12-2012

# Teaching Accessibility and Design-For-All in the Information and Communication Technology Curriculum: Three Case Studies of Universities in the United States, England, and Austria

Paul Ryan Bohman

# TEACHING ACCESSIBILITY AND DESIGN-FOR-ALL IN THE INFORMATION AND COMMUNICATION TECHNOLOGY CURRICULUM: THREE CASE STUDIES OF UNIVERSITIES IN THE UNITED STATES, ENGLAND, AND AUSTRIA

by

Paul R. Bohman

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Education
(Curriculum and Instruction)

Approved:

| | |
|---|---|
| J. Nicholls Eastmond, Ph.D.<br>Co-Major Professor | Cynthia J. Rowland, Ph.D.<br>Co-Major Professor |
| Martha L. Whitaker, Ph.D.<br>Committee Member | Susan A. Turner, Ph.D.<br>Committee Member |
| Martha T. Dever, Ed.D.<br>Committee Member | Mark R. McLellan, Ph.D.<br>Vice President for Research and<br>Dean of the School of Graduate Studies |

UTAH STATE UNIVERSITY
Logan, Utah

2012

## ABSTRACT


Teaching Accessibility and Design-For-All in the Information and Communication Technology Curriculum: Three Case Studies of Universities in the United States, England, and Austria

by

Paul R. Bohman, Doctor of Philosophy

Utah State University, 2012

Co-Major Professors: J. Nicholls Eastmond, Ph.D., and Cynthia J. Rowland, Ph.D.
Department: Instructional Technology and Learning Sciences

Digital technologies allow people with disabilities to participate independently in society in ways they never could before. The full realization of these new opportunities remains elusive, though, because working professionals in the information and communication technology (ICT) field rarely receive adequate training in how to make digital ICT accessible to people with disabilities. Adding accessibility to the university ICT curriculum can help create a critical mass of ICT professionals with accessibility awareness and expertise to finally realize the full accessibility potential of digital technologies. This dissertation provides a rich informational context from which ICT curriculum leaders can decide how to best infuse accessibility into their own curriculum.

Part I consists of detailed case study narratives of curricula at three universities, documenting the context in which the curriculum was developed, the curriculum rationale, and the process of design and implementation. The three case studies were: (a) the Web Sciences master's degree program at the University of Linz in Austria, (b) the Instructional Technology master's degree program at George Mason University in the United States, and (c) the Digital Inclusion master's degree program at Middlesex University in the United Kingdom.

Part II consists of a thematic analysis across the case studies of six main themes: (a) the curriculum goals and rationale; (b) the curriculum design process, from idea to implementation; (c) defining the scope of the curriculum; (d) instructional materials and strategies; (e) instructional format and media choices; and (f) program sustainability. The last theme, program sustainability, proved to be one of the most crucial aspects of incorporating accessibility into the ICT curriculum.

Part III situates the ICT curriculum within the broader theoretical economic development framework of the capability approach, which is an approach to economic development that takes into account many variables in the quality of human life, not just financial measures. The discussion addresses the unique power of digital ICT to create capabilities in people with disabilities, and the role of the ICT curriculum within an "accessibility ecosystem" of diverse, interconnected stakeholders. The discussion concludes with a list of indicators for measuring accessibility content in the ICT curriculum.

(448 pages)

**PUBLIC ABSTRACT**

Teaching Accessibility and Design-For-All in the Information and Communication Technology Curriculum: Three Case Studies of Universities in the United States, England, and Austria

by

Paul R. Bohman, Doctor of Philosophy
Utah State University, 2012

Digital technologies allow people with disabilities to participate independently in society in ways they never could before, but only if the technologies are created with accessibility in mind. Unfortunately, too many technology professionals graduate from their college programs without knowing how to make technology accessibility to people with disabilities. This dissertation provides information to help curriculum leaders decide how to best add accessibility into their own curriculum.

Part I describes programs at three universities, documenting how and why the curriculum leaders created and implemented the curriculum. The three programs are: (a) the Web Sciences master's degree program at the University of Linz in Austria, (b) the Instructional Technology master's degree program at George Mason University in the United States, and (c) the Digital Inclusion master's degree program at Middlesex University in the United Kingdom.

