues this tradition of instructional design and the current focus is on web-based instruction and the efficient use of technologies for learning (Petrina, under review). ET has lost its currency, hence in countries such as Canada, England, and the USA, ET is referred to as information technology or technology education. Some teachers have moved from a neglect of design tools and implications to an integration of design and information. Good ET deals with a variety of design tools and hence the new trend in switching the combination of words from ET to TE. These blurred boundaries are evident in schools where content and practices in ET and TE are indistinguishable. The pioneering work of Seymour Papert and the MIT Media Lab had much to do with the blurring.

**Information technology** or Information and Communications Technology (ICT) spans most economic sectors. Given the intensive automation that is currently taking place in industrial technology and service, ICT is currently the fastest growing economic sector. As a field of study, information technology is a sub-discipline of computer science, business management and engineering technology and a school subject. In the schools during the late 1970s and 1980s, courses called computer science or computer studies continued the practices of educational technologists, whose focus was on programming and applications. While a general literacy was advocated, little was done on the issues of implications. The courses were renamed information technology in the early to mid 1990s. In BC for example, the computer courses were renamed in 1996 when computer studies had little currency. Like computer science and studies, information technology reflects preoccupations with applications and in business education is information technology management. Currently, the term (not the practices) "information technology" is losing its currency, as most researchers argue that the new digital technologies extend well beyond information and communication. They engage a wide range of actions and are not merely conveyances of information with technology. Digital media design is
becoming the new term of choice. In the universities, cultural studies of information technology and of cybertechnologies are part of a larger practice of technology studies (Fig. 10).

**Figure 10. Information Technology and Computer Science**

**Digital media design** can be defined as simply design of, and with, digital media (Fig. 11). Digital media design reflects the convergence of communication, media and information

- technologies (camera, computer, copier, fax, messaging, phone, printer, audio & video player etc. convergences),
- modalities (image, print, sound, etc. convergences),
- practices (art, communication, design, fashion, film, marketing, media, medicine, programming, technology, etc. convergences) and
- corporate formations (cable & internet providers, music, newspaper, radio & television convergences).

Digital design refers to a branch of electrical engineering that deals with the design of digital hardware. However, the accessibility and applicability of software accompanying the convergences noted have resulted in a new knowledge worker and a new field of discourse, practice and study. Like industrial design, digital media design occupies a necessary space between art and computer engineering and science.

Digital media design focuses on the design of animated and interactive content for the internet, TV, CD, DVD, and other media environments. Digital media design is created for people to experience design within digital environments and other time-sensitive media. It "involves the development of interactive, malleable, and motion-oriented messages, and expands to two-way communication in which content can respond, adapt, and change in response to the user, host, or outside circumstance. Motion allows content and form to utilize the added dimension of time to transform the communicative capacity of still images while sound provides additional sensory capabilities." Digital media design signifies the new digital curriculum in the schools, such as animation, web design and video, and has more currency than information technology in education.

Design can be simply defined as "a structure adapted to a particular purpose" (Fig. 12) (Perkins, 1986a, p. 2). But this definition fails to capture design as a process, as knowledge or as a field of study. Design is both a mode or model of technological practice, and a discipline or field of study. Design is a source of philosophical and practical knowledge regarding problems
of aesthetics, ergonomics, health, function, structural integrity, and sustainability. It provides guidelines for successful construction or deconstruction, as well as criteria for discerning intent and quality, or the "workable" and "non-workable," in technology. Design organizes knowledge embedded in cultural tools such as engineering tables, drawings and models, heuristic strategies, efficiency calculations, reliability, recyclability and safety ratings, and user surveys attuned to physical or sexual differences.

![Design Diagram](image)

*Figure 12. Design*

Of course a unified notion of design does not exist, and as a rule, the more concrete the idea for an artifact, image or process, the more direct design knowledge becomes. Perhaps the Bauhaus came closest to connecting architectural, engineering, fashion, graphic, interior, product and urban design within a single fund of knowledge and style. Today, engineering design is generally a source of structural and material knowledge, while disciplines like architectural and product design are sources of aesthetic and ergonomic knowledge. Biotechnical and therapeutic design are sources of knowledge concerning agri- or aquaculture, health and medicine. Philosophies like appropriate or intermediate technology, user-centered design, integrated and participatory design, concurrent engineering, and product life cycle represent tangible visions for transforming the immediate ground of technological design.
Design in the schools is typically claimed by two subjects: Art and Technology. For the most part, neither of these subjects does justice to the practice and theory of design. Art deals with the elements and principles of design, most often with an emphasis on graphic or visual arts. Rarely are these principles applied to the production of functional artifacts. Technology, on the other hand, traditionally dealt with the production of artifacts but placed little emphasis on design. Artifacts were not so much designed as built and duplicated.

