Men have dreamed of liberating machines. But there are no machines of freedom, by definition.

- M. Foucault
THE BIRTH OF THE CYBERKID: A GENEALOGY OF THE EDUCATIONAL ARENA FOR ASSISTIVE TECHNOLOGY

DISSERTATION

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By

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ABSTRACT

Within an educational arena of heterogeneous accumulations of power, lodged within the leaky attachment between technology and humanism, technology in special education happens. But how is authority and influence distributed among the actors in this arena, struggling over what is to some appearances a remote, low-incident interest and loss-leader, to some nothing but an unfunded mandate, and to some a life-changer?

In this study, a deployment of wearable computers in special education was analyzed using methods of inquiry informed by genealogy and critical discourse analysis. Although not a methodology per se or a systematic theory, a genealogical project is a form of involvement in contemporary debate, dispute, and struggle and intervention in power/knowledge relations. In critical discourse analysis, formal features of discourse are cues to and traces of ideological conflict occurring behind language. For instance, the discursive features surrounding “work,” a concept at once laden with experiential value as a stable source of identity as well as an uncertainty induced by technology, are a cue to and trace of ideological conflict.

The analysis suggests that the deployment put in tension teacher relations to technology. The deployment produced tension in the dividing practices of who shall receive assistive technology and who shall not, knowledge about which is configured in the microgaze of the state as an object that shall flow through a network of “targeted
individuals.” Moreover, the heterogeneity of literacy was apparent, as the deployment redefined reading as listening -- an accommodation that was seen by actors as an ethically lowered standard to ensure success, a source of self-esteem in special education, and bespeaking the moral value of work.
Dedicated to the memory of Charles & Helen Savas, who filled me with courage and strength of purpose so that no empty space remained.
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CHAPTER 1

INTRODUCTION

Rapidly advancing technological is producing assistive devices are changing the lives of persons with disabilities. Factors that improve access to such devices are not well known, nor is the extent of the impact the devices have on the social roles, integration and participation of those who use them. The importance of government programs and insurance in providing these technologies is not well known, and even the characteristics of markets needed to stimulate the growth of assistive technology development, production and availability are yet to be studied. Conceptualizing the role of commerce in dismantling the “dependency” system would contribute to the reassessment of social programs for persons with disabilities (Barnartt 2005).

Assistive technology might at first glance seem an odd choice of industry on which to conduct such a study in the name of national security, until one stops to consider that it is within the circumference of every major war fought by the United States since the 20th century, from World War I to Iraq, that policies pertaining to disability also emerge. The fact that the gaze of the state has been turned on disability has implications for educational practice, because it is one of the fundamental purposes of education to give people bigger and better discourse maps with which to act on society, the world, and history (Gee 1999). In addition to shaping society in this way, schools are

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1 Previous strategic analyses have covered industries and technologies such as iron ore (United States 2001a), high-performance explosives (United States 2001b), shipbuilding and repair (United States 2001c), and ball and roller bearings (United States 2001d).
shaped by society; thus, what’s happening in U.S. schools regarding assistive technology is linked to a multi-billion dollar assistive technology industry in the U.S. and an even larger global market. For some firms, participation in the assistive technology industry is unintentional while for others it the reason for their business; for all of them, special education constitutes a niche market for their products and services. The "long-term health and competitiveness" of this industry was recently surveyed by the Department of Commerce, pursuant to national security interests. Among the findings, industry members reported experiencing increased competitive pressure from foreign firms both in the global and domestic markets.

The key question that this research asks has to do with conditions of possibility for assistive technology in the educational arena: in particular, I wanted to know how it became thinkable and doable for the emerging technology of wearable computing to become used by students receiving special education. I kept asking myself, how did it become possible for the idea of using wearable computers in special education become thinkable? The research agenda of special education technology has consisted of experimental research, observational and naturalistic studies, and case studies of particular devices. Edyburn (2002) speaks about an “emerging knowledge base on special education technology research and practice” and “dominant themes” such as accessibility, assistive technology, and implementation issues. In 2001, according to Edyburn, “a core set of seven journals contributed to 70% of the relevant articles [pertaining to special education technology]” (p. 5). Upon this ground then, how could I describe a constellation of agency, discourse, and material that constituted the conditions
of possibility for the birth of I dubbed the cyberkid? How were wearables being used as assistive technology? How is knowledge concerning them and these AT practices allowed to form? How do these cognitive prosthetics operate within relations of power, and how are ethical practices in school constricted, constituted, and reconstituted by their deployment?

I employed a methodology that draws upon the ideas about genealogy associated with Foucault, critical discourse analysis, and ethnographic practices such as interviews and fieldwork. The genealogical frame gave me the perspective I needed to belay the obvious truth about technology, special education, and disability. Critical discourse analysis gave me the tools with which I could examine the surface features of my qualitative data for signs of and cues to struggles behind and beyond words. Finally, seeking access to a school and observing the practices of the special education resource room, interviewing principals and teachers and students, being shown the hardware and the software, enriched the corpus of data that I put under the analytic lens. I had collected many documents from various fields and interests related to wearable computing, cognitive prosthetics, and assistive technology. In fact, as I lay waiting for IRB permission to enter the school and do my fieldwork, I analyzed this set of documents in search of that in the language which pointed to the possibilities that I was preparing to see in the field. I will return to my methods and the empirical trail I took in chapters 3 and 4.

Although in the United States, at least since Skinner, computer technology has been promulgated in the educational arena and school districts have been looking for
ways to pack their classrooms with more and more computers, only relatively recently have any among this constellation of actors turned their gaze to the what, how and why of computer use in school by students receiving special education. The special education literature is generally positive about this development. Research and development continues to give rise to objects like wearable computers, combining the mobility of a cell phone with the power of a laptop in a ruggedized form, and this finds, or doesn’t find, its way into school as an assistive technology.

For this type of wearable or distributed computing, a typical configuration includes an input device\(^2\), and a heads-up display that competes for attention with the user's surroundings. Displays small enough to be worn on eyeglasses provide the equivalent of a 6-inch monitor. Processors and memory can be distributed over the body, with wireless network access \textit{de rigueur}. Wearable computing is used in manufacturing and training; field technicians are outfitted with hands-free access to information in remote locations such as atop utility poles or in underground tunnels and large work spaces such as power plants or aircraft assembly hangars. Wearables provide augmented reality\(^3\) that allows for face or object recognition and context awareness in the form of monitoring vital signs, voice, and mood and location awareness in tagged environments;

\(^2\) Depending on the environment, sometimes a chording keyboard and mouse or ‘twiddler’ is used for input, or a keyboard worn on the forearm, or a folding keyboard carried with the computer. In the school study I conducted, the last of these was used.

\(^3\) Starner et. al. (1997) describe how wearable computers as platforms for computer-mediated realities. Of the four types of mediated realities that are discussed, virtual reality is probably the most commonly recognized. Virtual reality creates a completely computer-generated environment. Augmented reality adds computer-generated information (CGI, or virtual objects) to an existing, real-life environment. Wearables used to produce a diminished reality filter the environment by altering real objects, replacing them with virtual ones, or rendering them imperceptible. Mediated reality combines augmented and diminished realities.
a wearable computer acts as a platform for communication in the form of alerts, instant messaging, webcam, and collective intelligence.

At the same time, a discursive body of education law regarding assistive technology is also circulating. The Education of the Handicapped Act of 1970 was amended in 1975, becoming EAHCA, The Education for All Handicapped Children Act. In EAHCA originates the concept of mainstreaming children with disabilities into the regular education classroom or within the least restrictive environment. The act also describes the steps of due process regarding non-discriminatory integration as well as testing and placement.

The benefits of the The Americans with Disabilities Act extend to a broad range of people by cutting across all sectors of society; virtually every voter will experience positive benefits from the law or know someone who does. Policy makers saw important implications for the next century in terms of managing costs of potentially dependent populations. Demographers project a dramatic increase in the number of people who will live into their nineties. The extent to which their needs can be accommodated through responsively designed environments and assistive technology may save billions of dollars in institutional care, largely underwritten by federal programs.

As many as two-thirds of people with disabilities are unemployed, largely due to attitudinal and physical barriers that prevent their access to available jobs. With the national sentiment opposed to long-term welfare reliance and a labor-deficit economy, employment of people with disabilities is essential. An individual may become a member of the protected class at any moment in his or her life. Through support services and
assistive technology, The Americans with Disabilities Act expresses equal rights within
the US constitutional tradition.

In the weight of law regarding technology for disabled students expressed in texts
like the Individuals with Disabilities Education Act (IDEA) and the Technology-Related
Assistance for Individuals with Disabilities Act (Tech Act) is traceable an ongoing
construction of disability, assistive technology, subjectivity, and the glue of civil rights
and responsibilities that tries to hold it together.

Since the 1990s, wearable computers have come to be used in the performance of
inspection, maintenance, and manufacturing tasks in a growing numbers of economic
industries and sectors. In the assistive technology industry, the research and development
of wearable computers applied as navigation systems for individuals with impaired vision
and as sign language translators for the deaf is being pursued. Although not originally
researched or designed for school use, some wearable computer vendors niche market
their products to educators for use by mentally and physically challenged students
receiving special education. The object form under discussion is technological artifact
MA IV by Xybernaut. Although the processors in MA IV were 2 years behind typical
desktops, its price at time of fieldwork (2001) was from $4,000 to $7,500 each. No more
than a few thousand sold in 2000 (Schweder 2002).

1.1 Theoretical frame for the study

There are no doubt many ways to address the present. In the following study, I
have chosen to do so in terms of what we hold to be true about disability, about the
special education that children receive in school, and about the technology deployed there. That is, how do children with disabilities enter into “games of truth” (Foucault 2000) as disabled subjects organized around medical knowledge embedded within when relations of inequality?

Even though this question takes the formation of knowledge as its object, the emphasis of the study is not only epistemological -- what we can come to understand about disability or assistive technology in school -- but also in how we live in this time in these our bodies -- political, ethical, temporarily able.

Foucault wrote that politics was “a more-or-less global strategy for co-coordinating and directing [power] relations” (Foucault 1982). In this definition, power is conceptualized as dispersed, as existing within a network of constraints. Furthermore, there are power relations, not only one seat of Power. So, for instance, in this study, there is one type of power relations in technology, another in education, and yet another emerges in the area of disability, and these exist simultaneously (and heterogeneously) with the power of the state, which is the traditional object of political analysis. Foucault uses the metaphor of “capillary action” (Foucault 1982, 89) to describe the relation between massive accumulations of power such as that evinced by the state, and power relations as in the aforementioned localities. To be sure, the state exerts influence over what technological artifacts come into being and do not come into being, what counts as special education, and who shall receive it or not receive it; however, the way things go in these areas is not overdetermined by that power. Within this perspective, the goal of this study is to offer an analysis of the deployment of a particular technological artifact, reveal how it has been
used to promote relations of inequality and mitigate them. I am, to use yet another Foucauldian coinage, attempting to work as a “specific intellectual…not in the mode of the ‘universal,’ the ‘exemplary,’ the ‘just-and-true-for-all,’ but within specific sectors, at the precise points where [my] own conditions of life or work situate [me]” (Foucault 2000, 126).

1.2 Methods of Inquiry

This study is genealogical. Genealogical methods reveal the creation of objects through institutional practices. Genealogy reciprocally alternates and supports [the] archeological level -- the level of what made [an event or a situation] possible" (Foucault 1973, 31). Foucault’s archaeology, as a “strict analysis of discourse,” (Foucault 1982, 104) studies the practices of language to reveal the system of inclusion and exclusion that operates within the object of its study. Foucault’s archaeology of madness (1972) sought to reveal, “a whole series of binary oppositions which had each in its own way fed on the great opposition between reason and unreason that I had tried to reconstitute a propos of madness.”

An archaeology of disability would be disinterested in the truth of the claims made. It would not offer a progressive history of, for instance, rehabilitation engineering or medical knowledge concerning ADHD. In this sense, the truth can be said to be bracketed so that discourse cannot respond to critique merely in the terms of its truthfulness. This radical subversion of the truth, however, is not a denial of the truth or efficacy of particular disability practices. Rather, the subversion opens up the possibility
of uncovering the discourse’s connections to other discourses and practices and the conditions that give rise to practices such as deploying wearable computing as an assistive technology. Given that a particular discourse of disability has emerged, what is its relation to the *episteme* (Foucault 1972) of its time; that is, what are its rules of formation? An archaeology of disability then would historicize knowledge about disability, asking of it: what is the relation of disability discourse to other discourses around it? Why did disability and not another discourse arise instead? The approach to these questions is to first describe the network of discourses inhabited by disability and the *episteme* that orders it. After that, connections are made between this discourse and other (discursive and non-discursive) practices.

Foucault’s archeological project created the possibility for political and epistemological critique of psychology and other social sciences, but it itself has been critiqued (Deleuze 1988, Derrida 1978) for operating within the *episteme* that it calls into question. Of genealogy, Foucault (1980) writes: it is “the union of erudite knowledge and local memories which allows us to establish a historical knowledge of struggles and to make use of this knowledge tactically today” (83). Moreover, genealogical analysis tries to grasp the power of constituting a domain of objects.

Texts from various areas related to the development of wearable computing, assistive technology, and special education were selected and examined for their significant and structuring effects on the contested space of the educational arena for assistive technology. A case of wearable computers as they were implemented in a
middle school special education program in a suburban midwestern school district in the
United States was also studied.

Lyotard (1984) observed that machines have come to play an important role in
regulatory and reproductive processes and the power to make decisions is increasingly
determined by questions of access to information (14). The function of states, then, is to
govern, control and regulate knowledge as if it were another market. Learning circulates
as money does, instead of having ‘educational’ value or administrative importance.
Wearable computing, as worn access to information, is inscribed in this shift in
knowledge and its reorganizing effects on education. The idea that “learning falls within
the purview of the state, as the mind or brain of society” has given way to a society that
“exists and progresses only if the messages circulating within it are rich in information
and easy to decode” (5).

Knowledge and power, Lyotard goes on to write, are “two sides of the same
question” (9). Scientific knowledge, “governed by the demand for legitimation,” and
constituted within the rules of its requirement for proof or argumentation, is privileged
over “narrative knowledge, “legitimated by the simple fact that they ‘do what they do’”
(23).

Wearable computing, then, is inextricably linked to power/knowledge/body
relations. The augmentation practices that prosthetic technological organs afford
complicate the boundaries fixed for the modern body and the unique identity given to it
by God, by nature, or by scientific taxonomy. Nothing is given when it comes to
distinguishing animal from human from machine.
The medical politics of the eighteenth century linked the health of the population to economic management. One of the characteristics of this “noso-politics” (Foucault 2000) was the construction of the child within the medicalized family (90-105). Whereas up to then for the state or sovereign power the problem of the child was to produce enough of them that lived, there was now added the problem of managing the health of children, of ‘childhood’ itself, to insure that they survived into adulthood and became productive subjects. It became the objective of the family “to become a dense, saturated, permanent, continuous physical environment that envelops, maintains, and develops the….healthy, clean, fit…child’s body,” (96-97) and this medicalization of the family was accomplished in part through discursive practices of child care. This is the background against which the contemporary disabled child and his/her family, and the assistive technologies of which they are to avail themselves, are constructed.

1.3 Wearable Computing

Wearable computing occurs within a positivist framework of innovators and inventors and their functional systems, an accumulation of people, dates, ideas and devices. The idea of augmenting the capabilities of the body has its roots in the writings of Roger Bacon (1268) on the use of lenses in eyeglasses and other optical devices to augment vision and Robert Hooke (1665) who wrote on the use of “mechanical inventions” that would promote the other senses analogous to the way glasses improve vision. The 18th century saw the invention of an accurate and reliable marine
chronometer⁴, and the first wristwatch invented in the early 20th century for pilots to use in aircraft, where their hands are preoccupied with flying the machine, and more recent developments in miniature displays, speech recognition, language translation, microprocessors, and wireless communications since the 1970s and 1980s are predecessors of the wearable artifacts of today. As a matter of form, worn access to information emerges as a ‘geek chic’ accessory on the runway at fashion shows.

Ruggedized, hands-free access to information shifts the economic practices of production, efficiency, and profitability in plant operations, manufacturing, language translation, maintenance, medical practices, invisible computing, smart rooms, mobile worker concepts, and navigation. Wearable computers are employed by companies in various economic sectors and industries to enhance the functional capabilities of workers. Access to information improves the efficiency and productivity of workers in situations that require them to operate in remote locations or upon very large objects (underground, or inspecting the assembly of ocean liners). Access to information makes inexperienced workers more efficient, thereby reducing training costs.

Wearable or distributed computing is also being deployed as assistive technology. The United States assistive technology market is a limited, regulated, and frequently subsidized assistive technology market worth almost $3 billion in 1999. Wearable computing is a niche product within the assistive technology industry marketed to educators for students receiving special education. Wearable computing, used as it is in special education, can be said to produce the “normal” or conforming and the “deviant”

⁴ A pocket watch used to find the longitudinal position of a ship.
or non-conforming student as states identify, locate, and evaluate the children in their power to determine who shall need or not need special education and related services.

In the next chapter, I examine the themes raised here in the context of the literature in special education technology, developments in cognitive prosthetics and in mobile computing. Chapter 3 describes the critical poststructural method of inquiry that I used, including ideas from Foucault’s toolbox such as history of the present, genealogy, and archaeology, as well as critical discourse analysis. Chapter 4 contains my analysis of the data collected through document collection, interviews, and observations, and application of critical and cultural theories of education, technology, and disability. The final chapter is a conclusion of findings and how I came to describe what I saw as the birth of the cyberkid.
CHAPTER 2
LITERATURE REVIEW

The fieldwork for this study was conducted in a special education resource room, a location subsumed in special education technology literature. As a relatively new field that emerged in the latter 20th century about the same time as computers in education, I found that lines of the analysis led me to also consider literature from its progenitor field, educational technology. Likewise, the use of wearable computers by students with learning disabilities led me to discourse in the area of rehabilitation technology for cognition. Finally, critical poststructural work such as that engendered by Foucault, and the emerging area of disability studies, offer theoretical perspectives on the policies, practices, and artifacts one encounters in special education.

This chapter traces that development in three parts. The first part examines research on assistive technology for cognition in educational technology, special education, and cognitive prosthetics. The offspring of a turn-of-the-century marriage between psychology’s empirical modes of objectification and education, educational technology “involves the development of powerful instructional designs that generate the most productive cognitive processes required for particular learning tasks and for knowledge to be mediated by the cognitive processes produced by the technology” (Saettler 1990, 453).
If psychology and education are the conventional nineteenth century forbears of educational technology, then computer-assisted instruction or CAI is the twentieth-century single parent of special education technology. Beginning in the 1980s, computer-assisted instruction, accompanied by the computer management of instruction to “assist” teachers in administrating the CAI process, became dominant in special education (Woodward & Rieth 1997). The educational arena of the time had invested computers with a conservative mission to return to basics.

Working up the tree from these roots, I concentrate on several emerging issues identified in the current special education technology literature: 1) the ever-finer grain of specificity, customizability, and individualization of devices; 2) the efficacy and relevance of special education teachers viz. assistive technology; 3) the relation between cognitive prosthetics and curriculum; and 4) assessment and the indefinite climate of hope and despair with which special education is invested (Paul 2002, Tinker 2001).

The final part of this chapter turns to the emerging field of disability studies, which explores the perceptions that surround both the concept of disability and the actual experience of living and being educated “disabled” in the contemporary world. Included in this section is a discussion of the tensions between disability studies and special education. Research design and other matters of methodology are taken up in chapter three.