Part II analyzes six main themes across the three programs: (a) the curriculum goals and rationale; (b) the curriculum design process, from idea to implementation; (c) defining the scope of the curriculum; (d) instructional materials and strategies; (e) instructional format and media choices; and (f) program sustainability (which proved to be one of the most important themes).

Part III discusses accessibility and technology within the theoretical perspective of the Capability Approach, which is an approach to economic development that takes into account many variables in the quality of human life, not just financial measures. Digital technology plays a special role in increasing the quality of life of people with disabilities. The last section provides a list of ways to determine whether a curriculum adequately addresses accessibility issues or not.

**ACKNOWLEDGMENTS**

If I am to be honest, I have to say that creating this dissertation was one of the lengthiest and loneliest tasks I have ever undertaken. Thankfully, my co-major professor, Dr. Nick Eastmond, was a voice of optimism throughout the entire process, expressing faith in me, faith in the importance of my research topic, and faith that I could complete the often daunting tasks stretched out before me. He helped me secure a modest travel stipend for my research trip to Europe, and stood up for me in meetings with the rest of the committee during the proposal and defense. He tried his best to minimize my workload, even when department or university policies limited his ability to do so. He was kind and accommodating throughout the entire process, and I am grateful that he allowed me some leeway in meeting deadlines, while encouraging me to still do my part to get the job done. Nick, you were the ideal person to lead me through this process. Thank you.

My other co-major professor, Dr. Cyndi Rowland, is the person most directly responsible for my involvement in the topic of disability access to technology. More than a decade ago, when I was working as a master's-level graduate assistant, she encouraged me to apply to be the technology coordinator on a new federal grant for which she had recently received funding. The purpose of the grant was to provide web accessibility training to higher education institutions. I applied for the job. She hired me, and together we became the founding members of what would eventually become WebAIM: Web Accessibility In Mind. Under Cyndi's direction at WebAIM, I wrote countless tutorials, articles, and conference papers about web accessibility, and provided training for

universities, state and local governments, and corporations. I joined the Web Content Accessibility Guidelines Working Group to create version 2.0 of the guidelines. Thanks to Cyndi, I became an accessibility expert. She set me on this path. Through the dissertation process, her feedback was pointed and specific, showing that she cared about the topic, cared about my professional output, and that she actually paid attention to what I was saying!

Committee member Dr. Martha Whitaker was also an instructor of mine in several courses prior to the dissertation. She is a master discussion facilitator with keen insights and the ability to diffuse tension on contentious topics. Her quiet and firm commitment to principles of justice in education and gender policy set the tone for many rewarding classroom experiences.

Committee member Dr. Susan Turner treated me with the utmost respect during the proposal and defense, supporting my choices when other committee members questioned them. Committee member Dr. Martha Dever was graciously willing to participate on my committee despite her demanding schedule as the department head, and she provided guidance on other issues related to finishing the degree.

Of course I need to thank all of the interviewees who participated in this research. Their generously honest answers and willingness to help me and to further the cause of accessibility is evidenced by the detailed information provided in this dissertation. It was a pleasure to meet with you all! Thank you to Dr. Klaus Miesenberger, Barbara Hengtsberger, and Mario Batusic at the University of Linz. Klaus, your consistent, energetic dedication to the needs of people with disabilities is an inspiration. Thank you

to Dr. Michael Behrmann for offering me my first job at George Mason University, and to Dr. Nada Dabbagh for your continuing support as I taught the Web Accessibility and Design class. Thank you to Kristine Neuber for approaching WebAIM many years ago and incorporating accessibility into the Mason curriculum, and to Kara Zirkle for continuing to bear the standard of accessibility after I left. Thank you to Gill Whitney, Suzette Keith, and Mark Springett at Middlesex University. Your insights and practical advice are invaluable.