**Design and technology** is a school subject that emphasizes design in the study of technology (knowledge in designing, creating, using, maintaining, regulating, and recycling technologies—products, processes and services). Design and technology (D&T) is most prevalent in Australia, England, Ireland and Wales and is found in a number of schools in the US and Canada. D&T has its origins in the Craft, Design and Technology (CDT) programs initiated in England during the early 1970s to unify the workshop and lab-based technology subjects in the British schools. CDT was intended to amalgamate handicraft, or a concern with all aspects of artifact production, with design, or a concern with applied theory, and practical know-how (Chapter 7). D&T continues to emphasize design and creativity, but, like technology education and educational technology, minimizes the cultural and social implications of design and technology. CDT in England, beginning in the 1960s, aimed to change this isolation of design from technology. Today, design and technology in Australia, England, Ireland and Scotland continues the tradition of CDT in the schools with an emphasis on the design of artifacts but not the design of sustainable lifestyles. Advocates of D&T note that all students ought to have an opportunity, as part of their general education, to design and make functional objects under the direction of a teacher. D&T is part of what it means to be a well-rounded person. There are few pretensions that D&T will have vocational pay-offs.

**Vocational Education**, which referred to career education, work education or workforce preparation, has generally been replaced by **Career and Technical Education**. For instance, the venerable America Vocational Association (AVA), established in 1926, changed its name to the Association for Career and Technical Educators (ACTE) in 2000. Career and Technical education typically refer to a range of subjects that extend from agricultural education to trades and industrial education. At the upper levels of high schools, many consider technology education to be part of career and technical education.
"Career and technical education" is more appropriate than vocational education for a "post-industrial" era. Rather than an industrial model of vocational education, the new vocationalism positions technology studies as pre-engineering, pre-high tech trades, technical preparation, or "tech prep," for technical careers (Colelli, 1995). In the tech prep model, technology courses in the secondary schools are aligned with the curriculum of colleges and institutes of technology courses to ease transitions. In the best case scenarios, tech prep courses are accepted for post-secondary credits and skills developed are transferable to the technical careers of interest.

**Trades and Industrial Education** (T&I) refers to a specific form of vocational education in the trades. Trades education is defined by a long tradition beginning with the English Guild system of the Middle Ages and extending to modern apprenticeship systems. For most of the twentieth century, trade unions enjoyed a large amount of control over the education of apprentices, but that is changing under neo-liberal governments. T&I educators typically position themselves on the side of trade unions and see the high schools as pre-trades education. In this scenario, technical careers and trades legitimate and validate technology studies. The trades confer status for these teachers. Most economic forecasters predict a shortage in the trades in North America over the next decade, but the numbers will never be adequate to justify the existence of technology studies in the schools. For example, only 2.5% of the students in BC secondary schools have any desire to make a transition into an apprenticeship program after graduation, and only 1.3% actually enroll in an apprenticeship program while in school.

With that much said, technology in education reminds one of the Philosopher's Elephant, derived from the parable of John Godfrey Saxe. In the story, six people are challenged to describe an elephant from a part of the elephant that they immediately perceive. Each one
touches a part of the elephant, the reality of what they perceive and ultimately conceive is distorted by their interests. One from the group standing in front of the elephant touches the tail and describes a rope. The second touches the trunk and describes a snake. The third touches the tusk and describes a spear. The fourth touches the leg and describes a tree. The fifth touches the side and describes a wall. The last person touches the ear and describes a fan. Not one of the six could conceive of the elephant from their narrow interests. Some who look at technology, in our case, see design, educational technology, technology education or trades. Others see applications for art or science. Still others see information technology or communication. The disciplines merely grope for a component of the larger picture. Technology Studies, on the other hand, in its interdisciplinary nature and pluralism, provides for a collective of the disciplines and the bigger conception or picture of technology (Fig. 14).

All connotations of technology studies are evident in this book and operate through different channels. However, technology studies represents an attempt to remove the boundaries and walls that separate design, educational technology, information technology and technology education. Technology studies does this by turning our attention to the four interdisciplines that ground the boundaries. These four interdisciplines of design and technology education are: **Practice, Design, Studies and Criticism**. By turning our attention to all four of these interdisciplines, we begin to erode the boundaries separating design from educational technology from information technology from technology education. They are called interdisciplines because they are interdisciplinary; they are always and already more than a discipline. These four interdisciplines are the primary sources of knowledge for technology as a school subject (Fig. 15).

- **Technological practice** deals with the manipulation of information, tools, machines and materials for the design, production and use of artifacts and techniques.
- **Design** is both a mode or model of technological practice, and a discipline. Design is a source of philosophical and practical knowledge regarding problems of aesthetics, ergonomics, health, function, structural integrity and sustainability.
• **Technology studies** includes the anthropology, economics, history, philosophy, politics, psychology and sociology of technology.

• **Criticism of technology** extends from "internal" design criteria to social philosophies of technology dealing with values embedded in technological practices and their contexts. It deals with ethics, regulation, responsibilities and our relations with technology.