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5 “Assist” merits scare quotes here because of the way it misaligns with how the word operates in the correlative assistive technology. In the educational arena, the latter invokes a student, while the former calls forth a teacher-manager. The language attending the birth of the xyberkid is here, as everywhere in language, slippery.
2.1 Special education technology

Roughly 80 years after educational technology emerged as a field, at a time when “it was clear from most of the computer literature that the computer was viewed as the further extension and embodiment of traditional goals of education” (Saettler 1990, 457), the subfield of special education technology was born, inextricably intertwined with the computer revolution and the conservative mission with which the deployment of computer assisted instruction in general education had been invested. The literature was filled with technical explanations of special education computer technology. According to Roder (1997) this type of content is a sign that teacher self-confidence was an early issue in the face of persistent technical abundance and the need to choose. Out of this dense matrix of material coercions, the establishment, validity, and currency of special education teachers have emerged as an incitement to discourse on professionalization and best practices (Tinker 2001).

2.1.1 The special education teacher as an emerging issue

Woodward & Rieth’s (1997) review of special education technology literature traces two lines of research: one on technology for instruction and one on assessment. In so doing, the authors observe that special education teachers are inhibited in their use of technology. While it appears that a veritable cornucopia of technology is placed before special education teachers, at least rhetorically if not also materially, yet these educators don’t use technology enough. General education teachers will be familiar with this phenomenon and the explanations for it: difficult logistics and no money. Larry Cuban (1993) argues, however, that attributing the underuse of technology by general education
teachers in schools to logistical difficulties or lack of funds is only a partial answer and suggests a deeper problem: “many visions of how technology should be used in the classroom—ones that often stem from the research community—have been at cross purposes with core visions about teaching” (84). Comprehensive approaches to instruction using educational technology conflict with the teacher’s perception of the more informal, spontaneous instructional decisions that occur and that they prefer to make in the classroom. Researchers conclude that “a wide array of technology-based efforts have been guided by fundamental assumptions about teachers and teaching which were likely to have been in conflict with the special educator’s essential vision of his or her craft” (Woodward & Rieth 1997, 525). For special education researchers, another problem is that “the technologies are often prototypes, either not marketed commercially or [which] did not achieve sufficient visibility because of the narrowness of the special education commercial market” (Woodward & Rieth 1997, 525). Despite these findings, research on special education teachers finds that, even though they are frustrated by the quality of available programs, most teachers believe that students show increases in basic skills when using commercial software (Woodward & Rieth 1997, 522). Teachers also feel that microcomputer use has a considerable and positive effect on the motivation and self-esteem of students (Cosden 1988 in Woodward & Rieth 1997, Lewis 2000).

Another emerging area of concern over special education teachers is the role they play in identifying students who may receive special education. This diagnostic role places increasing pressure on special educators to collect, manage, and interpret large quantities of data on students and technology was offered as a fix for this too.
“Technology research in special education became more distinctive when researchers began examining ways in which technology could simplify the diverse if not overly complex roles required of public school special educators” (Woodward & Rieth 1997, 503).

Educational researchers now propose the use of databases and applications for mining their contents to shift how special education teachers find and manage their charges (Tsantis and Castellani 2001). Expert system programs to locate and identify abnormalities in student behavior and performance hold out the promise of doing so more efficiently and accurately than human teachers. “Research over the last decade in computer-based assessment has generally documented how well different technologies can simulate or even augment human assessment, as well as the extent to which these tools are cost effective, in terms of replacing the time-consuming and tedious work normally done by hand” (Woodward & Rieth 1997, 517).

2.2 Special education policy and law: Targeted individuals

One of the main intentions stated in the literature of special education is to address individual differences, indicative of the shift in the discourse on democracy that occurred in the United States over the course of the twentieth century from a discourse based on “equality-in-sameness” to one based on “equality-in-difference” (Baker 2002). Even prior to IDEA, individuals with “severe/profound disabilities” were routinely fitted with assistive technology (NCES 1998). Since IDEA, there has been an expansion into the “mild-to-moderate” portion of the spectrum of disabilities posited in the literature. Presently, learning disabilities and mental retardation, both cognitive, are the two most
commonly referenced disability groups in the special education literature (Edyburn 2001). However, as more and more students are subsumed by these labels and marked for assistive technology,

the criteria for identifying students with learning disabilities vary considerably within and across states and the quality of academic interventions for these students differs only marginally from that of interventions for students without disabilities in general education classrooms (Woodward & Rieth 1997, 525).

2.2.1 Curriculum and computers: Can I play my game now?

Woodward & Rieth (1997: 522) observed that “students with disabilities exhibited consistently high engagement rates [with CAI]….in spite of the fact that special education teachers tended to have relatively few direct contacts with students while they worked on computers.” Malouf (1988) argues that “arcade games compete for time and attention in the context of drill and practice” (ctd. in Woodward & Rieth 1997: 514). Neuman (1991 ctd. in Woodward & Rieth 1997: 522) observed that “it was common for students to approach even the most routine drill-and-practice programs in a competitive fashion, a disposition presumably based on their wider experience with computer games.”

Writing, math, reading, functional curriculum, and access to the general curriculum are the five most common curriculum applications of special education technology (Edyburn 2002). While most educational technologies are rehabilitative, the use of a wearable computer as a cognitive prosthetic, an external support, is a compensation technology. For example, a student might “read” a book by listening to a text-to-speech program output the digital text, or a student may “write” with a voice recognition program.
The sense of technology underuse associated with teachers is also leveled at the users of assistive technology. One of the assumptions about assistive technology is that the individuals for whom it has been prescribed should use it. States, their agencies and other governing bodies seek the ability to predict and control the use versus non-use or abandonment of assistive technology (Riemer-Reiss & Wacker 2000).

2.2.2 Assessment: indefinite hope and despair

Hopes and fears attach to new technologies. In American society, the notion of the technological fix has been an influential part of the discourse on technology and society, although in recent decades faith in technology has diminished. In education, new technologies drive innovations in curriculum design, pedagogy, and policy. Hope and despair attaches to the student at the margin, the student unaddressed by current technology. Students who receive special education are framed as the beneficiaries of emerging technology. As the needs of the least served are met by a rising tide of technology, so the thinking goes, all of society gains. Moreover, the primary prediction for innovations in assistive technology in education is that the technologies will produce a higher degree of individualization:

The technologies of the future will be more, not less, diverse, and they will engage many kinds of learners….the implicit goals of education will change from homogenization to diversification….new kinds of learning, new kinds of teaching, and new kinds of success (Ross & Meyer 2000).

Special education teachers are often placed in resource rooms where, in addition to providing instruction, they are also responsible for diagnosing students who may be eligible to receive special education and for recording movement towards the educational
objectives stated in each student’s IEP. The IEP is a product of IDEA. The idea of the IEP is for educators to react quickly and strongly to daily changes in the student (Woodward & Rieth 1997: 518). “What is striking about the most prominent strands of this research [on technology-based assessment] has been the interplay between software development and research. Frequently, the same researchers have prototyped, evaluated, refined, and researched their assessment systems.”

Research in special education technology makes use of an ontology and epistemology of instructional “promises” that produces a circuit of hope and despair.

Beware the seductive power of new technologies: probably everyone in the special education technology community has at one time or another succumbed to hype. We have believed that this new software program or that piece of hardware will solve some our problems or meet some of our needs better than the technologies we currently use. Sometimes our beliefs were borne out; many times, however, they were not (Lewis 2000, 11).

The construction in discourse and practice of this cycle of hope and despair leads to the pronouncement of a gap between expectations and “reality.” This gap is commonly understood as an effect of product marketing, and the special education technology literature is replete with cautions concerning the claims that elements of the assistive technology industry make about particular products. "A natural part of marketing involves making claims about a product. In many cases, the claims are modest:…In other cases they border on the outlandish" (Edyburn 2000, 16). Adding to the dismay that special educators are to have concerning technology is the unfortunate fact that many decisions about applications of technology in special education are "device driven;" as new devices appear on the market, it is not uncommon to find consumers,
parents, vendors, and professionals, the targeted individuals sought by the state, advocate strongly for their acquisition and use with different students—often with less than satisfactory results (Blackhurst 1997, 34). The educational arena for special education technology does not differ in this regard from general education’s historical development as a somewhat captive market for technology (Besser 1987).

After conducting a historical review of literature relating to research methodology in the area of technology and education for students with disabilities, Woodward and Rieth (2000) conclude that technology has yet to prove itself as a tool that can provide benefits beyond existing practices. The authors note that there has been a lack of comparative research to outline the differences assistive technology makes and therefore it has not been possible to determine whether the benefits of technology are any different to those seen from the use of other teaching tools. Another review (EHLT 2001) suggests that educational technologists have confounded the medium of technology with instruction, making it impossible to conclude whether change is a result of the technology or the type of instruction that adheres to its use.

One of the most obvious influences on special education technology is the deployment of increasingly sophisticated and cost-effective hardware and software. The appearance of expert systems, multimedia software, and a range of other devices previously unseen outside of laboratories and the military has dramatically broadened special education technology research and takes us to our next area, rehabilitation.
2.3 Cognitive Prosthetics

The Smith-Fess Vocational Rehabilitation Act was enacted after World War I and was amended with subsequent wars: in 1943, 1954, and 1965; that is, after World War II, the Korean War, and during the Vietnam War. In the 1943 amendments, mental retardation was covered for the first time, thereby circumscribing certain individuals for the first time and making them available for vocational training. In 1954, rehabilitation was moved from the Veterans Administration into the then-new federal Department of Health, Education, and Welfare. Since the 1980s, the Office of Special Education Programs, housed in the Department of Education (successor to HEW), has produced metastudies of the future of technology and its effects on special education (Hauser 2001).

However, it must be kept in mind that a principal assumption by the dominant in the construction and oppression of a minority group such as “the cognitively impaired” is that some form or another of \textit{a priori} on-the-body, biological inferiority exists; moreover, the visible, physical difference of people with disabilities evokes fearful reactions that perpetuate the notion of subordinate/dominant status. Society views people with disabilities as not quite human because they fail to meet twentieth-century Western values of physical attractiveness or individual autonomy (Goffman 1963). Meanwhile, the ever-finer grain of difference of disability articulated by educators and allied professionals also activates the technological fix of assistive technologies as a moral obligation of the normate. Despite this moral imperative, the Rehabilitation Act had to survive two presidential vetoes.
The Individuals with Disabilities Education Act, or IDEA (United States 1990) was amended in 1997 and 2002. IDEA specifically cites the use of computers in special education, IEPs, and rolls out the notion of Free Appropriate Public Education or FAPE. Many other laws, guidelines and cases are cited in relation to The Technology-Related Assistance for Individuals with Disabilities Act (United States 1988) and its amendment, the Assistive Technology Act (United States 1998a). In these texts lie a set of concepts, findings, and rationalizations concerning the use of technology in special education, including statutory definition of a disabled person.

The current field of cognitive prosthetics claims a spectrum of technology varying in form from beepers to robots. The dominant approach to the design and deployment of assistive technology for cognition, or cognitive prosthetics, is to “fit” particular individuals with a learning disability with a cognitive prosthetic that either takes the place of what the individual lacks or shifts the disability-induced problem onto the terrain of one of that individual’s strengths or unimpaired abilities (Higgins & Raskind 1995, Raskind & Higgins 1995, MacArthur 2001). A cognitive prosthetic might entail a change in strategy or in information characteristics as means of working around a cognitive impairment; thus, the assistive technology is conceptualized as an array of extrinsic supports which can, for example, compensate for a deficit in memory if the individual still has unimpaired executive functioning to assist with time management and antidawdling; a prosthetic may make use of voice recognition technology to bypass keyboarding and poor letter recognition, if the individual still has normal verbal ability;
likewise, a prosthetic may consist of a text-to-speech application to compensate for the inability to read, if the individual is able to hear and process the spoken word.

Prosthetics can be fashioned that can alert an individual when it is time for medication, where to find the correct medication, what constitutes a proper dose, and when and how to prepare the next dose. A prosthetic could be fitted to cognitively impaired children in school to eliminate dawdling in the halls between classes, thereby helping to return that different individual to a level of sameness comprised of access to the general curriculum in a least restrictive environment. To do so however, the cognitive prosthetic must be highly customizable, as differentiated as are the disabilities of the children. Each individual must be analyzed to identify not only the offending impairment but also the regular function(s) that might form the base for a compensatory shifting. Every student is a carpenter’s gothic of offload and external functionality for the unrehabitable. In the next section, I take up another timber in the frame, disability studies.

2.4 Disability Studies: Medical, social & postie models of bodies “not quite right”

In recent decades, a growing body of disability history, theory and research has emerged (Abberley 1987, Shakespeare 1994, Garland-Thomson, 1997, Gleeson 1997, Mitchell & Snyder 2000, Davis 2002,). A concomitant reconceptualization of disability has also made its mark on the way technology is construed. Hockenberry (2001) for instance, invokes the history of engagement that disabled people have had with technology when he writes: “we live at a time when the disabled are on the leading edge of a broader societal trend toward the use of assistive technology.” This is reminiscent of
Haraway’s (1991) oft-cited ‘manifesto’ in which she wrote that “perhaps paraplegics and other severely handicapped people can (and sometimes do) have the most intense experiences of complex hybridization with other communication devices” (p. 148).

Although we must be careful here, as Davis (1995) reminds us, not to denigrate disabled people by attributing extraordinary powers to them as compensation for their disabilities such as the way that blind people throughout the history of Western culture have been invested with “insight,” the history of disability is an aspect of the history of technology that is largely ignored and unknown.\(^6\)

The concept of disability has undergone a number of changes over the years, from deviant, stigmatized status to socially constructed status, cultural or linguistic minority group, and social movement. In terms of the approach that I took for this project, I will discuss the intersecting discourses that have constituted the ground for this emergent field and sketch recent critiques of the social model of disability from what could be called poststructural approaches to theory and criticism.

As mentioned previously, starting with the Rehabilitation Act of 1973, the disability rights movement had its agendas recognized, including the first statutory definition of discrimination towards people with disabilities that changes perspective, from a medico-economic discourse and attending definition of functional and vocational limitations, to a socio-political framework that focuses on the disabling qualities of the environment. The impairment/disability distinction is codified (Oliver 1996). Gleeson (1997) observes that disability and statistical analysis firmly rooted in the world of

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\(^6\) Catherine Kudlick’s (2003) review essay of disability history surveys work on the connections between, for example, gender and disability and race and disability, but there does not appear to be much work done on the interweaving of technology and disability.

In seeking to study the nature, meaning, and consequences of disability in culture from multiple perspectives and to provide an enriched and coherent view of disability as part of universal human experience, disability studies understands and analyzes disability as a phenomenon that simultaneously manifests itself at bodily, personal, and societal levels. The lines of analysis coming out of disability studies provides a context for understanding the meaning and experience of difference in society, including the asymmetry of the vexed effects of technology at these multiple levels.\(^7\)

The terrain of disability studies has taken shape through the contestation and negotiation among three discourses: medical, social science, and humanities. Each constructs knowledge about disability and produces disabled subject positions, but the truths they disgorge are frequently conflicting. Disability studies is sometimes defined to exclude voices coming from discourses about disability on the grounds that the latter have dominated the conversations about disability for too long. Disability studies is, for some (Linton, 1998) the social and cultural study of disability in contraposition to medical models of disability and social science models that make disabled subjects the object of inquiry from a position of otherness. This critique is partly in response to the way research has been framed within the dominant discourse of disability study, medical research.

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\(^7\) See Jain 1999.
There is little room in medical discourse for the sort of social, cultural, political, constructions of disability that informs so much of the work in these latter discourses. As part of this social model of disability, there has been a call for a more emancipatory and participatory disability research, a disability research driven by disabled people who are part of the entire research process (Barnes and Mercer, 1997; Moore et al, 1998; Oliver, 1997; Zarb, 1997). Miller & Crabtree (2000) write about the clinical research space from a double perspective as applied anthropologists as well as physicians, thereby presenting the clinical space as a complicated arena of interests. They construct an ethical framework for their participatory research that is committed to the agendas of disabled people seeking social justice. So, for example, one of the particularly difficult issues for them stemming from their research on/with disabled children is where the commitments of researchers should lie, given the uncertain place of children’s rights in society and “the variety of guises in which children find themselves experiencing family life.” (p. 72). They also write about the importance of reflexivity in disability research: “We have stated our belief several times, that being criticized about ourselves in terms of values, assumptions, practices, and personal and professional development is an essential aspect of an emancipatory approach to disability research” (p. 72). These attempts at reconstructing the medical space in which disability occurs notwithstanding, it does appear that the medical model of disability equates disability with dependency and rests upon a pathology of individuals and, ultimately, the rational subject. In a sense, medical research is not part of disability studies, as it is practiced in some of the social sciences and humanities; on the contrary, it is an artifact of oppression.
The social model of disability, including the inclusion of disability rights movements in the study of social movements, the role that oppressive environments and social structures play in causing disabilities (Cornelius 2000), the ethical and legal debates surrounding genetic research and assisted suicide, and cross-cultural studies of the economics, politics, and value systems that invest disability. Altman & Barnartt (citing Monaghen 1998) point out that “while there is a movement toward the development of a disability studies discipline, not unlike women’s studies or African American studies, the humanities have been more successful in establishing research and curriculum in these areas than the social sciences.” Linton (1998) also argues that the Humanities is the place in which to house disability studies in academia. Thus, the research and literature of the previous section of this review are peeled away from humanities-based disability studies.

One critique that humanities-based disability studies (Disability Studies$_2$) directs at science-based disability studies (Disability Studies$_1$) is that the latter consists of the objective study, carried out predominantly by non-disabled subjects, of deviant bodies that make available a concomitant set of disabled subjectivities and interventions designed for impaired individuals to implant, occupy, consume. Disability Studies$_2$ frames disability in terms of society, culture, and politics. Linton (1998) considers this difference between the two disability studies projects worth preserving because the effects of doing so allow for a heterogeneity of discourses that inform but are not dominated or subsumed by the positivist paradigm of inquiry into disability. “[Disability studies] is [ought to be?] an interdisciplinary field based on a sociopolitical analysis of
disability and informed both by the knowledge base and methodologies used in the 
traditional liberal arts, and by the conceptualizations and approaches developed in areas 
of the new scholarship” (Linton 1998, 2).

The U.S. Department of Education (USDOE) has articulated a response of sorts to 
the consequences on research of a social model of disability. A contextualized definition 
of disability transforms the conceptual models that researchers will deploy, redefines 
what measurements such as demographic studies, national surveys, and distribution data 
are expected to reveal, redesignates what areas of inquiry will receive greater attention, 
and reformulates how research under the new paradigm should be managed to include 
“stakeholder participation, interdisciplinary and collaborative efforts, large scale and 
longitudinal research, and new research methodologies” (p. 13).

The causes for this shift in ontological and hermeneutical perspective is, 
according to the report, the “emerging universe” of new disabling conditions; “new 
causes for impairment; differential distribution within the population; increased 
frequency of some impairments, including those associated with aging; and new 
consequences of disability, particularly related to socio-environmental factors, life-span 
issues, and projected demands for services and supports” (p. 1). New and in some 
instances still controversial illnesses or conditions identified in the report include AIDS, 
ADHD, violence-induced neurological damage, repetitive motion syndrome, chronic 
fatigue syndrome, childhood asthma, drug addiction, and environmental illnesses. Even if 
such diagnoses have proved controversial, they reveal much about American society's 
coming to terms with defining disability and responding to it. Another factor in the cause
for shift is the aging of the United States population, and the prevalence of disabilities among older people. A third attribution for the shift is the high prevalence of emerging disabilities related to poverty, abuse, and violence occurring among women, especially those already with disabilities (p. 22).