My parents—Charles and Sally—and siblings—Melissa, Carl, Daniel, Michael, Timothy, and Thayne—have provided helpful encouragement along the way. Michael, with his DDS degree, was the first in the family to become a doctor, despite being 10 years my junior. Perhaps I am late, but I am here now, and I am grateful to be loved by such wonderful people, and I am grateful that, as family, we all belong to each other! Mom and Dad especially, I love you, and I owe everything to you. Thank you.

I also have many friends who have provided help and encouragement along the way as I wrote my dissertation. In my most uncertain times, when I questioned whether it was even worth it to finish the degree, I had access to sympathetic listeners who provided encouragement at key moments, even though those moments to them probably seemed insignificant at the time. Thank you, Melanie Reed, for letting me stay at your place in Paris in between my European research appointments. You went out of your way to give me the best Paris experience possible, sharing your valuable time with me, from Caveau de la Huchette to Musée Marmottan Monet and everything in between. Thank you to Achim and Louise Erlacher for letting me stay at your house in Linz not once, but twice,

many years apart. You are such a wonderful family and I welcome the chance to repay your generosity whenever you need a place to stay in my neighborhood. Thank you to Klaus Lindgren for your translation services on Sunday in Linz and for a fun evening with deep, soul-searching conversations at the Ars Electronica Center. Thank you to Lizabeth Wagger, one of the best friends I have ever had, for always providing the most compassionate of listening ears, for taking genuine interest in my life and passions, and for playfully counting down the weeks until my return from my stay in Utah while working on my proposal. You have truly been a gift in my life, in the right time at the right place. Spins and dips, Liz! Thank you to Maki Sato for telling me "you can do it!" while proving it by example as you finished your own M.D. degree. We (you, mostly) were even able to figure out the nuances of that Kimono, which was quite an accomplishment! Thank you to Christina Rego for spending many long hours helping me pack up and move my things into storage (and testing out all of my pens!)—even though we had just barely met—and for providing encouragement even after I had left. Thank you to Robin Davis Mott for our many, sometimes edgy, conversations, and for your no-nonsense approach to life that showed me I should accept no excuses from myself and just get things done. Oh, and that badly subtitled Chinese movie was *awesome*! Thank you to Tamee Roberts for befriending me when I was in Utah writing my proposal and being my swing dance, conversation, and breakfast partner on several fun occasions. I wish you the best with your nonprofit venture, Women Empowerment Global Outreach! Thank you to Angeline Smith Van Evera, another Ph.D. student and fellow swing dancer, for letting me photograph your wedding, which was a great distraction for me from the

monotony of my dissertation! Thank you to Rebecca Oldroyd for keeping me company in the foyer on Sundays in Arlington when we were hungry for both a distraction and a reason to be there. Thank you for your supportiveness through my life transitions, and for our great conversations over the years. Thank you to Frannie Nadel for appreciating my sense of humor, for hugging me like your life depends on it, and for being quirky enough to amass a legendary novelty sock collection! Thank you to Allison Weiss for your open mindedness and ongoing acceptance during our conversation in Utah, and for simply being the wonderful, wonderful top-notch person that you are, with a delightful sense of humor and expansive thinking to make all of our conversations worthwhile. Thank you to Curtis Weber for the social times while I was in Utah, and for a constant, accepting friendship that reaches back into the early high school years. Oh, the days of DJing dances, playing upside-down helium balloon volleyball, throwing Plasti-tak at each other, or, you know, just being the kids that we were. Thank you to the multitalented and ambitious Sabrina Campbell for your intensely loyal and generous friendship that has expanded into a close working relationship. Never a dull moment! You believed in my artistic talent enough to offer me office/studio space in your own business, and have championed my interests whenever possible. Of course, I do the same for you, cake artist extraordinaire! Thank you also for the more personal conversations that demonstrate your ongoing trust and unconditional acceptance. Finally, thank you to Rachel Terry. You met me barely in time to make it into this list of acknowledgements, after essentially all the work on my dissertation was done, but already you have had a wonderful impact on my life as you have encouraged me in my artistic pursuits and simply allowed me to be my best self. May you always embody the childlike spirit of wonder and the passion for simple beauty that give you your unique magical charm. You are just such good company, and that counts for a lot.