![Figure 15. Interdisciplines of Technology Studies](image)

**A Place For Technology Studies?**

Although we often organize schools as isolated rooms of single subjects, these subjects do not really exist in isolation. There are interconnections among the subjects. And although there is a hierarchy of subjects in the schools, all subjects have their place and reasons for existence. This section of the introduction provides a picture of the interrelations among subjects as well as a context for technology studies in the schools. It is extremely important that technology teachers understand their role in the schools and the process of education. Technology teachers do not merely have isolated roles and tasks to be fulfilled. Technology labs and workshops are not merely places where technical skills are developed. Each day, technology studies plays a part in the whole development of students and their cognitive, emotional and physical lives.
An Inclusive Curriculum?

Purpose of Education: To provide optimum experiences and environments to empower children, adolescents and young adults to become caring and responsible citizens of a world community. To construct a "Big Picture" vision that is sustained by:

- Creativity & Ingenuity
- Imagination
- Personal Relevance
- Responsibility
- Integration
- Critical Thinking
- Cooperation
- Choice & Freedom
- Altruism
- Equity & Justice
- Activism
- Wholeness
- Ecological Sensitivity
- Curiosity
- Multiculturalism
- Open-Mindedness
- Inclusion

Central Framing Questions:

1. Who am I? (Concept of Self)
2. Who are we? (Concept of Community)
3. How do we care for each other and our home? (Concepts of Care and Sharing)
4. How do I love and be loved? (Concept of Respect)
5. Where and how can I find what I need? (Concept of Resource)
6. How do I use what I have? (Concepts of Creativity & Ingenuity)
7. How can I do what I need to do? (Concept of Activism)
8. Why and who says so? (Concept of Discernment)
9. How can I plan for tomorrow? (Concept of Hope)
10. How do I live in this world? (Concept of Reconciliation)
11. How do I know how to be? (Concept of Being)
12. How do I understand— How do I feel— How do I learn to learn?

How can I express myself and engage in dialogue within my community?

- Reading
- Writing
- Language Arts
- Visual and Performing Arts
- Math
- Foreign Languages
- Psychology
- Technology
- Design
- Media Studies

Where are we today and how did we get here? Where are we going?

- History
- Civics
- Geography
- Current Events
- Sociology
- Anthropology
- Archeology
- Zoology
- Primatology
How do my family and I stay emotionally, psychologically and physically healthy?

- Physical Education
- Home Economics
- Outdoor Education

(Example of themes)

- Health & Medicine
- Safety
- Leisure, Recreation & Work
- Women's Studies
- Gay and Lesbian Studies
- Men's Studies

How am I unique?
How do my family, community and society affect who I am?
What happens when I get older?
How can I tell if I’m healthy?

How do we live within our means while working to attain and sustain our resources?

- Design
- Ecology
- Biological Sciences
- Physical Sciences

(Example of themes)

- Technology
- Economics
- Agriculture
- Science Studies
- Engineering
- Business Education
- Career Education

How can I do or make this?
What and whose resources were/are used to make this?
What were the conditions under which this was made?
What will help me to change how things are made and used?
Who participates in technology?

How do I reconcile my desires and needs within a context of social relations?

- Philosophy
- Cultural Studies
- Human Sciences

(Example of themes)

- Theology
- Political Science and Law
- Peace Education
- Global Education
- Sex Education

What do I value and how do I act responsibly?

- Values Clarification
- Ethics
- Multiculturalism

- Moral Education
- Anti-Racist Education
- Introspection
- Activism
- Vision

Projection & Reflective Practice

This introduction provided an orientation to technology teacher education as well as the field of technology studies. A variety of positions on teacher education and technology studies were presented. These positions underwrite the remaining chapters in this book. Curriculum and Instruction were described as interrelated practices that are fundamentally important in the process of learning to teach about, through and for design and technology. The cycle of experience and cycle of reflective practice were described as a framework for teacher education. The primary intention of this introduction was to provide a broad picture of technology studies.

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and inspire you to make commitments that will ground your philosophy of technology studies. The secondary intention was to prepare you for the remaining chapters of the book. The next chapter will introduce basic issues in communication and the organization of instruction.

1. **Life History Exercise:** "We teach who we are" as the saying goes! BUT, as we increase our understanding of our own interpretive frames of reference, or world-views, we begin to open up to alternative ways of acting, feeling and knowing. Reflecting and acting on our socialization is a powerful tool to improve our practice in teaching. Hopefully, this exercise will encourage you to continue to question and rethink your assumptions about youth, culture, nature and technology. This will involve self-inquiry and an analysis of your predispositions to teaching about, through and for design and technology. Think back and reflect critically on your gendering and relations with technology. Try your best to answer these questions: What life experiences influence my current understandings of education AND technology? What particular cultures, especially technical cultures (e.g., cars, computers, construction, cooking, retail sales, sports, toys, video games) have I been immersed in? Why? What particular ways of teaching have influenced my own style? Why? Sketch out your life story as related to your socialization into education AND technology. Reflecting on your socialization and predispositions, what would be helpful to expand your notions of technology and ability to enrich your teaching practice? Parts of this may be amusing, other parts may recall difficult memories. Be creative—express your life history as best you can! Be refreshingly honest and critical. **Make commitments** to expand your understandings of design and technology, and of education. Resolve to professionalize your orientation to technology studies.