The “new paradigm” of disability perceives the disabled person as whole, functioning in an environmental context. The paradigm it is intended to replace constructed the disabled individual as deficient and thereby prevented from functioning. Such a shift in definition sensitive to human-environment interfaces means that a system for classifying and measuring the environmental components of disability and new models for describing and quantifying the interaction of environmental and individual variables must be produced; equality-in-difference. Thus, survey questions must also reflect environmental factors as well as individual characteristics.

New measures must enable researchers to predict and understand changes in the prevalence and distribution of disabilities that illustrate the link between underlying social and environmental conditions--poverty, race, culture, isolation, and the age continuum—and the emergence of new causes of disability, new disability syndromes, and the differential distribution among various populations in our society (USDOE 2000, 11).

Policy indicates that inquiry should be directed towards “the dynamic interplay between people and environment; of the adapting process, by the society as well as by the individual, and of the adaptive changes that occur during a person’s lifetime” (USDOE 2000, 12). The new paradigm means new interdisciplinary models for research to include fields such as architecture and business in defining the terms of accessibility and accommodation. Finally, the role of disabled people under the new paradigm must also change. The report calls for more disabled and minority researchers, and recasts disabled
persons as active participants, interpreters, disseminators, designers of research on the person-environment dynamic as well as, of particular relevance for this study, in the role of proactive consumers of information and services.

In addition to returning to epidemiological and demographic literature that the emerging universe of disability demands, Barnarrt & Altman (2001) identify several other “researchable issues” in social sciences relating to the social model of disability, including the inclusion of disability rights movements in the study of social movements, the role that oppressive environments and social structures play in causing disabilities, the ethical and legal debates surrounding genetic research and assisted suicide, and cross-cultural studies of the economics, politics, and value systems in which disability is embedded. Barnartt & Altman (2001) observe that “while there is a movement toward the development of a disability studies discipline, not unlike women’s studies or African American studies, the humanities have been more successful in establishing research and curriculum in these areas than the social sciences.”

More and more disability scholars (Linton 1998, Snyder, Bruggemann & Garlan-Thomson 2002) see the humanities as the place in which to house disability studies as a way to correct the cultural narrative of disability and the academic narrative, whose distinct sets of truth effects, she observes, are out of step. What she calls “academic discourse” constructs pathologized subjects from specialized fields such as rehabilitation and special education.

Linton points to a different narrative truth emerging out of disability, after decades of activism and social formation. Disabled people, disability communities and
cultures, are coming out onto the accessibilized street, more visible. It has been thirty years since the beginning of the contemporary Independent Living Movement. During this time, the previously separate groups of people with disabilities began to collectively fight for the respect, and demand the civil rights, enjoyed by mainstream America. There is now a first generation of laws protecting the rights of disabled people. Federal law now mandates access to employment, transportation, education, and public accommodations for disabled people in the United States. This legacy of disability activism is a crucial component in the construction of humanities-based disability studies.

A key difference between these two disability truth projects is that the academic narrative accepts the objective study by nondisabled subjects of deviant bodies makes available a concomitant set of disabled subjectivities, and designs interventions for impaired individuals to implant, occupy, consume. Disability community frames disability in terms of society, culture, and politics. Linton considers this difference worth preserving, because the effects of doing so allow a discourse on disability, or multiple discourses, informing but not dominated by, the academic paradigm of inquiry into disability. “[Disability studies] is an interdisciplinary field based on a sociopolitical analysis of disability and informed both by the knowledge base and methodologies used in the traditional liberal arts, and by the conceptualizations and approaches developed in areas of the new scholarship” (Linton 1998, 2). Claiming humanities-based methods of inquiry for disability studies defines a border between “disability and not disability” (p. 137) that Linton argues is worth preserving in the name of social justice. She’s working the impairment/disability pairing, and assigning the former to applied fields of inquiry.
such as rehabilitation and occupational therapy, and special education programs. The latter is the domain of culture and politics, which should inform the applied fields.

Linton identifies several troubling aspects of social science and science research that dominates the production of knowledge about disability in the academy, and has implications for those wishing to do disability research; namely, the marginalization of disabled people as objects of inquiry. Most of the time, academic research is conducted by non-disabled researchers on disabled subjects, but the knowledge thus produced is not situated as such.

As I have tried to show above, the social model has revealed the medical model’s shortcomings and been the basis for political action and social change. But disability scholars (Light 2000, Shakespeare & Watson 2001) have taken this model to task for its totalizing nature; it purports to explain all aspects of all disabled experience. Moreover, these scholars point out that the social model, although it differentiates itself from the medical model, is, like the latter model, still modernist in that it is grounded in the binary thought of subjectivity/objectivity and impairment/disability. The disability/impairment binary of the social model has recently undergone a deconstruction by disability scholars, in an attempt to yield theories that lead to better accounts of both the material reality of living with “deviant” physical bodies and the social (discursive and non-discursive) construction and oppression of them (Gabel and Peters 2004). Corker (1999) argues that current approaches to theorizing disability as a form of social oppression are hampered by a modernist conceptual framework, which is increasingly at odds with the contemporary social world and with developments in theory-making as a whole. One of
the points of articulation for poststructural work in disability studies is the definition of
disability created by the social model that ignores the body (Hughes and Paterson 1997,
Samuels 2002). A realignment of the disability/impairment distinction is vital for the
identity politics of the disability movement. The body is at the heart of contemporary
political and theoretical debate, yet the social model of disability ignores it. The
transformation of the body from a reactionary to an emancipatory concept implies a
sociology of impairment. Shakespeare (1994) argues that impairment and imagery are
neglected within the social model approaches to disability. He argues that this is
connected to the neglect of representation of disabled people in culture. He also
compares the experience of disabled people to that of women to explore the prejudice
underlying cultural representation. This is reminiscent of Haraway (1991) who writes
that the dilemma for feminism is “using and being trapped by” the premise of
dichotomized genders.

In order to bring disability theory closer to the lives of disabled people and the
politics of new social movements, it is argued that the conceptual underpinnings of theory
must be broadened beyond their current focus on structures, which view differences in
terms of delimiting boundaries, to one which includes an awareness of the relational,
mediatory and performative role of discourse, and the increasing importance of local
knowledges in shaping the social and political world. Breckenridge and Volger (2001)
call for a
disability studies [that] dissolves deeply entrenched mind-and-body
distinctions and further destabilizes the concept of the normal, whosecharted internal ambiguities have themselves become too familiar. An
ethics and a politics of disability are crucial to the work of the university--
pedagogically, theoretically, and institutionally. But reconfiguring knowledge in light of disability criticism is a project that is likely to take longer than making public space accessible.

Linton (1998) analyzes the naturalized, euphemistic nomenclature of special education to reveal an otherwise other-ridden repository of failure and despair for the embodiment of disability and of race and gender biases, with a complexity of interests surrounding the deployment of information technology in the educational arena. Thus, disability studies critiques technologies of difference, a disability technology with which to normalize the disabled body through the promise and presumption of curative shifts including offloading cognitive functions and turning the targeted individual towards the benefits of assistive technology.

2.4.1 Power/knowledge and disability studies: the implantation of impairment

Although the social model of disability and its impairment/disability distinction has become part of policy and dominant discourse, there is some critique of this theoretical position (Tremain 2001, Allen 2005) for positing a natural physiological state of impairment. Using Foucault’s theoretical concept of power/knowledge, particularly in his analysis of sexuality and perversion (1978), these authors argue that impairment is “implanted” by the historical medicalization of bodies, a deployment without which the medically perceived normal body could not be called into being. As Allen (2005) explains regarding perversions, “the more that psychiatrists looked for sexual deviants, the more they found. Sexual perversions are not medical discoveries about human nature, but are rather artifacts implanted among us by the experts who ‘know’” (94). So power/knowledge operates in the history of impairment as well. Knowledge and power
move backwards and forwards in alternating motions; each gives to the other its authority without necessitating a concession or compromise in methods or operations on either side of the virgule. Impairment, then, is an artifact of the medical science that measures it; instead of impairment perceived as a lack in the body, it is a supplement to the body.

Further complicating the analysis is the deployment of assistive technologies. They are also attached to the body, in order for it to achieve capability and autonomy. However, as individuals are entrained with technology, they may not only acquire (or reacquire) capacity, but also become invested with new forms of subordination. The situation of the cyberkid in this context will be examined in Chapter 4.

Several discourses on disability have been traced in this chapter, all of which act to bring forth the artifacts of special education, the school child who shall/not receive it, and the cognitive prosthetic. The dominant approach to disability is the medical model. The social model of disability raises a distinction between physiological impairment and socially constructed disability and this theoretical approach has had an impact on dominant discourse on disability in the last 15 years. The influence of ‘poststructural’ theory on disability is evident in critiques of the impairment/disability distinction of the social model on the grounds of how power/knowledge operates to create or “implant” impairment upon individuals. Even though, as mentioned, social models of disability have gained some acceptance among policy makers, these models are, for the most part, incompatible with each other and are representative of the multiple paradigm status of the social sciences (Skrtic 1995).
2.4.2 Special education is a known offender

Special education was a challenging field in which to locate my project because from a disability studies perspective it seemed to me that special education was like a known offender, an applied field with a prior record of incarceratory practices, itself now to subject to the oubliette as unreconstructable.

But recent work (Cole 1997, Danforth 2004) describes a coming paradigm shift that resituates special education as internally divided rather than irredeemable. Danforth (2004) uses the sociological concept of heresy to analyze the emerging struggle and tensions two opposing, asymmetrical camps of special education researchers, including technologists: dominant “positivists” and marginal “postmodernists.” The fight is over the production of knowledge in the profession. Positivists declare that the infidel researchers who take postmodernist standpoints threaten to lead the field of special education astray; postmodernists question the authority and control of the positivist paradigm.

In addition to the fragmentation between those special education practitioners and researchers who espouse and defend special education’s dominant positivist paradigm and those who take postmodern positions, Danforth (2004) cites a third dimension to the conflict: the work of outsiders that critiques and analyzes the positivist theoretical base of special education – the work of non-special-education theorists, researchers, and practitioners who are increasingly represented in the academic literature “without provoking the least response from the defenders of orthodox special education” (450).
This is particularly true with respect to the work being done by disability studies scholars (Davis 1997, Linton 1998, Garland-Thomson 1997).

Just how is special education framed within disability studies (of the sort I referred to earlier as disability studies², or multidisciplinary disability studies)? Examining a few passages from Linton (1998) will give us a sense. First for consideration is disability studies’ multidisciplinarity, which “contests the current academic division of labor in which the study of the phenomenon [of disability] rests in the specialized applied fields (…special education…) and the rest of the academy is largely exempt from meaningful inquiry into the subject” (Linton 1998, 2). This academic segregation is analogous to the historic sequestration of disabled men, women, and children common to many societies and cultures. Linton continues in the vein of “the great seclusion” with reference to special schools and classrooms where “we have been hidden” (Linton 1998, 3).

Next, she considers the language of special education; in particular, she lingers on the modifier ‘special.’ Linton argues that the term is a euphemism⁸ that, when the act of substitution is rewound, reveals that disabled subjects are offensive and unpleasant:

An entire profession, in fact a number of professions, are built around the word special. A huge infrastructure rests on the idea that special children and special education are valid and useful structuring ideas….the reality [is] that neither the children nor the education are considered desireable and that they are not thought to ‘surpass what is common’…. Labeling the education and its recipients special may have been a deliberate attempt to confer legitimacy on the educational practice….It is also important to consider the unconscious feelings such a strategy may mask. It is my feeling that the nation in general responds to disabled people with great

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⁸ A euphemism with an ironic twist, of course, because whereas a euphemism typically involves the substitution of something unpleasant with something agreeable or neutral, ‘special’ suggests superiority.
ambivalence. Whatever antipathy and disdain is felt is in competition with feelings of empathy, guilt, and identification (Linton 1998, 15).

By arguing for a humanities/social sciences based disability studies, Linton and other disability scholars seek to instill a productive tension in the scientific and applied fields that now dominate special education. She is aware of the ‘indictments’ against special education, and the ideology of oppression which stands in relation to this applied field; looking forward, she does not see a form of special education that can survive the serious injury of its past. We cannot rehabilitate or restore special education to some former good condition or reputation; rather, the entire rationale for educational bifurcation into disabled and nondisabled must be demolished and a new building raised in its place which includes a healthier, more productive range of human difference within its walls without resorting to the establishment of a “special” wing. Linton is guardedly optimistic about the turn to inclusion in special education, although she is not encouraged by the evidence of how inclusion tends to really play out in practice. Danforth’s analysis of the heresy of postmodernism in special education posits several possible outcomes, including a schism within the field, and the return to the theoretical fold of the heretics. What’s not clear yet is which of these results would be the healthier, more productive outcome for society.

In the next chapter, I entwine the educational technology-special education technology-rehabilitation tree with the destabilizing questions and approaches found in the work of Foucault.
CHAPTER 3
METHODOLOGY: THE GENEALOGICAL APPROACH

Foucault held a chair at the Collège de France, which he entitled ‘The History of Systems of Thought’. His writing and lectures raised the subjects of discourse, thought, and knowledge in relation to power. His analyses of power and governance (Foucault 2000) identify a shift in relations between sovereign and subject. As an institution, education is imbricated in the shift from purely coercive forms of power, which either compel subjects to act in specific ways or prohibit subjects from acting in certain ways, to the hybridity of the anatomo-political/bio-political, or bio-power, which is exercised along a continuum of governance of the self, the family, and populations. For example, it is taken for granted in the schools of today that teachers care for the ‘well-being’ of their charges although this sentiment was not prevalent in education prior to the nineteenth century and the rise of teaching as a respectable profession for middle-class women to enter. Moreover, the approach taken in this project examines the ‘micropolitical’ or ‘capillary’ level of school practices at which biopower is exercised.

What we have then is an analysis at the intersection of science, politics, and ethics. Science is the set of procedures that establish objectivity and a scientific domain.

A game of truth. Scientific analysis of the epistemological structure of assistive

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technology includes the limitation of wearable computing as an applied field and how the establishment of assistive technology in school – special education technology – changes political structures and moral practice, both of which are presupposed by the organization of special education and its technologies as a scientific domain. So, politics and ethics have a role in the organization of special education technology – in particular in this study the deployment of wearable computers – and the organization of this field has effects on political and ethical practices. The politics, the relations of power under discussion here, form a politics and government of the self. The study is of special education technology within the framework of the political institution of school – the educational arena for assistive technology. So, for instance, which political strategy has, by denying or giving its status to wearable computers, been able to appeal to certain forms of knowledge and certain moral attitudes? The ethical practices related to science and politics include forms of relation to oneself and to others. The analysis regards the establishment of moral practice and implications of who is the object of assistive technology – the methods, techniques, and exercises directed at who becomes a cyberkid. And just as with the other two lines of this analysis, these forms of morality are reflected in and changed by the establishment of special education technology and wearable computing as a field and the politics of the institution – school – in which it operates.

The regime of truth that governs what can and cannot be said regarding wearable computing in the educational arena for assistive technology is an interplay of multiple codes and perspectives which constrain and authorize, make normal and deranged, good and bad, within and against an intertextual chain of dominant discourses on education,
Foucault (1972) writes that discursive regularities, as divisions or groupings, “are always themselves reflexive categories, principles of classification, normative rules, institutionalized types” (p. 22). From this analytic perspective, the discourse of the arena is a vehicle for the construction of social subjects and its texts can be analyzed for political purposes. The contested terrain of the educational arena for assistive technology is a site of conflict and negotiation. Certain relations of power are brought into being through the linguistic features of writing in this arena, its form and content, expressions, images, and metaphors.

3.1 The analytic grid of power, discourse & knowledge

By questioning the obviousness of discourse and knowledge, the foundational, taken-for-granted truths upon which they rest, Foucault opened the way to a line of questioning about how statements obtain the status of truth and what effects these truth claims have. In his writing, lectures, and interviews, Foucault outlined two complementary approaches to study, archaeology and genealogy.

3.1.1 Archaeology and the concern for truth

The object of analysis of archaeology are bodies or systems of knowledge. The archaeological deals with the organization of statements into scientific discourses, thereby exposing the discursive regularities of those statements considered true. It is the formation of the modern subject within the “human sciences” of psychiatry, medicine, biology, economics, and linguistics towards which archaeology was poised.
The object(s) of my study -- assistive technology, cognitive prosthesis, and special education – also take shape among and between the human sciences.

_What archaeology is not_

An archaeological approach can also be identified by what it does not provide. For instance, this approach is not a new and improved hermeneutics; there is in the archaeological a no more truer or deeper understanding of history. Likewise, archaeology is not an effort to totally reconstruct the past. Lastly, in the context of my study, archaeology posits that the discursive conditions of education, or for that matter, special education, do not represent a development or a progression. Histories of education show how the development of education is coincident with transformations in several historical domains such as economics, culture, and politics (Butts & Cremin 1953). By assuming an archaeological stance towards my subject, I am not denying the historical formation of certain ideas and practices. I am simply not focusing on this causality. So, regarding hermeneutics with suspicion, and turning away from any claims to privileged, deeper understanding and from a teleological development of history, we are left with a method of detachment, a suspension of norms and truths, a questioning of the taken-for-granted, and an analysis of events at face value – the statement in its positivity.\(^{10}\)

\(^{10}\) the term 'positivity' pops up with great frequency in Foucault’s work with a variety of functions. I refer here to its designation as approach to discourse that excludes anything lying beneath or hidden within it. For archaeology ‘method,’ discourse is to be described only on the level of its basic, operative existence, its existence as a set of emerging and transforming statements and relations between statements.
Archaeological devices

Of the many key analytical devices relevant to an archaeological approach, I will discuss three – discursive formation, episteme, and archive – in general and in the context of framing this project.

1. Discursive formation

Discourse produces the objects about which it speaks. The subject I chose to study, cognitive prosthetics in special education, concerned me with the describable organization of writings on educational technology and assistive technology and the transcribed speech stemming from a case of the use of wearable computers by certain students receiving special education in a Midwestern middle school between 1999 and 2002, the particulars of which are described in the next section of this chapter. In the analysis that follows, I sought to identify the discursive formation of the cyberkid through the discursive relations that these texts maintained with each other and the same or differing patterns to which the arguments in these writings conformed.

2. Episteme

An episteme represents the historical conditions of possibility for empirical sciences at a given time. It is the space within which the sciences can appear. What can be said by the sciences is dependent upon the orders of other discourses. An episteme is, according to Foucault (1973) a “historical a priori [which] delimits in the totality of experience a field of knowledge, defines the mode of being of the objects that appear in
that field, provides man’s everyday perception with theoretical powers, and defines the conditions in which he can sustain a discourse about things that is recognized to be true” (p. 157-158). As the total set of discursive practices, the episteme is the totality of relations that can be discovered provides the necessary background of assumptions and principles against which the emergence or disappearance of a problem/solution lie.

The idea is that the conscious, intentional level of analysis of problems and solutions takes shape through unconscious, uncontrollable rules of formation. These rules include, but are not limited to, the ways in which discourse comes to have meaning (Foucault, 1973). The way language operates is not in the conscious control of any individual, group, or institution; the rules of language make it possible for individuals, groups, and institutions to have and act on conscious intentions. In the case of the project I undertook, I am concerned with the discursive regularities that yield the possible and impossible statements regarding the educational problems of disability, specifically learning disabilities, mental retardation, and autism spectrum disorder and their educational solutions, specifically assistive technology, cognitive prosthesis, and wearable computing.