Looking back, there are many whose influence precedes my dissertation but whose impact in my life remains with me still. There are too many to name them all, but I will mention two. Thank you to Silvia Alvarez, who, forever young, will always be a beautiful, joyful part of my life. I miss you dearly. Thank you to Sherri Kellogg Soth, who taught me incalculably valuable lessons about life and about myself so long ago, even though it took me far too many years to fully benefit from them. I am deeply grateful to you on so many levels, and I am truly blessed to have known such an incredible, giving person. I will always hope the absolute best for you in every possible way.

As lengthy as it is this list of acknowledgements is still far from complete. Thank you to all who have encouraged me, befriended me, and loved me throughout my life. My experiences with all of you *are* my life. Thank you all so much.

Paul R. Bohman

## CONTENTS

# LIST OF TABLES

# CHAPTER I

# INTRODUCTION

Historically, people with disabilities have been largely dependent on others for their well-being and sustenance. Sighted individuals had to serve as the surrogate eyes for the blind. Hearing individuals served as the surrogate ears for the deaf. Mobile individuals served as the surrogate arms or legs for those with motor impairments. The dependency inherent in these relationships may provide rich opportunities for human interaction, but when surrogates are either unavailable or unwilling, this dependency can lead to isolation and helplessness. It can become a burden on both sides of the relationship.

The electronic computer era of the twentieth century ushered in an impressive array of high-tech assistive technologies for people with disabilities, giving them the ability to independently perform many tasks that they could never have performed before. Motorized wheelchairs allow people with almost no mobility in their bodies to make their way from one destination to another without needing to be carried, pushed, or pulled. For people without the ability to talk, computerized speech synthesizers provide a method of communication that was completely unimaginable only a few decades ago. Text-to-speech software programs—often referred to as "screen readers"—allow people without vision to use their computers to access information (providing it was created with accessibility in mind), without requiring someone else to read to them or interact with the computer for them. As Feyere, Miesenberger, and Wolhart (2002) stated, "People with disabilities can be seen as one of those user groups benefiting most from the movement towards the Information Society." Even though assistive technologies do not eliminate the underlying biological causes or limitations of the disabilities, they can nevertheless free a person from the dependency once associated with these conditions. These are truly amazing times, with amazing possibilities for people with disabilities. The opportunity for a person with a disability to chart a personal course through life—to make independent decisions and to perform independent actions—has never been more real or achievable.

Information and communication technologies (ICT) are especially promising. They can provide new methods of employment, education, and recreation previously unavailable to people with disabilities. With access to digital information, and the ability to write electronic documents, people with disabilities can participate in the work force on equal footing with the general population. To achieve the full extent of this promise though, technology professionals must design ICT systems, interfaces, and resources to be compatible with the methods and assistive technologies used by people with disabilities. Otherwise, the peril is that technology professionals will merely create new realms of disablement as new technologies emerge, and unnecessary dependence in the lives of people with disabilities. The juxtaposition of the potential promise and perils of technology leads to the topic of this dissertation: teaching accessibility within the ICT curriculum.

The purpose of this dissertation is to help faculty make informed decisions about integrating accessibility into the ICT curriculum by studying other programs that have already done so, analyzing themes across these cases, and presenting a theoretical framework to justify adding accessibility to the ICT curriculum. The ultimate goal is to improve the opportunities and capabilities of people with disabilities. After presenting the literature review and research methods, the substance of this dissertation is divided into three parts. Part I creates detailed *case study narratives* of three programs in three different countries and different academic disciplines that have integrated accessibility into the ICT curriculum. Part II presents a *thematic analysis* of some of the common themes that emerged while creating the case study narratives. Part III situates the ICT accessibility curriculum within the broader context of Sen and Nussbaum's *capability approach* to economic development, social justice, and individual well-being (Nussbaum, 2002a, 2006, 2011; Sen, 1993, 1999, 2009), which will be discussed in some detail.