3. Archive

An archive is generally understood to represent a collection of texts from a given period or a totality of texts that circulate around a given object of analysis. As an archeological device, the archive is not comprised of texts alone, but of the conditions of the possibility of such an archive. That is to say, the archive is a set of relations and
institutions that enable statements to continue to exist, “the general system of the formation and transformation of statements” (Foucault, 1972, p. 130). During the early stages of document collection and preliminary analysis, I built up a body of texts from various of the human sciences and from popular culture pertaining to wearable computing; at that time I was still thinking of the archive as a static collection of things.\footnote{Such a volume of scientific papers, business-to-business periodicals, popular magazines, newspaper articles, government reports, and press releases that threatened to bury me and any hope of emerging with a project.} The turn came when I started to ask what system was behind the emergence of this multiplicity of statements.

\textit{The insight of archaeology}

Foucault’s archaeological work is responsible for ‘apprehending’ the nature of the modern subject (“modern Man”) as a product of the human sciences of biology, medicine, psychiatry, economics, and linguistics. The we who we think we are did not exist before 1800.

\subsection{Genealogy and the concern for power}

Although not a methodology \textit{per se} nor a systematic theory, a genealogical project is an “unmasking or denaturalizing work…concerned with ‘small’ stories, marginalized topics, and taken-for-granted practices” (Meadmore, Hatcher & McWilliam, 2000, p. 466). Genealogy purports to identify clues to the techniques of the production of bodies through positive constraint.
Moreover, genealogy was, for Foucault anyway, a new truth game that made tactical use of history as an antidote against political dogma and propaganda.

It could be said that the object of genealogy is involvement in contemporary debate, dispute, and struggle; that is to say, it is a form of intervention in power/knowledge relations that brings about different acts and thoughts regarding contemporary problematizations. One code of conduct for the genealogician, as it were, is to refuse the scholarly assumption of progress and instead get a grasp on the complexity of an event by shortening one’s vision. “What is important is that a line of descent be drawn to the emergences, the discontinuities, and the events closest to the ‘problem of the present’ under investigation. These should guide the inquiry….” (Meadmore, 2000, 201). Genealogy exposes the contingency of contemporary limits of what can be thought and done not to clear the ground for the proposal of an alternative truth, but to help bring about different thinking and action as compared with contemporary problematizations.

The concept of descent describes truth as a secondary or unintended consequence of contingent events. The path to what is known is not amenable to planning or prediction but is instead uncertain and dependent on casual events for its existence.

Genealogy does not resemble the evolution of a species and does not map the destiny of a people. On the contrary, to follow the complex course of descent is to maintain passing events in their proper dispersion; it is to identify the accidents, the minute deviations—or conversely, the complete reversals—the errors, the false appraisals, and the faulty calculations that gave birth to those things that continue to have value for us; it is to discover that truth or being does not lie at the root of what we know and what we are, but the exteriority of accidents. (Foucault, 1984, p. 81).

Thus, in terms of this study, what made the truth be known about the use of wearable computers by students receiving special education is not satisfactorily
explainable as a result of the intention of their teachers or the outcome of premeditated policy decisions of school administrators concerning the use of computers in school nor as the effect of disability law. Those causes persist in a positivist light, bringing clearly before the mind a bowdlerized account of the cyberkid while the texture of his/her story is actually choppier, more disconnected, even arbitrary. As Marshall (1990) explains:

Genealogy as descent is not a continuous and uninterrupted notion. There is a multiplicity of factors that must be unraveled from lowly sources and subjugated knowledges that will play havoc with notions of continuity. There are errors and accidents to be discovered which will disturb notions of order. The search for descent is not a search for firm foundations; on the contrary, it discovers moving sands, fragmented and incoherent events with faults, errors, omissions, faulty appraisals, and pious claims and aspirations. The move is in general to show that ‘historical truths’ rest upon complex, contingent, and fragile ground. (Marshall, 1990, p. 19)

**Genealogical devices**

In describing some of these ideas here, I am not trying to provide a definitive judgment or final meaning; nor do I intend to be bound to ‘what Foucault would say or do’ about this or that or to demonstrate religious devotion or conformity to something ‘Foucauldian’. Instead, as several other educational researchers have done since Foucault’s work made the scene (Hoskin 1979, Jones and Williamson 1979, Walkerdine 1984, Jones 1990, Tyler 1993, Hunter 1996, Sheurich 1999) I use Foucault to think about education as a site of disciplinary practice, of regimes of truth and power, and of modes of regulation of the social and the self.
1. Dispositif/grid of intelligibility

Whereas the archaeological episteme consisted of the conditions of possibility of statements, the dispositif or grid of intelligibility marks a conceptual shift away from the thoroughly discursive. Foucault (1990) states that the dispositif is a "thoroughly heterogeneous ensemble" of discursive and material elements, including "discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions" among myriad others. Dispositif is where the discursive and the non-discursive (material practices) intersect. Dispositif helps bring about an analytics of power that understands power as expressive and productive (biopower), as opposed to that which represses or mystifies. Conceptually, the dispositif places us in the middle of what Deleuze (1989) calls "a multilinear ensemble composed of heterogeneous lines" with power, knowledge and subjectivity comprising the major variables.

In these relatively broad terms, the notion of a dispositif is appropriate for considering the development of assistive technology in special education that emerges and operates as a complex ensemble of institutions, discourses, capital flow, government programs, educational projects, and entrepreneurial practices. Further, the concept of the dispositif and its complexity avoids the tendency to view the development of assistive technology in information age as monolithic and uniform. It is also important to point out that the elements of a dispositif do not always act in concert, they can have a wide range of positive and negative effects and unpredictable outcomes. At the same time, however,

12 In the work of Gilles and Deleuze, dispositif is translated as ‘assemblage.’
they do operate to achieve overall effects and a dominant strategic function. For example, Foucault (1980b) writes that the function of the dispositif of madness in the nineteenth century was “the assimilation of a floating population found to be burdensome for an essentially mercantilist economy” (p. 195n).

2. Regime of truth

The mechanisms and instances by which a society creates to enable individuals to discern the true from the false constitute a regime of truth. Foucault (1980a) identifies five of these techniques and procedures in contemporary western societies: the dominance of scientific discourse in establishing the truth, the accountability of truth to economic and political forces, the "diffusion and consumption" of truth by means of societal apparatuses, the control of that distribution by "political and economic apparatuses," and the fact that truth provokes political debate and social confrontation.

3. Practices

Genealogical work does not focus on theory or ideology as means to understand power. Instead, the concern is with practices – discursive and non-discursive or material. By means of genealogy, Foucault sought to identify this constitutive grid of social regularities or governmentality, “power bent on generating forces, making them grow, and ordering them, rather than one dedicated to impeding them, making them submit, or destroying them” (Foucault, 1979, p. 136). It is modern social discipline, or fordism understood not as the result of various institutions (for my purposes, education) consciously altering their policies in response to economic and political conditions of the
Foucault’s analyses focused on places like the prison, the asylum, and the school. In studying these sites, he argued that discipline’s line of descent connects events long prior to the object of study, that is, the present.

…the clinic and the prison appear as early and still isolated proving grounds for regulatory practices that became fully developed, operational, and hegemonic only much later, in the twentieth century…the disciplinary society emerged in its own right only after the general diffusion of techniques that had been pioneered much earlier, in scattered discrete institutions. (Fraser, 2003, p. 163)

For educators who want to understand the rules of formation governing how education defines its problems and solutions, *Discipline and Punish* (Foucault, 1979) has been a relevant work for some time. In this text, Foucault provides an elaborate explanation of how the mechanisms of discipline for a prisoner and a student are similar. In the first case, the ultimate goal is for an inmate to internalize the mechanism of surveillance established within the building. Rather than a merely a place in which store bodies, the deployment of technology in the modern prison transformed it into a place which "can be used to carry out experiments, to alter behavior and to train individuals" (Foucault, 1979a). From an educational perspective, power relations are defined through prison-like deployments of technology used to study, make different (i.e., virtuous) and prepare children for life on the ‘outside.’

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13 Imagine a passage such as this one rewritten for school: “At the time of the creation of the Auburn and of the Philadelphia prison [the common school] which served as models (with rather little change until now) for the great machines of incarceration [education], it was believed that
descended from the technologies of panopticon, surveillance, and internalization.14

Likewise, I turned my gaze to the descriptions expressed in these texts and whether they were in accordance with the same codes or not and to what relation could be said to exist between the formative unities of discourse and certain non-discursive practices of ICTs in school.

*The insights of genealogy*

Truth and power are always related and depend on each other, although neither dictates to the other. Rather than analyzing power as subjective, something emanating from a center that one can acquire or seize, genealogical approaches discern that power is not the result of individual choice or decision. Instead of asking who holds power and where it comes from, the genealogician looks into how power relations work and the effects of particular relations. Thus, power is a name for a set of relations. There are different types of power relations such as pastoral power, negative power, and productive

something indeed was produced: 'virtuous' men. Now we know, and the administration is perfectly well aware, that no such thing is produced. That it's a question simply of a great trick of sleight of hand, a curious mechanism of circular elimination; society eliminates by sending to prison [school] people whom prison [school] breaks up, crushes, physically eliminates; and then once they have been broken up, the prison [school] eliminates them by "freeing" ["graduating"] them and sending them back to society; and there, their life in prison [school], the way in which they were treated, the state in which they come out ensures that society will eliminate them once again, sending them to prison [prison]." (Michel Foucault, "On Attica," trans. John Simon, *Telos* 19 (Spring 1974), reprinted in Sylvère Lotringer, ed., *Foucault Live Collected Interviews, 1961-1984* (New York: Semiotext(e), 1996) 114. Cited in *Attias* 1999).

14 Likewise, I would add *Madness and Civilization* to the list of texts relevant to educators interested in genealogical frames for their projects. Through it, one sees that power is exercised not only in the experimental space of the prison but also in the juridical space of the asylum, "where one is accused, judged and condemned, and from which one is never released except by the version of this trial in psychological depth, that is, by remorse. Madness will be punished in the asylum, even if it is innocent outside it" (Foucault 1965, 269). Pedagogy and educational psychology can be genealogically related to asylum administration and medico-juridical bureaucracy of truth practices.
power. In terms of this study, for example, pastoral power, the relation of the sovereign ‘shepherd’ to his ‘flock,’ figures in educational discourse that tends to the well-being and self-esteem of students. In the case of this project, the pastoral mission is associated with the deployment of wearable computers as a type of cognitive prosthetic among certain students receiving special education and thereby “marked by their own individuality” (Foucault, 1977, p. 331). Negative power is displayed in the dividing practices of education law, which establishes the definitions and criteria with which states, districts and schools distinguish (one purpose for which is to authorize the bestowing or withholding of special education and its concomitant assistive technologies) the students who are disabled from those who are not. In addition, modern relations of power are for the most part productive and do not primarily work through negative repression or coercion. Productive power is delineated in the entrepreneurial methods and practices that effect the implementation of assistive technology in school, in the historical formation within curriculum of the IEP or Individualized Education Plan, and in the ways that students come to see themselves as better off with a cognitive prosthetic than without one.

School is a contested site, a site of political struggle where the exercise of power is evident. Foucault tells us that power “is co-extensive with the social body,” so that “there are no spaces of primal liberty between the meshes of its network” (Foucault, 1980a, p. 142). At the same time, power relations exist only where resistance is possible.
In the face of total domination, relations of power cease to be; in order to have a relation of power, there must be, however imbalanced, the situation of individuals who are in a position to resist.

3.3 Invoking Foucault

It is these two approaches to analysis, archaeology and genealogy that help to frame my project. I see them as complementary in their concern for the complexity of the intersection of the discursive and non-discursive and how the insight of archeology into the conditions of possibility of statements informs genealogical inquiry into how modes of knowing and problematization enable the formation and transformation of disciplined, governed and self-governing subjects.

The next chapter offers a detailed description of the methodology employed in this research, critical discourse analysis, as well an account of data collection and how the study emerged to take its present shape.
CHAPTER 4
METHODOLOGY: CRITICAL DISCOURSE ANALYSIS

In the first chapter, I introduced my theoretical, interpretive, and purposive considerations in choosing the focus of this study, the emergence of cognitive prosthesis in special education. My theoretical concern is with the intersecting processes of technology, disability, and schooling within which power is exercised and the subject position, cyberkid, is inscribed. In Chapter 2, I situated this project in literature from several fields that have formed around wearable computing, assistive technology, and special education and discussed my study in relation to these current theoretical orientations and their implications for the overall design of the study. In Chapter 3 I discussed how genealogical frame for the study. In this chapter, I describe the method of critical discourse analysis that I used to analyze the data and present the particulars of what and how data were collected for this project.

4.1 Critical discourse analysis

Discourse analysis is a large and varied field. In each area of study, the term discourse is used differently. Discourse analysts know discourse as a unit of language

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15 For a discussion of the historical development of discourse as an analytic tool and how it has become common currency in varied fields, including critical theory, feminist theory, linguistics, philosophy, social psychology, and sociology, see Sara Mills. *Discourse. New Critical Idiom*. 2003. Routledge. In what follows, I use the terminology with which she groups theorists concerned with discourse: discourse analyst, social linguist, and critical linguist, realizing that these sobriquets are a convenience and not a rigid ontology of types.
above the sentence. Discourse analysts look at higher-level organizational features of a text, the ways in which words can be made to function in language to signal turns and announce the desire to affect a shift in subject. This level of analysis is not concerned with the meaning of words or their interpretation, but with the structural properties of words in use.\textsuperscript{16} Although the language is ‘real,’ however, the reader is idealized in this form of discourse analysis. The social relations between speakers or writer and reader do not influence the analysis. The exercise of power cannot be grasped, except in the critique of the methodology itself that reveals the ways in which it naturalizes social, dominant practices. The analytic strengths as well as the shortcomings of discourse analysis as described here and represented in the works of Coulthard (1994) led to an approach to discourse that viewed the text as more than a simple product that could be interpreted by the analyst.

Social linguists combine a focused analysis of the text and concern with methodology to social and cultural aspects of discourse and relations of power. While this approach to language, which yields analyses of the discursive construction of knowledge about subjects by focusing on the meaning of particular key terms, has important uses, it has been pointed out (Furlough 1992, Mills 1997) that this form of discourse analysis tends to abridge the position of the speaker, combining or filling that position with that of the interpreter or analyst. As with discourse analysis, this relation between subject and object is not problematized in the analyses of social linguists although they do address

\textsuperscript{16} Discourse analysts, in contrast to traditional linguists, are interested in how language functions in actual conversation and writing. Traditional linguists (as I remember all too well from my undergraduate courses in this subject) tend to invent sentences, distinguishing, for example, impossible utterances from possible ones by the use of an asterisk.
relations of power between speakers more than the former form of analysis. The way out of the conundrum of text as transparent product available for reliable single interpretation is opened by critical linguists who, influenced by and modifying to their purposes the work of Foucault, analyze discourse for its effects on individuals, including how certain knowledges are elided while others become authorized, “how discourse is shaped by relations of power and ideologies, and the constructive effects discourse has upon social identities, social relations and systems of knowledge and belief, neither of which is normally apparent to discourse participants” (Fairclough 1992, p. 12). Using discourse as a method of analyzing texts for political purposes, since both subjectivity and ideology are language driven, Fairclough (1989) writes: “Discourse is a practice not just of representing the world, but of signifying the world, constituting and constructing the world in meaning” (p. 64). Language is a social practice and the traces of social struggle are embedded in the formal features of language. Using the work of Foucault, Fairclough argues that power accumulates within the everyday practices of social institutions.

In terms of this study, that means within the significant and structuring effects of spoken and written texts in the contested space of the educational arena for assistive technology, in constituting the subject positions available and not available to people in relation to assistive technology in school, and in constraining and authorizing both what can be written about educational subjects or how they can be interpreted and the ordering of technology or what can be produced. Discourse analysis regards how people language the world and are “languaged” in the world, remembering that the construction of natural and social forces through discourse is always incomplete and aware of the episteme or
social and historical conditions that have permitted the ‘subject’ (developing
child + cognitive prosthetic) to become an object of scientific investigation and subsequent
liberation. Moreover, there are multiple competing discourses in every context.

Critical discourse analysis of educational policy, although not a dominant
methodology, has nevertheless become more frequent in recent decades (Sheurich 1994,
approach to policy studies based on the early works of Foucault. Scheurich delineates
four arenas of focus. The first focus is the social construction of ‘the problem.’ Second,
study of that which constitutes the set of social conditions within which said problem can
or cannot emerge as a problem. Related to this analysis of the social regularities of the
problem is an analysis of the conditions under which its solution can or cannot arise.
Finally, the last arena of study is the scholarly field(s) that lay claim to the study of the
problem and which are invested with the authority to offer solutions, including the
approach which considers these four arenas of study. Taylor (2004) and Thomas (2004)
draw attention to the increasing importance of language in social life and use critical
discourse analysis in policy research in education. Their work draws on principles of
critical discourse analysis articulated by Fairclough (1989, 1995) to document multiple
and competing discourses in policy texts, highlight marginalized and hybrid discourses,
and document discursive shifts in policy implementation processes.

Thus, there is in play in the arena for assistive technology normative statements
negotiated within relations of power in the policies of law, business, science, and
technology. Analyzing legal texts is important because the legal system produces texts
that are combinable with knowledge work in other discourses and provide them with juridico-ethical credentials or “the weight of law.” The way that subjects in education are constructed in legal discourse determines, for one, who will and will not receive special education or be disabled. For our purposes, for example, the law decides which students must be fitted with an assistive technology device such as a wearable computer. Critical race theorists like Ashe (2000) and Delgado & Stefancic (1999) critique legal narratives to challenge their claims to neutrality, objectivity, and color-blindness as well as the ahistorical analysis of law. Critical race theorists recognize the experiential knowledge of people of color in analyzing law. I tried to historicize the natural, legal, rational subject of assistive technology. So we see in “Foucauldian discourse analysis” a shift from institutions and subjects to discursive practices, subject positions, and conditions of possibility and intelligibility. The goal of discourse analysis framed in this way is to become aware of how individuals are shaped by dominant discourses into docile bodies subject to the needs of institutions -- the need to measure and prescribe, to diagnose and cure, and to be transformable and inventible; moreover, consequent to the analysis, the goal is to become capable of generating resistance and counter discourses.

The analysis that follows in the next chapter analyzes particular features of the vocabulary circulating in texts and discourse types in the educational arena with regard to wearable computing such as rewording, collocation, and overwording. Rewording is the systematic replacement of one wording for another. In Fairclough (1989) “existing, dominant, and naturalized” (p. 113) wording is replaced with oppositional wording in oppositional discourses. Collocation is both the tendency of specific words to appear in
groupings and the metaphorical transfer of a wording from one domain of use to another. Overwording describes an unusually high degree of wording or having many near synonyms. Overwording indicates preoccupation with some aspect of reality and possibly shows the focus of ideological struggle. I also sought to clarify meaning relations in the data; instances in which the meaning of one word is nearly the same as that of another, or in which the meaning of one word is included in the meaning of another, or in which the meaning of one word is incompatible with another, such as when ‘read’ is incompatible with ‘disabled’. I also lingered on certain metaphors (“hoops”, “paperwork”, “weeding out”) that appeared in discourse. Moreover, interruption, a formal feature of constraint in discourse, occurred during interviews. Some of the interviews were interrupted by third actors. In some instances, the third actor was mediated through technology: an interview cut short by a school bell or by a cellular phone. Other times it occurred face-to-face, as when a teacher being interviewed speaks with a student in the room, or when a teacher being interviewed is interrupted, prevented by another teacher from inserting a factual error into the interview.\textsuperscript{17} I also experimented with the use of proprietary text mining software that uses an algorithm based in Bayesian statistics to generate concept maps by automatically grouping strings of words into suggested clusters of meaning.\textsuperscript{18} During this phase, for example, I was trying to work out a map of relations

\textsuperscript{17} I was not using Fairclough as a blueprint for my analysis; rather, I sought to apply some of his guidelines for discourse analysis to certain aspects of the data such as those briefly described here, with which I was wrestling. Of course, once I began, the traffic between Fairclough and the data quickly became two way and I found myself poking through the data with certain of his ideas about discourse analysis, as it were, preconceptions with which to make interpretive marks.

\textsuperscript{18} It was prohibitively expensive to purchase, so I used it intensively for 30 days, its trial demonstration period. I discuss this experiment and its results on the next chapter.
among “work”, “disability”, and “technology” and from the textual data I entered the program extracted and mapped a taxonomy of ‘concepts’ and ‘entities’ around them.

In the next section, I turn to some the tensions inherent in the methodological frame I have constructed for the project and raise the issue of researcher reflexivity.

4.2 Analytic tensions and reflexivity

Before proceeding to the next section, a description and discussion of the data for this project, I would like to make explicit a tension that underlies much of the foregoing discussion of critical discourse analysis; namely, that in this project I have applied a deconstructive logic to discourse analysis as a method and a means to truth. Underlying discourse analysis is the idea that language keeps up with life19. I wish to keep this concept as both a limit and a resource, working “under erasure” (Spivak 1976) with this concept of language that is at once so vital to the validity of my analytic enterprise and at the same time something I seek to avoid universalizing.

Related to this tension produced by focusing on the language of individuals and groups, the qualitative researcher’s ‘write-up’ is the source of another linguistic tension in this project, that between theoretically informed work and letting the data “speak for

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19 The idea is attractive (and by no means new) especially, for this microstudy, the semiotic sensitivity of language to the minutia of ideological formations and social change:

The word is implicated in literally each and every act or contact between people—in collaboration on the job, in ideological exchanges, in the chance contacts of ordinary life, in political relationships, and so on. Countless ideological threads running through all areas of social intercourse register effect in the word. It stands to reason, then, that the word is the most sensitive index of social changes [italics original], and what is more, of changes still in the process of growth, still without definitive shape and not as yet accommodated into already regularized and fully defined ideological systems. The word is the medium in which occur the slow quantitative accretions of those changes which have not yet achieved the status of a new ideological quality, not yet produced a new and fully-fledged ideological form. The word has the capacity to register all transitory, delicate, momentary phases of social change (Volosinov, 1930, p. 19).
itself.” I seek to, as it were, read against myself (Lather 2000) and my desire for transparent access to the other by reading for difference instead of sameness. By conceiving and executing this study of assistive technology in education, I do not presume to settle anything; rather, my goal is to present something unsettled. Moreover, by choosing to dwell upon the word and discourse, I applied myself to how the thinking that has accumulated around education, disability, and technology gets organized into patterns. I directed my attention not so much to the interpretation of what I was told as to looking after how I was told, recognizing the difficulties that adhere to subjects who would say that which can be neither said nor heard, without paying a price, in the educational arena for assistive technology. The people who spoke to me were telling me something about living in a complicated world of knowledge, bodies, and prosthesis and it was, in the best sense of the word, a stretch for me to represent their commanding position in writing and analysis. I will return to these tensions in chapter five.

In the final section of this chapter, I tell how the project came to be and discuss the who, what, where, how, and why regarding the data I collected.

4.3 The origin story

Richardson (2000) writes of ethnographies having four characteristics that establish them as “realist tales” of social science writing: experiential authority, documentary style, presenting the culture member’s point of view unproblematically, and interpretive omnipotence. Although my project is not deep or thick enough to be considered an ethnography, nevertheless as a work conducted under the mantle of social science, in my write-up I am also to an extent bound to these narrative conventions. That
is why I take them up here. Experiential authority establishes as fact that certain events and texts actually happened and exist and they constitute modes of data for scientific study. Documentary style establishes the difference between researcher and the research subject. Unproblematic presentation can be embedded with a “plethora of facts” deployed in such a manner as to impress the reader with its volume and establish the researcher as appropriately attentive to the notion that multiple themes and patterns can exist in data. Interpretive omnipotence refers to the assembly of assertions and warrants as knowledge upon an underlying grid of supporting evidence. These ideas I also wish to work with under erasure; the story I tell will abide by these conditions and seek their authority but not without, as it were, also expressing a troubled mind and applying a troubling pen in order to expose and assume some of their analytic limits.

4.3.1 The IRB proposal and data analysis

I came across articles about uses of wearable computers as assistive technology in special education in 2002. Through web searches, I came across documents related to the Capitol Area Consortium on Wearable Computing, which was a grouping of schools both public and private, and a company that engaged in the research, development, manufacture, marketing, and sale of mobile and wearable computing and communication systems, as well as software and service solutions for various industries including transportation and aerospace, retail, telecommunications and media, and government and military. Their participation in the consortium indicated an interest in expanding into the education market.
I learned that the group no longer existed *per se*, although some of the schools still had a wearable computer or two, or were still engaged in using mobile computing with students. It was during this preliminary research that I came across the names of Emily, a middle school multiple disabilities teacher, and Edwin, a middle school teacher for children with learning disabilities. A *Wired* article (Dean, 2002) reported how these two had introduced the use of wearable computers as assistive technology with their students in a public school district of a Midwestern state.

In the summer of 2003, I submitted my research proposal to the Behavioral and Social Sciences Institutional Review Board at my university. During the month that it took for me to hear back from the board, I turned my attention to the documents on wearable computing that I had been assembling. Since I did not know when or if I would be able to do fieldwork, I decided to work with the corpus of data I had in hand -- texts whose readership included engineers, inventors, early adopters, consumers, producers and manufacturers of wearable computing -- and started to code it. These data came from various publications: institutional analyses of the assistive technology industry, science and engineering journals, business-to-business literature, education law, and technology-themed periodicals.

Later in the summer, I received a response from the review board. The board had questions and wanted more specifics concerning my fieldwork plans. I was granted a provisional protocol number, with the understanding that I would revise and resubmit my application. If, after this second review, the board was satisfied, I would be allowed to enter the field. Some of the revisions had to do with precise wording (for example, I

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20 All names for participant individuals and institutions are pseudonyms.
stated that pseudonyms would be used to guarantee the anonymity of the participants, but that is not correct; my use of pseudonyms was protecting the identity of the participants). The more challenging concerns that the board raised had to do with who my participants were exactly. The board wanted to know exactly how many teachers, how many students, in what grades and what ages. To provide a broader context for the study, I had also intended to conduct fieldwork at sites active in the research, development, manufacture, and distribution of wearable computers. The board wanted faces and places, but I did not have commitments from any particular firms or agencies. To me, this seemed like a catch-22: I could not reach out to these sites before my research proposal had been accepted, yet the board, before accepting, wanted to know who exactly I would be speaking to? I decided to nix the plan to visit companies, research labs, and agencies, and made no mention of it in my revised proposal. I still think that the data that would have come out of this fieldwork would have enriched the study, instead of solely analyzing press releases and other public texts these interests produced with regard to developments in wearable computing; however, I chose to curtail my fieldwork in the interests of moving the project along.

The board accepted my revised application, gave me an IRB protocol, and I began making plans to visit the school. The school district is located in a United States Midwestern state, in a township of approximately 11,000 residents. The school in which the study took place is a middle school (grades 5-7). According to 2004 BETA survey data, the school houses 531 students, 37 teachers, and 2 administrators. In 2004-2005,
about 12% or 65 students received special education. About 6 students used wearables as part of their IEP. The school population is overwhelmingly (96%) white.  

4.3.2 Making contact and the observational phase

I contacted Emily and Edwin by email in the spring of 2003, asking about the fate of the consortium and other questions, including how the idea to use wearables in special education got started, as well as making preliminary inquiries into the possibility of coming to the school to meet them, their students, and other key actors in this initiative. I indicated that I was a doctoral student and that I intended to study their use of wearables for my dissertation. The same day I received a lengthy, enthusiastic and encouraging response from Emily, filling me in on the plight of the consortium (“The consortium is, from what I know, not around anymore”) and telling what she knew about what the other schools in the group were up to with their initiative to use wearables, which was not much. She also gave me the quick version of “how the whole thing started,” including her and Edwin’s disappointing experience at the hands of a company that manufactured and marketed wearable computers. Basically, they felt that the company had ripped off their idea of bringing wearable computers to the education market as well as their work on the project, including the software Emily had used, the modified book bag she had designed to hold the computer and peripherals, and the specific set up that she and Edwin had configured for the computer, all without offering any compensation. Their initial pleas and presentations to the company for support went unheeded, but shortly after the

21 BETA 2004 survey data.  
http://www1.osn.state.oh.us/beta/survey_results.asp?survey_type=teacher&year_a=2004&aggregate_a=building&entity_id=10702&entity_a=10702&entity_name=Erwine+Middle+School
two teachers received a grant and purchased two wearable computers. The company that leased them two wearable computers had gone on to develop a marketing plan to sell more wearable computers to educators. I came across many press releases that were part of this public relations campaign. The teachers were miffed, and I was excited about learning more from them and digging into their recent experiences. Emily wrote:

I am very interested in helping you with your work, as it is rare for me to find someone else interested in this life-altering technology. I am a special education teacher in […] district. I use wearable computers each day with my students, in grades 5-7 who have moderate to profound mental retardation, autism and cerebral palsy. I am also the teacher who started the use of wearable computers in the classroom, as assistive technology.

Soon after receiving the reply from Emily in the spring of 2003, I contacted the director of technology for the school district to request entrée. A few weeks after that inquiry, I received another email from Emily welcoming my project. She told me that Edwin, at Fisher Elementary, had used wearables with 3rd and 4th graders who have learning disabilities.

I visited the special education resource room that Emily ran in the fall of 2003. All persons interviewed or observed for this study were provided a release form that was approved by my university’s research foundation. Interview and observation data were coded to protect the confidentiality of the schools, administrators, teachers, and students that participated in the study. The book of codes was stored as an electronic document on a secure storage device. Hard copy was stored at my home in a file cabinet to which only I had access. In case they had any questions or concerns about my methods or objectives,

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22 The wearable that was used by students cost around $7000 in 1999. In 2001, the company released a new model with a basic configuration costing around $4000 and higher-level packages going for $6000.

I gave participants contact information for me, my dissertation advisor (who was the principal investigator), and my university’s research foundation. In initial letters I sent to potential participants (and in the case of minors, their parents or guardians) I made it clear that participation in this study was voluntary and that they could withdraw from the study at any time without penalty.

I visited the middle school four times between September and November and interviewed administrators, teachers, and students. Most of these interviews took place in Emily’s resource room. Emily and Edwin were each interviewed twice. In the time since Edwin began to use wearables with learning disabled students in Fisher Elementary between 2000 and 2002, he had been promoted to the position of technology coordinator for the district and thus, in an ironic reversal, no longer had a classroom from which to use wearables with students. Before his promotion, Edwin had been a special education teacher at Fisher Elementary for 6 years. The principal of the school was interviewed once. A telephone interview was scheduled with the director of technology who, however, was unable to keep the appointment and subsequent efforts to arrange a telephone or face-to-face interview were unsuccessful. Also, four students were interviewed once each, all of whom had used or were currently using a wearable computer and whose use was prescribed in the student’s IEP.\textsuperscript{24} These students are described in greater detail in chapter 5.

At the time of this study, Emily had been a special education teacher at King Middle for three years and was the newest member of the special education faculty that,

\textsuperscript{24} As mentioned, Jeremy, the ‘alpha cyberkid,’ had relocated to another school district and supplied answers to a questionnaire that was sent to him.
in addition to her, consisted of a veteran teacher who has been a special education teacher “for a good number of years,” a veteran special education teacher who was in her first year in this district, and one veteran regular education teacher who was in her first year as a special education teacher. Emily is certified as an assistive technology evaluator. With passage in 1997 of the Individuals with Disabilities Education Act (IDEA), which required that a consideration of assistive technology be part of the assessment practices applied to students receiving special education, this credential has begun to appear in institutions of higher education; the question concerning assistive technology had to be asked of every student receiving special education. The principal was in her first year at the school.

The particular device used by participants in this study was a ruggedized, portable PC with power supply, touch screen display, mouse, folding keyboard and earphones, all of which the student carried in a specially designed backpack. The computer weighs less than two pounds compared with 5 to 8 pounds or more for a ruggedized laptop. For input and pointing, the students in this study used either a foldable or touch screen keyboard and/or mouse. The students I observed used a handheld display that could either be worn on a belt or carried in the backpack, along with a hard drive, two hot swappable batteries, and keyboard or mouse. Students used regular Windows software, specialist text-to-speech software for reading, and “homebrewed” instructional materials made by Emily.

4.3.3 The pilot study

The enthusiasm of Emily’s first reply to my queries has its roots in a pilot study she and Edwin had conducted a few years earlier (Zverloff 2001) based on the case of

25 These are the words of the principal. I did not meet the teacher in question.
one student, Jeremy. He was the first kid in the school, perhaps even the country, to be fitted with a wearable as an assistive technology. Jeremy was featured in many of the press releases and reportage that gave early impetus to this study. His was the story of the dramatic turnaround of the anti-social fifth grader who used to bite Emily until she outfitted him with a wearable. He went from biting to talking and reading with a wearable computer in 90 days. By the time I came on the scene, Jeremy and his family had moved to another school district and I was unable to visit with him in person. With the help of Emily, he completed a questionnaire instead.

During fieldwork I also collected school documents, including information about IEPs. A student’s individualized education plan (IEP) is an object of legal discourse describing the civil rights of disabled individuals in the United States, the responsibilities of states to educate school-aged individuals with disabilities (which includes both IEP and another legal concept, FAPE) and the recourse available when disputes arise.²⁶ As Woodward & Reith (1997) tell us, woven into the deployment of microcomputers in U. S. schools during the late 1970s was the promise to increase student access to “intensive, individualized remediation” and decrease teacher workload and training (p. 507). Computer technology would make it possible to provide truly individualized instruction, thereby fulfilling the promise of the individualized education plan, which was already part of the special education curriculum.

The school implements IEPs; a wearable computer can mean something carried around school in a backpack along with power, input, and output devices. It can also mean, in the same school, a “laptop strapped to an a/v cart that the student wheels down

²⁶ FAPE = Free Appropriate Public Education; IEP = Individualized Education Plan.
As Lyotard (1984) observed, "along with the hegemony of computers comes a certain logic" and control over deciding “‘knowledge’ statements” (p.4).

I left the field in November with mixed feelings. On the one hand, I had begun to register what felt like data saturation with regard to Edwin and Emily’s involvement with the project. Preliminary analysis of the data did was not producing new codes, but more and more hits for the existing codes such as ‘work.’ On the other hand, I was not pleased with the fact that I had not observed the students in a class using a wearable (other than in the resource room) nor had I spoken with any general education teachers who had had a student who used a wearable, even though in the interviews with special education teachers there surfaced the sense that there was some resistance to the cyberkid coming from the general education teachers (analyzed within the category of ‘work’). So I felt full and not full at the same time. Moreover, due to personal circumstances (I was expecting the birth of my first child) and the school calendar and the logistics of commuting the distance between my home and the field, I did not have any more time to dedicate to the field. Thus, following a brief period of transcription time to get the interviews off audiotape and into a visible form, a second round of data analysis began in the winter of 2003 and continued into 2004.

4.3.4 Data analysis II

A critical discourse analysis (Fairclough 1989, 1992, 1995) was conducted upon the data to identify problems and solutions regarding assistive technology in the formal learning space of school, including both descriptions and assumptions. For instance, one problem for the company involved in the case was that, compared to the broad

27 Quoted from interview with principal.
deployment and concentrated users in schools for desktop and laptop computers in the general education curriculum, only a fraction of students, widely dispersed across the many school districts that comprise the educational system of the United States, might benefit from the use of a wearable computer as assistive technology.

The data collected in interviews and documents were read and reviewed. I coded them for ‘empowerment,’ statements made by participants referring to the benefits bestowed by the use of wearables; ‘experience’ for when participants told of experiences with a wearable computer and/or self-interpreted those experiences; and ‘geek’ for where participants spoke of stigma related to the technology.

The results of this critical discourse analysis are examined in the next chapter.
The metaphor of the arena conjures up in me images of gladiators going toe to
toe; the Thunderdome, two walk in, one walks out. A place dedicated to competition and
risk. I grew up in a city with a sports facility named *The Arena* and now I live in a village
that boasts a skating rink with the same name. It’s a landmark for everyone around here.
And I have come to believe that the concept of competition and concomitant risk is
familiar to most.

Come to think of it, risk in the educational arena comes in many forms; bringing
weapons into the classroom, hazing, bullying, instituting acceptable drug policies and
Internet policies, maintaining academic integrity, getting drawn into battles between
science and religion, complying with a miscellany of laws concerning sexual harassment
and testing standards and disability rights, balancing the needs of children and the
expectations of parents and the finitude of resources. The educational arena is a place of
roiling reforms and paradigmatic revolutions, a place of seemingly perpetual turmoil that
occupies numerous actors or stakeholders: administrators, teachers, parents, and students,
to name the most obvious, but also mayors, governors, legislators, and employers. The
number of actors in the arena is already large and continues to grow. Like eyes adjusting
to a night sky, the longer you maintain your gaze, the more stars you begin to see.
Moreover, history itself is an agent; the ground upon which these stakeholders seek purchase for their interests is deeply indoctrinated in hegemony and tailored to suit the average white male. The objects of my analysis are certain ideological and material conditions of the educational arena and the formation and circulation therein of a discursive mélange of cognition, disability, and technology. Early during research, while still establishing contact with potential participants, I described the research this way: “I am interested in what happened, how the initiative to use wearables in schools happened, what interested parties in the educational arena are responsible for wearables in schools…” And from my journal during this same formative period: “The arena metaphor is common in texts on education. What I find helpful in it is its combative among competing in hostility close quarters unarmed combat [sic]. A place where each actor knows 10 ways to kill you with a shoe.”

The consensus of the scholarship in special education and assistive technology was of course not so purple. I have no wish to be mistaken for rejecting serious consideration of this scholarship, or for dismissing the judgments of these communities of researchers; nevertheless, I was disappointed and dissatisfied in some indefinable way to be hailed by questions such as, how do we use technology to include children with disabilities in the general education curriculum? How do we include students in class discussions and participation? How can a teacher customize instruction with a minimum of technology skills and time? I realized that these are after all the questions of scholarship that had results and outcomes squarely in their cross hairs, these are the questions that could purportedly lead to reformed policy and enlightened pedagogy. They
act in accordance with prevailing standards and, as Danforth (2004) points out, bringing one’s own research into harmony and accord with the fold is a simple act of self-interest for those whose footing in academia is less secure:

The campaign for scientific conformity can profoundly impact the work of new researchers; untenured university faculty members; and doctoral students, whose immediate career success depends, to some extent, on how senior researchers view their research. It may be that the message to conform to a specific articulation of disability science has the greatest impact among this relatively vulnerable and low-powered group, who do not have the cultural capital (such as doctorates and university tenure) that would allow them the luxury of pursuing dissident forms of disability scholarship (454).

So, perhaps I should have taken one of the questions above, or one like it, and given my inquiry the same shape, outline, and contour. Instead, however, what emerged was an analysis of wearable computers as an assistive technology for students receiving special education that was framed by a metaphor of position, opposition, and non-position (or elimination), of lethality occurring locally, routinely, as a technique for the pursuit of educational ends; framed, as it were, in a fragile and dangerous educational arena.