The three curriculum programs chosen for inclusion in Part I of this dissertation, the case study narratives, are (a) the web sciences program at the University of Linz in Austria, (b) the instructional technology program at George Mason University in the U.S., and (c) the Digital Inclusion program at Middlesex University in the U.K. All of these programs have the same main goal in mind: to make technology more accessible to people with disabilities by teaching accessibility concepts and skills to rising ICT professionals. Each program approaches this goal slightly differently, allowing for rich comparisons between the programs. This dissertation does not attempt to rank order the quality of these programs or pass judgment on them. Instead, all three cases are presented as legitimate approaches to the task of teaching ICT accessibility in the curriculum. Curriculum developers at other institutions can learn from the experiences of the faculty in the cases presented here, copying, adapting, or rejecting the particular curricular methods of the cases as appropriate to fit the circumstances at their own institutions.

The thematic analysis in Part II of this dissertation used four initial research questions as a starting point: (a) How did the *context* (laws, institutional policies or conditions, faculty expertise, etc.) contribute to the development of the curriculum? (b) Why did the faculty integrate accessibility into the curriculum (what was their *rationale*)? (c) How did the process of creating the curriculum unfold (including any successes or setbacks along the way)? (d) What choices did the faculty make about *instructional materials and strategies* (instructional media, topics covered, target audience, instructional methods, etc.)? Over the course of the research, I found an imperfect alignment between these initial questions and the data that were emerging, so I altered the organization of the thematic analysis to more accurately reflect my observations. The final list of themes in the thematic analysis is: (a) curriculum goals and rationale, (b) the initial idea, getting the ball rolling, (c) defining the scope of the curriculum, (d) instructional materials and strategies, (e) instructional format and media, and (f) program sustainability. Program sustainability, in particular, emerged as one of the most important themes, even though I had not anticipated it at all in my initial research questions.

The discussion in Part III of this dissertation uses the capability approach as a theoretical lens through which to analyze the impact of the ICT curriculum on the lives of people with disabilities. In essence, I use the vocabulary and perspectives of the capability approach as a way to explain and justify the purposes of this dissertation, and to make the case for teaching accessibility as an integral part of the ICT curriculum. I then extend the discussion by suggesting a list of indicators by which to measure the successful integration of accessibility principles into an ICT curriculum.

The central argument throughout this dissertation is that adding accessibility into the ICT curriculum is an important step toward improving the lives of people with disabilities in the digital age.

It is through the ICT curriculum that future ICT professionals learn the foundations of their profession. If the ICT curriculum fails to educate them about how and why to make ICT accessible to people with disabilities, ICT graduates may enter the workforce not only without accessibility skills, but perhaps also without the knowledge that accessibility is an issue at all, let alone that it is an issue worth taking seriously. Every curriculum that teaches ICT without simultaneously teaching about ICT accessibility misses the opportunity to shape the future of the profession toward more inclusiveness toward people with disabilities. The failure to include accessibility and design-for-all in the ICT curriculum perpetuates the cycle of ignorance among ICT developers and maintains the status quo of exclusion and marginalization of people with disabilities who cannot use the inaccessible products created by the ignorant developers. At some point, this cycle needs to end, and the ICT curriculum is a logical place to start. Teaching accessibility as a part of the ICT curriculum in is one way to ensure that the rising generation of technology professionals obtains the knowledge and skills to become part of the enabling solution, and not part of the disabling problem.