I accumulated much thought, reading, and writing with and about the arena. I was able to write, for example, that the educational arena for assistive technology holds true upon a plane, a grid of classes or species of diseases and their origins, the final result of which is to “make possible a body of medical knowledge, that towards which medical knowledge must constantly proceed” (Foucault 1994, p. 9). The nosological essence, in concert with the localization of disability within a patient and with the observing eye of a doctor, comprises a concrete space of perception that defines the visible forms of
disability; a flat, homological space of likeness between difference portrayed in the medical gaze directed upon that which is visible in the disability. The child to or not to receive assistive technology and the juridico-medical IEP team are looped together by a grid of intelligibility that directs the professional’s gaze and which is confirmed by this gaze. Thus, in order to know, in order to enact the social identity of special education teacher on an IEP team, for example, the teacher must recognize while already in possession of the knowledge that supports that recognition. The consideration mandate of the IEP team infers that its members have sufficient knowledge of assistive technology devices and services. The IEP team recognizes in each candidate for assistive technology the configuration of a disability confirmed within the rational space of the grid. In this way, the disability is allowed to fulfill its true nature, and technology is allowed to fulfill its true nature as a “fix.”

So what are some of the roles that constitute special education in school? There is the student, of course, spatialized within the array of types and degrees of impairments and disabilities described above. There is the role of the parents, idealized as members of an aggressive middle class, who, in instances where they disagree with the school system’s judgments about their children’s education, call upon attorneys and/or compel school systems to do the same. The composition of this advocacy in special education changed significantly with the attorney’s fees amendments to the IDEA of 1986, which gave courts authority to award attorney's fees to parents who prevail at administrative hearings or in court.28 There is also the role of lay advocates, such as an organization like Easter Seals, to name just one, that have lent weight to the passage of EAHCA and

IDEA. And then there are the educators themselves; the teachers, the administrators, and the teacher’s aides; and there are the related service providers who come into the precinct of the school: speech and language therapists, physical therapists, occupational therapists; social workers, counselors, nurses, and physicians. There is the business of the assistive technology industry – a mixture of large technology corporations, small entrepreneurial concerns, and inventors. Moreover, the arena is comprised of documents: EAHCA, IDEA, state statutes, section 504 of the Rehabilitation Act, ADA (particularly Title II to public schools and Title III to private schools) the Tech Act and the AT Act. These roles and these acts perform special education technology. Their placement in the arena reflects current thinking; some actors may, for instance, act with low interest and low influence. Their placement in the arena may not be optimal, they be characterized by the arena as having high interest and high influence, but their present place may be one of high interest and low influence, as, for example, parents who are portrayed as having a great interest in the educational institution their child is attending but may exercise little actual influence over the enterprise.

5.1 Visualizing the arena

I was writing about the arena and the actors and the acts that together, although not “together,” constituted assistive technology in school. I also had several episodes of visualizing the people, organizations, discourse, and practice involved in or effected by the educational arena for assistive technology. Table 1 is an attempt to identify the interstices between certain actors in the educational arena for assistive technology and formal features of discourse. This would help me put together a description of the
discourse that depends upon and creates the arena. Fairclough (1989) organizes a preliminary description of texts that requires the analyst to constantly alternate attention between the surface of the features (what is there on the page, in vocabulary, grammar, structures) and the discourse type of the text (interview transcript, school brochure, research paper, legal code, etc.)

<table>
<thead>
<tr>
<th>Field of technique:</th>
<th>Education</th>
<th>Business</th>
<th>Law</th>
<th>Family</th>
<th>Popular culture</th>
<th>Economics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actor:</td>
<td>Teacher, Student, Principal</td>
<td>Entrepreneur</td>
<td>Attorney</td>
<td>Parent</td>
<td>Geek</td>
<td>Inventor</td>
</tr>
</tbody>
</table>

| Who can benefit from wearable computers? | EXPERIENTIAL VALUE: Differences between texts in their representations of the world. |

| What social relations are created in assistive technology? | RELATIONAL VALUE: The choice of wording in texts creates and depends on the social relationships between participants (teacher/entrepreneur, student/geek, researcher/participant, etc.). |

| What’s right/wrong with special education technology? | EXPRESSIVE VALUE: Evaluations embedded in contrastive schemes that embody different values. Who shall/not receive special education and concomitant technology and how will it be done well? |

Table 1. Formal Features of Discourse/Table of Relations

Figures 1 through 4 below are attempts to communicate visually some aspects of the arena.
Figure 1 is a representation of how an actor in the arena can at times assume a position of great influence, occluding the interests of other stakeholders. In the figure, an unnamed actor in the center is eclipsed by technology.

Figure 1. Technological occlusion of the arena
Figure 2 also deals with technology as a dominating interest in the arena. Unlike the drifting orbits of occlusion, technological interests in Figure 2 are fixed; a hegemon, with explicit holds on and alliances with other actors.

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**Figure 2. The technocentric arena**
Figure 3 shapes the arena according to the principle of the Venn diagram; stakeholders have overlapping interests with one another. There is even a central spot of interest common to all actors.

Figure 3. Overlapping interests in the educational arena
Figure 4 is a conception of the expanding arena. By giving each actor its own entrance/exit, this figure reminds us that stakeholders in the educational arena have interests and lives outside of this arena as well and that the resources and attention brought to bear by each actor in the arena varies with time and circumstances.

Figure 4. Expanding points of entry and exit
Taken together, these figures describe an educational arena for technology that is a continuously and actively built and rebuilt complex of discursive and non-discursive practices-- legal acts, business interactions, teacher practices, student speech -- enacted with the right props at the right times in the right places. In the following sections, I will focus on particular formations in the arena, beginning with legal discourse and its dependence on and creation of technology, disability and education.

5.2 Who framed cyberkid?

I have described an educational arena for assistive technology constructed as an intersection of parental, medical, educational, and media discourse. Before I turn to another formative discourse, the legal, I want to dwell a on the children who each took a turn as a cyberkid at some point between 2001 and 2003 in their education between elementary and middle school. How did these kids see themselves with their wearable? How did they coopt and/or refuse various discursive frames?

N. had used a wearable in 5th grade for spelling and reading. D. had used a wearable in 4th grade (I talked to him the year after that use when he was in 5th) for reading. P. was a current user, and Emily had made a Boardmaker version of a history book for him. K. had used a wearable in 5th and 6th grade for reading, writing, and time management.

29 Boardmaker is a computer software program that contains libraries of Picture Communication Symbols with which one can fashion communication boards, picture schedules, instruction sheets and so on. It is one of the most commonly used programs in the field of augmentative and alternative communication.
All school districts in the United States are required by law to identify, locate, and evaluate children with disabilities. One of the early attempts to address the education of disabled individuals is the Education of the Handicapped Act of 1970. This statute was amended in 1975 and begat The Education for All Handicapped Children Act (EAHCA). EAHCA addresses due process regarding nondiscriminatory testing, placement, and integration of children with disabilities into regular classrooms. The concept of due process as it pertains to students with disabilities and as it is delineated in EAHCA is an elaboration of a 1972 case\(^\text{30}\) in which due process includes prescribing methods for identifying disabled students and their placement in as well as exclusion from school. Due process also includes the right to a hearing and an appeal, access to school records and the production of a paper trail of notices and decisions at all points along the way. This case and one from a year earlier in 1971\(^\text{31}\) set the stage for EAHCA.

In addition to due process provisions, EAHCA also differs from EHA because the amended text provides federal funds to any and all states that develop a plan to educate all of its students with disabilities, provided that the plan makes use of the principles of Free Appropriate Public Education (FAPE), Least Restrictive Environment (LRE), and Individualized Education Plan (IEP). Although technology is not specifically mandated in EAHCA, it is the concept of an individualized education based upon the student’s impairment-based needs that assistive technology such as computers will be associated


with in later statutes. In EAHCA, special education is defined as “specifically designed instruction, at no cost to parents or guardians, to meet the unique needs of a handicapped child, including classroom instruction, instruction in physical education, home instruction, and instruction in hospitals and institutions.”

The definition of “handicapped child” is accomplished through a list of impairment categories, at least to one of which a child being decided must belong:

- the mentally retarded
- hard-of-hearing
- deaf
- speech-impaired
- visually handicapped
- seriously emotionally disturbed
- orthopedically impaired
- other health impaired
- deaf-blind
- multi-handicapped
- specific learning disabled

The Individuals with Disabilities Education Act (IDEA) is an amendment of the Education for All Handicapped Children Act (EAHCA), which is itself an amendment of the Education for the Handicapped Act (EHA). Assistive technology, including both services and devices, is one of the two areas of revision to EAHCA by IDEA. IDEA specifically cites the use of computers in special education.

The IDEA and its corresponding regulations also define children with disabilities as those suffering from at least one of the following conditions: mental retardation, hearing impairment, speech or language impairment, visual impairment, serious

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32 It must be remembered that in the 1970s, personal computers were a hobby for a small group of enthusiasts who built their own machines from kits, such as the Altair 8800, introduced in 1975 (here the history of the personal computer comes into play: IBM 5150 PC introduced 1981; Apple II introduced 1977; Apple I introduced 1976; IBM 5100 introduced 1975, sold for about $10,000; etc. going back to the Simon, introduced in 1950.) It was not until the 1990s that wearable computing was positively identified in specific statutes, regulations, codes, and litigation pertaining to AT (Assistive Technology), special education, or disability. This will be discussed in greater detail in the following section of this chapter.

33 See 20 U.S. 1401(1) & (2).
emotional disturbance, orthopedic impairment, autism, traumatic brain injury, specific learning disability, or other health impairments. New to this list compared to that enunciated in EAHCA is autism and traumatic brain injury.

In IDEA an assistive technology device is defined as “any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.” This definition is broad and includes a range of devices from low to high technology. Under IDEA the legal definition of assistive technology services is “any service that directly assists an individual with a disability in the selection, acquisition, or use [bold mine] of an assistive technology device.” [20 U.S.C. Chapter 33, Section 1401 (26)]

I bolded the words in this definition because they are an overwording and suggest a point of tension or struggle. I continue with this analysis of other aspects of IDEA definitions, to point out that while services are overworded, the object of services and devices, the disabled subject, is not.

the evaluation of the needs of an individual with a disability, including a functional evaluation of the individual in the individual’s customary environment;

The range of impairments and conditions is, in the above and in relation to the following description of services, compacted. In the following, services are overworded:

purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by individuals with disabilities;
selecting, designing, fitting, customizing, adapting, applying,

maintaining, repairing, or replacing of assistive technology services;

coordinating and using other therapies, interventions, or services with
assistive technology devices, such as those associated with existing
education and rehabilitation plans and programs;

Individual/Family (italicized to indicate that it is not overworded) is distinguished
from the more overworded expression of Professionals:

training or technical assistance for an individual with disabilities, or, where appropriate, the family of an individual with disabilities;

and training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of individuals with disabilities.

This analysis of discourse suggests conflict in the relations governing “service.”

The services establish the relations, the network of targeted individuals, the truth about
AT. The object of the truth, individuals with disabilities, having already been
overworded (and in that sense established) in discourse defining children with
disabilities, are here discursively compacted in relation to services and professionals.

Defining disability is not limited to EAHCA and IDEA. The definition of
disability and the application of these definitions is actually broader under other statutes.
The Americans with Disabilities Act (ADA), for example, employs a three-part definition
of "disability." For the ADA to apply to an individual, the individual's physical or mental
impairment must substantially limit the individual's major life activities. This individual must also have a record of such an impairment and be generally regarded as having such an impairment. Physical impairment can include any physiological disorder or condition, cosmetic disfigurement, or anatomical loss affecting one or more of several major body systems, as defined by the statute. Mental impairment may include any mental or psychological disorder, such as mental retardation, organic brain syndrome, emotional or mental illness, and specific learning disabilities.

The provisions of the Rehabilitation Act of 1973 regarding the definition of disability are also broader than those of IDEA. For example, a child with AIDS may not be eligible for special education under IDEA. Often, legal cases brought under IDEA are concerned with deciding who is protected by the act and therefore who shall/not receive special education. In legal discourse, then, there is tension in the way students are defined by the diversity of types and degrees of impairments. The nosology of disability is a slippery construct.

In the 1982 Rowley decision, the United States Supreme Court provided students seeking specialized services with the historical “educational benefit” test. In recent IDEA amendments there has been a separate emphasis on preparation for work. The AT Act of 2004 states “the increased importance of assistive technology in employment, as more individuals with disabilities move from public assistance to work through training and on-the-job accommodations.”

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34 Related to, perhaps, the shift from education to work accomplished in welfare reform of the 1990s.

35 Sec. 215 of the Rehabilitation Act of 1973 covers training pertaining to rehabilitation engineers, technicians, and teachers.
Teachers are targeted individuals for technical assistance and training activities in the development and implementation of laws, regulations, policies, practices, procedures, and organizational structures that promote access to assistive technology devices and assistive technology services for individuals with disabilities in education. In law, training for teachers is defined within a framework of “training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to, employ, or are otherwise substantially involved in the major life functions of individuals with disabilities.” I shall return to teachers and training in a later section of this chapter.

I would also like to point out how the cultural foundations of disability lie in the way that law, race and special education intersect. For one, it is Brown v. Board of Education and its successful challenge to the policy of separate but equal racial segregation in education that paved the way for the employment of concepts like Free and Appropriate Public Education and Least Restrictive Environment to the practice of mainstreaming or integrating children with disabilities into regular classrooms. Thus, Brown is an important precedent for special education legislation. There is, after all, no federal constitutional right to education in the United States. However, because states have historically undertaken the project of educating the citizens living within their jurisdictional borders, the courts have deemed the Fourteenth Amendment’s due process and equal protection principles applicable to the enterprise of education.

In the years following the Brown decision, there were many such cases seeking to redress the inadequacy of special education across the country; however, even twenty
years after Brown, of the estimated eight million children with disabilities in the United States in the 1970s, three million of them were not receiving appropriate programming in public schools and another one million were altogether excluded from state public education (Rothstein 2000, p. 12).

The consensus about this state of affairs attributes it primarily to inadequate financing for special education; local school districts of the 1950s and 1960s were simply unprepared to shoulder the costs. By the 1970s, state education agencies had assumed the primary responsibility of providing funding and concomitant guidelines and enforcement practices of special education. The guiding principle that emerged from these state efforts was to minimize the negative impact that children with disabilities had on regular classroom teachers and students. The tone of this policy carried disturbing consequences for children of color; the methods employed to identify students with disabilities were both crude and prone to misuse, and it soon became apparent to anybody who bothered to look that racial minorities were overrepresented in special education programs.

Many of the findings of fact in the IDEA Amendments of 1997 project that racial minority students with disabilities will continue to have it worse than their white disabled counterparts for several reasons: because of the underrepresentation of minorities in special education professions, because “poor African-American children are 2.3 times more likely to be identified by their teacher as having mental retardation than their white counterparts”, and because “although African Americans represent 16 percent of elementary and secondary enrollments, they constitute 21 percent of total enrollments in special education” (IDEA 1997, p. 7). This is a social equity issue that persists.
The legal discourse of assistive technology in particular consists of a simultaneous particularity and multiplicity in constructing the student with a disability, such that the project of educating an individual becomes a “custom job” of exceedingly fine granularity, with technology to be applied along an ever-widening spectrum of impairments.

The AT Act of 1998 introduces the concept of targeted individuals and these identities lend form to the educational arena for assistive technology: The term "targeted individuals" means - (A) individuals with disabilities of all ages and their family members, guardians, advocates, and authorized representatives; (B) individuals who work for public or private entities (including insurers or managed care providers), that have contact with individuals with disabilities; (C) educators and related services personnel; (D) technology experts (including engineers); (E) health and allied health professionals; (F) employers; and (G) other appropriate individuals and entities.

In general The State shall develop and promote the adoption of policies that improve access to assistive technology devices and assistive technology services for individuals with disabilities of all ages in the State and that result in improved coordination among public and private entities that are responsible or have the authority to be responsible, for policies, procedures, or funding for, or the provision of assistive technology devices and assistive technology services to, such individuals (AT Act 1998).

In the legal discourse there is “shall”, as above, and there is “may,” as in “The State may support activities to increase access to, and funding for, assistive technology devices and assistive technology services.” Shalls are unfunded mandates. Mays can be ignored.

States ‘may’ contract with small businesses to “assist such businesses to design, develop,
and market assistive technology devices or assistive technology services.” These contracts may provide incentive for inventive business to come up with “AT solutions.”

However, as we shall see in the next section, it’s not so easy to turn a buck on the cyberkid.

5.3 Work

Work was an early coding. Out of every text work came tumbling, in response, as it were, to unasked questions, the truth concerning whose work wearable computers were, what work uses them, the extra work they make for teachers, and of course, “Do they work?”

5.3.1 Recognition work

Work, like power, is, in traditional analyses, a kind of possession. We say that such and such is the work of so and so. In this view, the effects of work are traceable back to a responsible individual. It is taken for granted that the credit or blame for work done is assignable to this person or that one. Every work place is rife with stories of those who opportunistically reap undeserved credit for work by claiming for themselves the work of others and tales of the obscurity to which the latter are consigned. It is as if, to twist the cliché, you are not what you do, you are what you say you did.

Recognition work (Gee 1999) is reflexively related to that in discourse that makes visible to others who one is and what one is doing. I use this concept to analyze material, political, sociocultural, and semiotic aspects of the recognition work of the special education teachers who piloted the use of wearable computers.

One material aspect of recognition work that came to the fore in this study was the wearable computer itself.
The wearable computer used by the teachers is the property of a company engaged in the research, development, manufacture, marketing, and sale of mobile and wearable computing. The company holds over 500 patents worldwide, including U.S. patents covering mobile and user-supported computer technology, including the wearable computer system, as well as transferable core technology and display technology. The structure of the company’s business operation is such that it must build the market for its products and services. Thus, the company’s marketing strategy has been to seek partnerships with giant technology corporations like IBM, Texas Instruments, Sony, and Toshiba at the same time as it acquires patents to protect it from competitors. Nearly 75 percent of the company’s marketing budget goes into building awareness of the wearables category. This includes "capturing the minds of the intelligentsia" through donations, loans, university funded and local foundation purchases of wearable computers for computer science departments in order to generate buzz and discover practical new uses for wearables. Given this marketing strategy based on recognition, it is not surprising that the company eventually expressed an interest in the work of Emily and Edwin and loaned them one wearable, before the two teachers wrote and received a state funded technology grant with which they purchased two wearables.

Wearable computing is part of the movement and rhetoric of “ubiquitous computing.” So it is common to come across intentions and predictions, such as “putting on a wearable may become part of getting dressed for work” and rhetoric like “digital duds” in the popular press and in the B2B trades. However, there was disagreement among entrepreneurs in foretelling the market for the particular computer that the
teachers ended up using with Jeremy and other students. In 1998, one firm predicted that annual sales would reach 160,000 units by 2001 and will create a $600-million market in the U.S. by 2003 and that in time there will be as many manufacturers of wearable PCs as there are makers of desktop, laptop or handheld computers (International Data Corp.). But would the wearable computer grow to perform specific functions, such as in large vehicle maintenance work, nuclear and industrial automation, and medical applications requiring hands-free remote communications, or could it be made into an object of desire for a broader market of business professionals, academics, and “geeks” with money? The company that ended up selling wearable computers to Emily and Edwin was also trying to sell them to consumers and they had in mind several segments of the population: well-off day traders of financial securities, news addicts, and Web surfers, for example. Moreover, one prediction was that the killer wearable, a play on the concept of the “killer application”, would be an executive entertainment and business center (“bizitainment“?) “to dispel the tedium of air travel more compactly than a laptop” (Ditlea 1999). For the holiday 1999 season, the company stocked their latest model with upscale retailer Hammacher Schlemmer in New York, Beverly Hills and Chicago. In the summer of 2000, the firm unveiled Showcase space in two windows on the Park Avenue side of Manhattan's Waldorf Astoria. The company clearly wanted to be recognized by a Fortune 500 clientele of business professionals.

The company’s annual conference for 2000 was 2 days long, registered 800 attendees, and cost $350,000, excluding the human capital of employees to arrange and staff the conference. Just as the electric light was the result of more than just an inventor
tinkering with current in a vacuum, the case of the wearable as used in special education
was more than just an affect of two inventive teachers. Emily wondered if parents
appreciated all the work teachers have done to impact their childrens’ reading levels, and
self-esteem? Emily writes: “It does take a lot of time to adapt work to be on the
computer, but we feel it is our job, and that is what we are there to do, set our students up
for success!

The teachers wrote a white paper gauging the positive impact of the wearable on
student progress in accessing the regular curriculum and other objectives specifically
identified in IEP. Emily and Edwin conducted a case study on Jeremy, a nine-year-old
boy with Autism Spectrum Disorder, who was in a K-3 Multiple Handicapped class.

According to Jeremy’s 2000-2001 IEP, as described in Edwin and Emily’s white paper,

He was able to attend to a story for 3 to 5 minutes, and did not respond to
questions relating to the story. Verbally, Jeremy had severe
communication deficits. He spoke in unintelligible utterances that did not
appear to be relevant to the events at hand. When prompted he would use
pictures to state his wants and needs. During free time, Jeremy often
engaged in self-stimulatory behaviors including lining up of toys and
tossing of toys in his lap. He had severe deficits in fine motor skills and
was unable to consistently use crayons or scissors. Additionally, Jeremy
exhibited several maladaptive behaviors that included biting, kicking,
pinching, and screaming. These behaviors were most prominent when he
was attempting to communicate a want or need. Jeremy became agitated
easily and would often require physical assistance to calm down.

After trying a succession of communication aids, the teachers tried giving Jeremy
a wearable computer in 2000. This act set off a ripple in the arena. Not only were there
affects on Jeremy, but throughout the stakeholders.

You wanted to know how the initiative for education started,” Emily wrote
back to me in an email. This was an early contact, and I asked her for her

36 A pseudonym.
story. She continued: “I called the company. I was the one who made the contact, got them excited, told them I would buy one and had them let me borrow one. And then I taught a student to talk and read with it in 90 days, and they realized that maybe they could sell more!

This description of the events surrounding the cyberkid gives us a cue to some of the tensions inherent in recognition work, and between actors in the arena. Teachers see themselves as hard(est) workers but least recognized; moreover, they do not attribute this lack of recognition to the vagaries of their fellow consumer-citizens, but to the machinations of a company that, I would come to learn, the teachers said had robbed them of their ideas, lending to the cyberkid a sense of something ill-begotten.

In the interviews, wearables took several forms in discourse. For instance, it took the form of a complaint that teachers who had students with IEPs calling for the use of a wearable did not work hard enough to accommodate the use of these devices by students in their classes. It took the form of an effect: the wearable computer made more work for teachers. It took the form of solution: the training of teachers in the use of wearables. Both teachers and administrators identified training as an issue. In interviews and correspondence, teachers impressed upon me the amount of work they had put into the wearable computer implementation; authorware to create learning materials, grant applications, servicing the computers, which, although ruggedized, succumbed nonetheless to student “interrogation” and use. Lastly, in a sort of double word score for “work”, they spoke of their efforts to formally train other teachers so that they too could work.

Me: What kind of training is in place now for teachers who will be having kids with wearables coming into their classrooms?
Edwin: What we did, when we received funding for the individual students we talked to our district so those teaching could pass some sort of training. Emily herself wrote a proposal to the district and gave them a couple options, and the options that we thought would work would be to have Emily or myself. If we offered Emily’s services, it would be a contractual position to which she would be available two hours a week to go and visit, you know, she would spend two extra hours a week to go to classrooms and work with the teachers. That idea was not welcomed by the district for many reasons. The other option that we said would be just to do an introductory lesson to explain the computer, explain some of the applications and then have follow up, you know, have follow up, just daily in-services during paid workdays. The difficulty with that was then you have to cover with substitute teachers.

So, what the district chose to do and what they did do was they gave one full day of in-servicing, 8 hours, where we went over all the parts of the computer, how to turn it on, what it is. We taught a small amount of Windows itself and then we went into BoardMaker and we talked about some of the other things that could be easily downloaded onto the computer. And that was what we did in 8 hours. Since then we have voiced concerns about the effectiveness of this approach.

Me: Did all teachers attend the training?

Edwin: That was for the teachers who were going to have those students in their classroom using wearable computers. Just special ed. teachers. We were going to take the approach like we did in my classroom where the person overseeing it would be the special ed. teacher and then if needed they would show the regular ed. teacher. Since then, no additional training has gone on. That was one day a couple years ago. And then this whole thing started. It wasn't last school year but the end of the school year before. So it was the end of my first year.

Me: No training this year?

E: No. And the reasons for that I would imagine would be...I don't know...they would probably say money. It just wasn't made a priority. Maybe they just assumed that Emily and I would take care of that. And I do do some things. Like last week, a new teacher came into our district who has a student with a wearable computer and I did I went in and I went through over an hour. We went through the different parts of the computer how to turn it on, showing them some applications. Just little things that would at least gets them using it. There is a speech therapist that has been here from the beginning of the project, so the new teacher can at least have daily contact with someone who has used it in the past. I provided that one day.

I'm trying to do as much as I can, Emily's trying to do it on a daily basis. I guess we're doing more than we give ourselves credit for but we
also did a workshop just on BoardMaker after school one day. We had
nine people show up. Nine special ed. teachers.

Public law calls for trained personnel to assist individuals with disabilities to use
assistive devices and services and to enhance the skills and competencies of individuals
involved in providing assistive technology devices and assistive technology services. The
following exchange with a school administrator recognizes tension between teachers,
students who use wearables, the school bureaucracy, and the implementation effort.

Me: The training issue. Do you see any remedies for that? What would
you like to see?

Admin: That's something our special services department is working on.
What I would like to see is some actual foresight and seeing where those
students are going next year, what teacher those students are going to have
at the end of this year, so those people can be trained at the end of this
year. So next year when those students arrive in their classrooms there's no
gap. That's what I would like to see.

The groundbreaking work that the teachers were doing set in motion a discourse of
recognition at district level. The overwording and collocations in the following text taken
from a presentation that had been put on the web, for example, suggests the cues
ideological contestation regarding disability and work that underwrites special education
policy and practices

During the 2001-02 school year, three District teachers worked to explore,
test and evaluate the possible applications of wearable computers for
students with disabilities throughout the school district. Students ranged in
age from 9 to 17 and in disabilities from Learning Disabilities and Mental
Retardation to Autism, Communication Disabilities and Orthopedic
Disabilities….

The first set of collocations alludes to a way of classifying teacher work (explore,
test, evaluate applications). The second set continues the classification of teacher work,
but in terms of classifying the objects of/for that work, *students...Learning Disabilities...Mental Retardation...Autism...etc.* The students are sorted by age, a naturalized educational practice, but they are also organized according to a nosology of Disability (with a capital D). The collocation of these words, their capitalization and the use of the concept of a range of disability parallel to (and perhaps “as natural as”) that of age are cues to the naturalization of disability. In addition to teacher work and disability, a preoccupation with application emerges in the continuation of the passage:


This string of eight noun phrases naming applications for wearable computing is all the more imposing because three of the phrases are compound (italicized “and”) and the last phrase displays overwording with “enhancing or supplementing.” We could say that there is much tension in the arena over the use of wearable computers as assistive technology in special education. From what other discourses in the arena is a sense of tension, and is there a way to, with some precision, identify some of its strands?

Let’s consider assistive technology advertising. A typical AT ad begins with a call to the subject of the text: perhaps individuals with cognitive disabilities; describes the ends: independence and self-sufficiency; nominates the means: its latest product; and ends by recalling the subject. Table 2 schematizes this interpellation:
Table 2. Schematic of AT advertisement

Two comments. First, a classification scheme is displayed in the second call to the subject(s) and again in the overwording of the product that presupposes a representation of social and natural worlds. Second, the [instrumental] ideology of technology is revealed in the grammar of the statement (the grammar of beginning, end, and mean).

Consider the classification schemes: 1. The object: a small, fully individualized, battery powered and wearable cognitive prosthetic assistive technology system; 2. The subject: individuals with developmental disabilities, traumatic brain injuries, acquired brain injuries (stroke survivors, individuals with Alzheimer’s disease).

5.3.2 Do they work?

“What was surprising is that I had experienced and inexperienced mechanics using them, and within a short time they were all working at about the same speed because they had all the information right in front of them” (Alpert 2002). In the business literature the training requirement on a wearable was deemed low for those who
already use PCs. In some reports, inexperienced workers using wearables performed as well as experienced mechanics. I was unable to do fieldwork in industry settings. In the school setting, where I did my fieldwork, each student positioned and was positioned by the wearable computer in different ways.

5.4 Who was/is cyberkid?

The wearable computers are, in effect, on “permanent loan” from the state. Each computer is tied in this way to a particular student. For instance, the first child to use a wearable, Jeremy, moved to another school district and the computer he used went with him. This is because the use of the computers is written into each student’s IEP, as a result of an assistive technology evaluation, conducted, in this case by Emily, who has been trained to evaluate and assess student technology needs. One of the challenges Emily and Edwin faced was how to make assistive tech “cool.” This is an ethical consideration expressed in discourse through relational values. Usually, technology—orthotics and prosthetics, for instance—are objects that serve as disability markers, as a means of differentiation. They felt this was important in order to foster in students a sense of self-esteem.

Their solution was to cut holes out of a smart-looking off-the-shelf backpack to run cables. The computer goes in the netting on the outside of the backpack where a water bladder was designed to go. If the computer were inside, it would get hot. Instead, all that goes inside is the keyboard or other input devices, headphones, and other things.

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37 The computer literacy of teachers came up in data.

39 I discuss this in Chapter 3 in relation to the IRB process.
The bag was small compared to the bags that most kids carry around. What follows are some details of some of the students I talked to who were currently using a wearable or had used one in the past.

5.4.1 Access to everything causes problems: The case of P.

P. was a current user and wanted to continue to use a wearable in the future. He used it to read primarily, and also to write. Emily told me that one thing she liked about the wearables was they were rugged and stable. P. told me otherwise. He said he had lots of problems with the wearable when he used it and that Emily and Edwin kept having to fix it. Emily told me that P. was to blame for most of the problems. She said he often got into trouble for messing around with the system files “He wants to fix things himself, be independent.” This might seem like a behavior to encourage, but Emily told me that, using the system software’s administrative function, she had to lock P. out of the control panels of the system software. “Access to everything causes problems.” When I talked to P., he told me he would like to learn how to troubleshoot, but with regard to the latest instance of problems with his computer, he told me he had dropped it, but that he hadn’t messed around with any system files. Emily didn’t believe him.

P. was also not allowed to use his wearable by some of his current general education teachers. Emily told me: “If his parents knew the law and what’s going on, we’d be in big trouble.”
5.4.2 I might want to talk to you again: The case of K.

K. was a former user by choice. He was in 7th grade when I spoke to him and he told me he had used a wearable in 5th and 6th grades. I asked him why he didn’t use it now and he said his new teacher wouldn’t let him.

Me: In seventh grade you’re not using it?

K: No I got put in a different homeroom….I’m not using it because I can only use it if I was in Emily’s homeroom. [My new homeroom teacher] doesn’t want me to use it anymore.

He used an onscreen keyboard and touch pen. He used the wearable equipment to read. Text-to-speech software would utter what K typed as well as readings that had been scanned. I asked K. to describe some of the ways he used read with his wearable:

K: [There was] a box with a person’s face in it and then a voice in the computer will just start reading the words for me. You have to try to study or try to memorize what the computer is saying.

Me: If you came across something, say some sign or just something that you wanted to read, while you were just walking around, would you type it in?

K: Yes. If I typed anything in and I clicked on that face, the computer would read it to me.

K. also used it to write. “I used to do paragraphs, but I didn’t use it for vocabulary words.” He was mainstreamed for English. He used speech-to-text software and word prediction applications. As Emily explained, word prediction applications revolve around a tradeoff between keystrokes and time: the fewer the keystrokes, the more time consuming it is to search through all the predicted terms to find the desired word. K. also used a daily planner application, which he described to me:
K: What I do is whatever I have to do for my classes, I would put down right next to the dot. On one sided there is my subject is there and then I click on it and a blank side will pop upon the other end and there will be dots [bullets]. To the right of the first one is Monday’s activity and the second one is Tuesday’s activity and so on. So I would put down right next to that dot. And then I would just do it. And I would just leave it there and if a new week starts I just erase all the activities and just put new ones in.

As the hall bell rang, signaling, among other things, that my time with K. was over, I asked him about computer use at home. He told me there was not a computer in his home.

Me: Did you use [the wearable] at home?

K: No. I didn’t even take it with me. I just left it at school.

Me: Why didn’t you take it home?

K: I didn’t want to I guess. I just wanted to take my homework home and leave the computer at school. That’s all.

Me: Hmm.

K: Well I have to get to class now, so I might want to talk to you later.

Me: Thanks for talking to me.

5.4.3 When can cyberkid be cyberkid?: The case of N.

N. is a former user, but not by choice. He used a wearable in 3rd grade for spelling and reading and hoped to keep using one as a reading prosthetic throughout his school career, but his current English teacher was not letting him do so. While talking to N about this during interview time in the resource room, Emily, who was hovering, cut in
to tell him (on the record, as it were) that he has the right to say to his teacher that he wants to use his wearable for spelling and reading, and that if she says anything then he can tell his Mom.

5.4.4 Playing games: The case of L.

I met L in the resource room one day. He was sitting at a table using a laptop. I asked him what he was doing and he said he was doing math. I asked him what kind of math and he said, “math baseball,” whereupon he explained the rules of the game and invited me to watch him play. He had use of a laptop and mouse written into IEP.

L. was not the only cyberkid who showed an interest in games, as you can well imagine. However, speaking to Edwin, I learned that the wearable computers were not taken out of the school for two reasons and the first one was gameplaying. The students would play games on the wearable computer, but they are not allowed to have games on the computer. If students could play games, they would take the wearable computer home to do so. Since they cannot play games, they do not want to take the computer home. During the time that K. was a user, for example, he did not expressed a desire to take the wearable home. The second reason had to do with how the wearable is configured. If students could surf the web on the wearable at home, then they would want to take it home. But because the wearable has only wireless Internet access and none of the students using the wearable in school have wireless connectivity at home, students do not want to take the computer home. Edwin also expressed concern that students might be robbed or lose the computer or that the computer would come to school not working more often than not, as was the case with P. Finally, I would like to relay one of
the projects that Edwin used to do with some of his students using digital textpads, before he got involved with wearables at the elementary school where he used to teach. He called it the Quiz Lab Project. Edwin worked with children diagnosed with learning disabilities, and one of the things he would have them do was go around the school with the textpads and quiz their peers on subject material. Edwin liked this project because it turned the tables for the disabled kids in relation to their nondisabled peers – using technology to foster self-esteem – in addition to the pedagogical soundness of making students authorities on content. We expect those who are quizzed to learn, but when students give quizzes they also learn from that position as well.

5.4.5 Tensions

As Fairclough (1989) posits, the more reasons people give, that is a place where there may be tension. From the standpoint of actors in the educational arena for assistive technology who represent the industry, one source of tension lies in the contrast between the large untapped market for computers that schools in the United States have represented to desktop computer manufacturers (microcomputers) for decades and, despite the increasing number of students receiving special education in the United States, the dispersed nature of the AT market. As Edwin pointed out, there might be 1 or 2 students in a school, maybe 50 in a state, who could benefit from the use of a wearable. For now at least, how to wrest profits out of this sort of specialty market is something that eludes many AT players.
5.5 Experimental concept mapping and data mining

As mentioned in Chapter 3, I experimented with the use of concept mapping software towards the end of the analysis phase of the study. I was feeling pretty saturated by this point with particular points of tension that the discourse analysis has identified, but I was interested to see what mining the data would yield in comparison to these claims that the critical discourse analysis suggested.

I ended up submitting 51 documents to the analyzer. Unlike many text analyzers, qualitative research applications, this one accepts .pdf files, so I was able to submit a fairly large number of the documents I had collected since beginning this project. The collection includes business literature, popular magazines, company press releases, legal texts, policy guidelines, scientific papers, and transcripts of the interviews I conducted with teachers, administrators, and students at school. Below are some selected samples of the documents:

Document 3. Business Sample:

It could be said that the work of NESTA Futurelab should involve finding technological solutions to real world problems in education, starting from the teachers and the learners to identify what their needs and concerns are. However, research into young people and technology over the last five years has taught us that we need to pay attention to the ways in which learners' uses of technology outside schools impacts on attitudes to, styles of, and expectations of learning inside schools. If we consider, for example, games consoles; we know that children's experiences of games play shapes the ways in which they engage with other digital environments and that their experiences of rich multimedia worlds outside school affects their expectations of learning environments inside school.

Document 4. Business Sample:

The CPU features a 128-MHz RISC processor, 64MB of memory (32 RAM, 32 ROM), and runs on Windows CE 3.0. The PocketPC 2002 operating system is not used in this version because its interface isn't as familiar to the average user as CE. The 11-ounce package, complete with
protective case and belt clip, is slick and ideal for listening to MP3s or watching compressed video. Expansion's not a problem with the Type II CompactFlash slot, ideally for use with a 1GB Microdrive for expanded memory or in the case of our review unit, a Socket Wi-Fi wireless network card.

Document 5. Business Sample:

What was surprising is that I had experienced and inexperienced mechanics using them, and within a short time they were all working at about the same speed because they had all the information right in front of them. In both cases, mechanics wear PCs around their waists like belts. The FedEx technicians use 4-by-8-inch touch-screen computers for I/O, accessing data on a server through wireless networking, while the ambulance mechanics wear head-mounted displays equipped with voice-input capability, accessing data from a local CD.

Document 6. Business Sample:

Wearable computer manufacturer said yesterday that its new line of products will be available by the middle of this month. The Fairfax, Virginia-based company's clip-on computers are currently used by the US military and in medical and factory floor applications. The new device uses a 500MHz Intel Celeron processor, twined with a Texas Instruments DSP chip for processing applications like simple command and control speech recognition.

Document 13. Business Sample:

*Machine Chic. The Poma Wearable Computer Is Flashy But Not Very Functional.* It isn't easy to stand out in a place like New York City, where outrageously dressed people are as common as pigeons.

Document 15. Business Sample:

Previously, the Gartner Group also mentioned in an April 17, 2001 Research Note, *Wearing it Out: The Growth of the Wireless, Wearable World,* "By 2007, more than 60 percent of the European Union and U.S. populations aged 15 to 50 will carry or wear a wireless computing and communications device at least six hours a day." The report also emphasizes a dramatic increase to 75 percent of these populations by 2010.

Document 16. Legal Sample:

The term "technology-related assistance" means assistance provided through capacity building and advocacy activities that accomplish the purposes described in any of subparagraphs (A) through (K) of section 3001(b)(1) of this title.
The term "underrepresented population" means a population that is typically underrepresented in service provision, and includes populations such as persons who have low-incidence disabilities, persons who are minorities, poor persons, persons with limited-English proficiency, older individuals, or persons from rural areas.

The term "universal design" means a concept or philosophy for designing and delivering products and services that are usable by people with the widest possible range of functional capabilities, which include products and services that are directly usable (without requiring assistive technologies) and products and services that are made usable with assistive technologies.

Document 18. Legal Sample:
A 1997 case from Austin Independent School District (AISD) in Texas. Among other complaints, the parents requested that their child use a computer-based reading program rather than the non-computer-based program the school was currently using with the child. This request was denied on the grounds that it is a methodology decision and as such is left to school districts.

Document 25. Legal Sample:
A public agency must keep title to and exercise continuing administrative control of all property, equipment, and supplies that the public agency acquires with funds under section 611 or 619 of the Act for the benefit of private school children with disabilities. The public agency may place equipment and supplies in a private school for the period of time needed for the program. The public agency shall ensure that the equipment and supplies placed in a private school are used only for Part B purposes and can be removed from the private school without remodeling the private school facility.

Document 28. Popular Culture Sample:
He wired the family home to eavesdrop on his parents' conversations and invented a sonar raccoon detector for the backyard. He and his brother, Richard, now a computer science professor at Canada's University of Waterloo, put up sensors that would detect when a parent was coming upstairs, so the boys could pretend to be sleeping by the time their bedroom door opened.

Document 29. Popular Culture Sample:
His first wearable system had to be carried in a heavy backpack, then it morphed into a terrible-looking beast that featured a helmet topped with rabbit-eart TV aerials. Eventually Mann developed a system that
could be hidden behind sunglasses, and now uses the one-side-of-the-face wraparound. It can plug into a variety of computers and devices.

Document 34. Popular Culture Sample:

Greg Priest-Dorman, a system administrator at Vassar College who frequently uses a wearable computer, says he tries to go at least one day a week without the device, so that he can still function without it. And he often takes his computer-glasses off when talking to his young daughter, so that she knows he is focusing on their conversation. "There's a lot of potential for increased isolation" with wearable computers, he says.

Document 37. Popular Culture Sample:

Georgia Tech Ph.D. candidate Helene Brashear demonstrates the camera-based version of the Mobile Sign Language system she developed. A wearable computer is outfitted with 3-D cameras to track her hand movements as she signs in American Sign Language. Brashear is investigating infrared and laser light in her efforts to design wearable computers that translate American Sign Language into English text on either a user's computer display or cell phone.

Document 39. Popular Culture Sample:

I know we're standing at the threshold of an age of wearable computers, and I'm all for a device that will help my memory and provide me with protection, information, and communication tools when I'm out walking around. But I think the cyborg living as a human camera concept smacks of the delightful naïveté of a scientist who has spent much of his life among university researchers. From my view of the social world, the idea of arming your local PTA, country club, or barroom with cameras that upload images to the Net is terrifying.

Document 40. Popular Culture Sample:

"It's bulky, it's heavy," says fourth-year undergrad Greg Harmandayan. Classmate Daniel Friedmann concurs: "What you wear on your waist and this head-mounted display isn't what I thought of as being completely wearable." Special student Stephen Ross, on a break from his full-time job, complains that "the equipment's battery life is too short to allow us to go online for any extended period of time."

Document 44. School Teacher Sample:

Some kids use them as motivators...I will do it if I can take the wearable to science. In teaching, it makes me think of how I need to adapt the general education assignments to all my students’ full participation,
while getting the same end result, even if it means an alternate route for them getting the information. They may not be able to read the text and find info about the Civil war, but they can go on the wireless web, do a search, and use a text to speech program to find the same info and fill in a digital worksheet and email it to the teacher.

Document 46. School Teacher Sample:

Parents appreciated all the work that was done. N's mom felt that specifically using wearable computers and using that as assistive technology has made a tremendous impact on their reading levels, on their self-esteem, on their desire to come to school, on their computer knowledge in general, you know those things are noticeable. It's always been very positive.

The analyzer produces maps of concepts in these 51 documents. The map conveys information about frequency through brightness and conceptual similarity through relative position. Thus, the brighter the dot that represents the concept, the more often it appears in the collection. The map can also display links between concepts, and the brightness of these lines communicates how often the two connected concepts co-occur closely within the text. The nearness of concepts in the map indicates that they co-occur with similar other concepts. The analyzer also produces a ranked concept list where, for instance, I learned that the concept of “disabilities” occurred 414 times throughout the collection, or in almost 85% of the material. “Children” occurs 313 times, and “services” 273. I was already working with “work” as a code, and out of that analysis emerged the claim that, based on the discourse analysis, there was tension in and behind the discourse of “service.” This is one of the ways in which it came to my attention that the structure of the market for AT made it difficult for business concerns to profit. This is a finding of the AT Act. While discussing the need for broader implementation of universal design principles, the following observations are made:
There are insufficient incentives for commercial manufacturers to incorporate universal design principles into the design and manufacturing of technology products, including devices of daily living, that could expand their immediate use by individuals with disabilities of all ages. There are insufficient incentives for commercial pursuit of the application of technology devices to meet the needs of individuals with disabilities because of the perception that such individuals constitute a limited market.

This experiential discourse on the world of AT is slightly at odds with other assessments of the industry (US Dept. of Commerce 2003). This may be due, in part, to the different experiences of large firms and small firms in the AT industry. The bulk of the U.S. AT industry’s revenues are concentrated among a handful of AT manufacturers. Eleven firms accounted for nearly 70% of industry revenues in 1999 (Dept of Commerce 2003) although small firms, employing fewer than 10 people, make up the majority of the industry.

Another complication has to do with the relation between assistive technology and medical insurance regulations. Since the bulk of AT products and services are paid for through insurance, manufacturers hesitate to design and develop any product or service that insurance companies will not cover. At the same time, insurance companies do not indicate whether or not they will cover a product or service until it is on the market. Larger firms make efforts to influence insurance companies and seek assurances that a particular product will be covered. Smaller firms must often take on additional overhead expenses to bring a product or service to market that may or may not be deemed coverable.
5.6 Summary

In this chapter I analyzed certain discourses circulating in the educational arena for assistive technology, and found that particular features of this discourse betrayed tension among the experiential, relational, and expressive values that were expressed. There is, for instance, conflict in and behind the values attached to work, disability, and technology. The work surrounding the use of wearables is experienced from a variety of perspectives, often conflicting, in the educational arena. There is the matter of recognition work, of being recognized as the performer of certain work. In some instances this recognition is desired, in other instances it may not be so because the work itself is undesired. For example, wearables make “extra work” for teachers; at the most literal level, there is the “extra work” involved in scanning a vocabulary worksheet or spelling test so that text-to-speech software can operate on it. It is also “extra work” to design and produce alternative learning material for students. Emily uses BoardMaker to create alternative interactive texts that take the place of a standard textbook of the regular education curriculum. It is a lot of work and often times, if not all the time, custom work; because of, the alternative textbook is built around the particulars of the student’s disability(s). So the type of production curve teachers usually face – initial steepness that flattens out over time as subsequent classes of students use the same materials, never appears with the cyberkid. Instead, the initial input requirements are high and they remain high over time.

When a student with a wearable arrives in class at the beginning of a school year, it may be the case that the teacher has no digital material for the student to use even
though that is the expectation and indeed the mandate laid down in the student’s IEP. Teachers sometimes arrange for the cyberkid to be transferred to other classes, or won’t allow them to bring a wearable to class or not allow them to use it. This was so in the case of K. when he graduated from third grade to fourth.

The administrative experience is one of standardization and above all, training. The administrative response is to work on tagging students with wearables so that their teachers next year can be made aware ahead of time (“warned”?) that such a student will be in their class, with the expectation that the teacher would augment his or her materials accordingly. Fairclough (1989) writes: “In any society there will be mechanisms for achieving coordination and commonality of practice in respect of knowledge and beliefs, social relationships, and social identities” (75). He identifies inculcation and communication as two mechanisms locked in struggle with each other. Inculcation is the process of naturalizing the social world “under conditions of class domination and division” (75). Communication is the means by which the constraints on contents, relations, and subjects are coordinated. “…inculcation is the mechanism of power-holders who wish to preserve their power, while communication is the mechanism of emancipation and the struggle against domination” (75). Can we say then that the tensions that are expressed on the surface of discourse point to where these two mechanisms conflict, where communication is seeking to resist inculcation?
CHAPTER 6
CONCLUSION

The status of knowledge is altered as societies enter what is known as the postindustrial age and cultures enter what is known as the postmodern age... Knowledge in the form of an informational commodity indispensable to productive power is already, and will continue to be, a major – perhaps the major – stake in the worldwide competition for power. It is conceivable that nation-states will one day fight for control of information, just as they battled in the past for control over territory, and afterwards for control of access to and exploitation of raw materials and cheap labor.... Knowledge is and will continue to be produced in order to be sold, it is and will be consumed in order to be valorized in a new production: in both cases, the goal is exchange. Knowledge ceases to be an end in itself, it loses its “use-value” (Lyotard 1984, 3-5).

Knowledge about the assistive technology industry is a form of economic national security as well as an outgrowth of the ongoing military research and development into 1) rehabilitation of disabled veterans and 2) a more wired soldiery equipped with smart clothing and an augmented reality of the battle space.

In 1999, pursuant to the Defense Production Act of 1950, an assessment of the "long-term health and competitiveness" of the United States assistive technology industry
was conducted by the Strategic Analysis Division of the Bureau of Export Administration, Department of Commerce. By the time the results were published (United States 2003), the division had become part of the Office of Strategic Industries and Economic Security, part of the renamed Bureau of Industry and Security. The Strategic Analysis Division worked on the survey in partnership with the Department of Education's National Institute on Disability and Rehabilitation Research, NIDRR and the 700 research laboratories, from sixteen federal departments and agencies, comprising the Federal Laboratory Consortium. Assistive technology might at first glance seem an odd choice of industry on which to conduct such a study in the name of national security. Industries and sectors undergoing this assessment previously are easier to associate with 'defense' interests: advanced ceramics, advanced composites, artificial intelligence, optoelectronics, and superconductivity. On the other hand, given the ongoing interest in developing “cyborg soldiers” for the 21st century and beyond, perhaps it is not so strange after all for developments in assistive technologies to interplay with the interest of the military.

The study described above conducted by the U.S. Department of Commerce estimated the value the assistive technology industry in the U.S. as $2.87 billion in 1999. The presence of some products in this market is coincidental. The wearable computer of this study is an example.

By 2007, more than 60 percent of the European Union and U.S. populations aged 15 to 50 will carry or wear a wireless computing and communications device at least six hours a day, rising to 75 percent of these populations by 2010. Of these six hours, time
carried or worn for educational purposes by students and education professionals, as well as those in occupations that provide educational service and support, is likely to increase dramatically.

Speaking of the changes technology brings to society, McLuhan (1964) noted that, “it is the framework itself that changes with technology, and not just the picture within the frame.” (219). Economic instability, structural unemployment, globalization, and downsizing suggest another technological shift in the framework, in which information technology is seen as the dynamo of economic growth, and education as the means to that growth. Moreover, in moving from the print to the electronic age, McLuhan (1999) argued that the Western world was evolving, cognitively, toward a right-brain dominant society. As a result of the more holistic approach this brings to processes of knowing, as information structures become much more simultaneous, discontinuous, and dynamic, he predicted that “new education will have no goals whatsoever” (101). His claim stands in contradistinction to the cost-cutting, efficiency-driven agenda promoted in current school reforms.

In this study, I have attempted to describe the emergent problem-solution of cognitive disability and assistive technology and the regularities that shape its construction in the educational arena. I have spent a significant portion of time within the medico-juridical tabulation of the modern disabled subject, a question of signs and of capacity. I have lingered on the rhetorico-material that brings disability into a descriptive, governmental and technologically mediated regime entitling and restricting individuals to and from special education. I have tried to account for that which counts, and describes
and defines the targeted individuals who shall and shall not comprise a network for assistive technology knowledge: who-doing-what should know about and disseminate assistive technology?

Much of what I have represented in this study -- processes of modern power in schools, the infiltration of cognitive prosthetics throughout the social body, and the special education resource room can be theoretically framed within a closed circuit. The representation of cognitively disabled subjects leads to and is shaped by ideology, which is itself mutually constitutive with assistive technology policy, which in turn produces effects on bodies, which only underscore the representation of cognitively disabled subjects, and so on around and around. The assistive technology device ‘wearable computer’ was embedded in a matrix with targeted individuals, dividing practices for who shall receive special education and who shall not, and the microgaze of the state turned on education, enterprise, and cognition.

And what of technology? How does it mediate?

Critical studies of technology in education (Coyne 1995, Besser 1993, Muffoletto 2001, Bromley and Apple 1998) reveal how information technology marginalizes the ethical, decontextualizes human experience, and amplifies/promotes domination. Besser (1993) describes how educational reform and the prominence of "computer literacy" in curriculum recommendations in the 1980s coincided with the mass marketing of computers. "The pressure for ‘computer literacy’ did not come from some clear and pressing need for ‘good citizens’ to have to know about these machines. Rather, this movement came from the traditional forces that had shaped public education since its
very beginnings” (61). Themes such as progress and the primacy of science and technology that came to prominence as a result of the industrial revolution contribute heavily to the consistent placement, since the 1970s, of computer literacy high on the educational agenda. Coyne (1995) argues that the opposition between technical issues and all other non-technical issues, including human factors, “far from sustaining a dynamic, indeterminate, dialectical tension…is thoroughly entrenched and institutionalized in the way information technology industries and practices are organized” (76).

The disabled subject with a cognitive prosthetic is an assemblage, a who-I-am/what-I-am, a work of recognition, a matrix of self/tech, a cyberkid, able to actively see the world and act in it, and to passively be seen by the world and to be acted upon or interpreted by it. The cyberkid occupies an already configured space. How does one, after all, become able to become one? The answer seems to be that this rhetorico-material self has been framed by the ways in which multiple agencies anticipate the deployment of assistive technology, which I have attempted to trace in the discourse and the practices of the educational arena. What, then, are some interpretive and existential features of the cyberkid? In no particular order:

1). The implementation of technology even in the same school can be uneven. The wearables were not used for Internet either in the school or at student homes. It was sometimes used as a desktop computer that stayed in the school’s special education resource room. Moreover, a wearable computer can mean something associated with the “cutting edge” carried around school in a backpack along with power, input, and output
devices. It can also mean, in the same school, a laptop strapped to an A/V cart wheeled from class to class. As Lyotard (1984) observed, "along with the hegemony of computers comes a certain logic" (p.4).

2. Teachers shape and get shaped by technology. Teachers decided that wearables would not be allowed out of the formal learning space of the school. Students would not be permitted to take them home because their homes lacked the appropriate information infrastructure, for fear that students would be robbed of the devices coming and going, and to forestall the inevitable: students playing computer games.

It was, to begin with, the claim that teacher indifference killed the deployment that led to my analytical interest in “work” and the values traced in the formal features of discourse where “work” appears. Larry Cuban’s (1989) study of attitudes about teachers and computers identifies how technology shapes teacher practice, how the success and failure of technology in schools collocates with the teachers in the school. Cuban interprets teacher resistance to technological change by arguing that teachers are constrained by technology when they avoid it and constrained when they don’t.

In my study, I found the teacher’s relation to technology was that of a targeted individual, desired in law, marked for network inclusion to share information about the educational benefits of assistive technology with other targeted individuals in school, district, and state. However, a critical analysis of the discourse suggests struggle behind the language that teachers, administrators, and entrepreneurs devoted to the wearable enterprise. Subscribing to technology means overwork and under appreciation for teachers expected to provide curriculum and instruction for students with cognitive
prosthetics. The special education teachers who got the wheels rolling poured hours and personal resources into the implementation, and got screwed out of compensation for their work by the company that lent them the wearables, which absorbed the white paper they wrote detailing the pilot study of the use of wearables in special education, as well as the idea for the backpack to carry it in, and developed the marketing strategy of the cyberkid. But there was no compensation to the teachers. It was a sore point for them.

General education teachers felt put upon by the need to make their lessons accessible to kids with cognitive prosthetics and found ways around the initiative, forbidding the use of wearables in their class or getting students who would use a wearable computer transferred out of their class. Administration framed this problem as a lack of “foresight” by those leading the implementation, while the entrepreneurs who were initially attracted to this assistive technology application of their product later lost interest in it because the numbers weren’t working: not enough students were using wearables, the school district doesn’t have money to buy them, and, when all is said and done, if a choice must be made between buying one or more computers for a computer lab and purchasing one wearable computer, in most schools the computer lab will get the nod.

3. Reading gets redefined.

“There has been no company that has come in and said, ‘Wow, wearing your computer could really make a change in how we educate children, and give kids with special needs access to a new world of communication, curriculum and leisure!’, (but that is still what we think!). Wearables play a different role in teaching and learning for each child. Some children are given a voice from a wearable, as it serves as a mobile communication
device. Some children are given access to textbooks that they can read/listen to for the first time in their normal classes, even though they can't read.

Reading “even though they can’t read.” What is this instead-of reading? Is it an example of an accommodation? An ethically-lowered standard to ensure success? The seam along which self-esteem is attached to the moral value of work? The formation of modern subjects in an age of simultaneously expanding and converging media? An effect of middle brow culture: when you listen to a book on tape, are you reading?

4. A morality is assigned

Moore, Beazely & Maelzer (1998) ask: where should the commitments of researchers should lie, given the uncertain place of children’s rights in society and “the variety of guises in which children find themselves experiencing family life”? (p. 72). They conclude that it is unethical to give students an assistive technology in school that they cannot use anywhere else. Within the rhetorico-material that integrates elements of the self.tech matrix that is the cyberkid, the wearable, by law, goes wherever the kid goes. The student who was the subject of Emily and Edwin’s pilot study transferred to another school district, and a wearable went with him. This is unlike the rules that govern the relation between students and the material objects of school. The wearable computer, unlike the desktop in the computer lab, is school responsibility, but not school property. This is a way in which the assemblage is rendered.

How can the problems that are posed in the discursive regularities of education, disability, and technology be freed? How could I constrict their flow and study their internal configurations and contradictions? This study situated assistive technology in its
linkages through methodologically inducing discursive ruptures to the field of inquiry and interrogating its already-said, through acts of restriction, constricting the truth effects of discursive unity, the obvious truth. *Tie the bandage with gauze around the appropriate limb between the wound and the heart, as close as possible to the wound but above the knee or elbow. Use an overhand knot (the same as the first stage in tying a shoe).* Deconstruction makes visible the idea that “normalized” positions are actually particular and not universal. Focusing on difference instead of similarity can work less in silencing and more in hearing, seeing, all people. Western Humanism underwrites truth, knowledge, norms, and policies, but there are always those who are on the wrong side of the binaries, and this incites us to interrupt the normative. *Place the stick on top of the knot and tie a second overhand knot over the stick.* The cyberkid, then, is an unstable, undefined, assemblage of social difference (race, class, cognitive wellness) and technology that is open to reconfiguration and reinterpretation. *Twist the stick until it pulls the bandage tight enough to stop the bleeding. Tie the ends of the bandage around the limb and secure the stick with gauze.* Discourses are not closed systems, however; it may be possible to make decisions about assistive technology that shift historical thought and material conditions. *Mark "TK" on the injured person's forehead in pen, along with the time of application.* This will require a great deal more thought and discussion than the present study can bear, into the preponderant discourse of identification, location, in/exclusion, accountability, and play between salvation and despondency that marks the birth of the cyberkid.

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40 In addition to being the abbreviation for tourniquet, TK is also used in publishing to indicate in the layout of pages where missing copy is “to come,” setting up in editors under deadlines a simultaneous feeling of salvation and despondency.


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