# CHAPTER II

# LITERATURE REVIEW

## ICT Inaccessibility and the Curriculum

Beginning in the late 1990s, a host of studies documented widespread disregard for the ICT accessibility needs of people with disabilities in web sites and other technologies across many sectors of society, including in government (Hong, Katerattanakul, & Lee, n.d.; P. T. Jaeger, 2006a, 2006b; Mulvey, 2008), in libraries (e.g., Brobst, 2009; Schmetzke, 2001), in higher education (e.g., Kane, Shulman, Shockley, & Ladner, 2007; Sloan, Gregor, & Gibson, 2002; Thompson, Burgstahler, & Comden, 2003), in secondary education (May & Zhu, 2009) and corporate or other private sector web sites (e.g., Disability Rights Commission, 2004; Kreps, 2008; Lazar, Jaeger, et al., 2010; Loiacono, 2004; Lopes, Gomes, & Carriço, 2010; Trulock, 2006; Yao, Qui, Du, Ma, & Huang, 2009). The technical knowledge of how to create accessible ICTs is no secret. The World Wide Web Consortium, or W3C (see Appendix A for explanations of abbreviations used in this dissertation), published version 1.0 of the Web Content Accessibility Guidelines (WAI) in 1999 (Chisolm, Vanderheiden, & Jacobs, 1999), and has since updated it to version 2.0 (Caldwell, Cooper, Guarino Reid, & Vanderheiden, 2008). Even when web developers claim to know about accessibility, though, their often poor implementation of accessibility techniques on their own web sites (Abrahams, 2009) suggested that they know far less than they think they do. Whether out of ignorance or a willful decision to ignore accessibility principles, a large portion of those who create technology-based resources have created unnecessary barriers for people with disabilities by failing to implement accessibility best practices. There is ample room for improvement.

People with disabilities recognize the disparity in access, and have asserted their rights through legal channels. Numerous lawsuits and complaints have been filed against corporate web sites (Kuchinskas, 2005; Law Office of Lainey Feingold, 2010; *National Federation of the Blind v. Amazon*, 2007; *National Federation of the Blind v. Law School Admissions Council*, 2009; *National Federation of the Blind v. Target*, 2007; *Shields, Boggs, and Stockton v. Disney,* 2011; *Smith v. Hotels.com L.P.,* 2009; Standen, 2010), government entities (Loriggio, 2010; Milley, 2010), and against universities (BakerLaw, 2010; Danielsen, 2010a, 2010b). Many of these lawsuits in the Unites States have been filed under the Americans with Disabilities Act (ADA), despite its lack of references to the internet (Fkiaras, 2005). The U.S. Department of Justice did issue a letter suggesting that the ADA may cover the internet (Patrick, 1996), but this was a nonbinding opinion. Policymakers have also debated whether to explicitly include the internet in an update to the ADA ("DOJ Proposed Rule Making on Website ADA Compliance," 2010). Other countries have implemented antidiscrimination laws similar to the ADA, such as the Disability Discrimination Act (1995) and the Equality Act (2010) in the UK, and the e-Government law of 2004 and the Behindertengleichstellungsgesetz (antidiscrimination legislation) of 2006 in Austria (Miesenberger, 2006). Section 508 of the Rehabilitation Act in the U.S. (U.S. Access Board, 2000) specifies explicit accessibility guidelines for a range of technologies, and requires U.S. federal government entities to adhere to the guidelines in their procurement practices. While Section 508 has played a lesser role in lawsuits than the ADA, the strength of Section 508 is in exerting pressure on vendors and contractors to meet accessibility guidelines in order to qualify for federal government contracts. In fact, the European Union has adapted the approach of linking accessibility laws to procurement in Mandate 376 ("European Commission Standardization Mandate M 376," n.d.), which is still under development at the writing of this dissertation. The threat of litigation may not be the most altruistic motivator for making content accessible, but the laws at least bring attention to the issue and attempt to motivate government and commercial entities to comply with accessibility guidelines, under the threat of legal and/or economic penalties.

More optimistically, a case could be made that accessibility is beginning to come of age in some ways. Ever since the release of the Web Content Accessibility Guidelines by the Web Accessibility Initiative of the World Wide Web Consortium (version 1.0—Chisolm et al., 1999; version 2.0—Caldwell et al., 2008), and the accessibility requirements of Section 508 of the Rehabilitation Act (U.S. Access Board, 2000), the awareness and acceptability of ICT accessibility has gradually increased. It has been a slow process, to be sure, with uneven results and a wide spectrum of attitudes (Abrahams, 2009; P. T. Jaeger, 2006a), but the outlook has evolved. The once widespread ignorance, apathy, or antagonism on the part of some toward accessibility (Lazar, Dudley-Sponaugle, & Greenidge, 2004) is less common and less acceptable in some professional circles, especially in some large companies that no longer treat accessibility as an afterthought (Krazit, 2009), and try to integrate accessibility into product life cycle.

Though there is still plenty of room for improvement, these advances are encouraging, and some recent studies have reported a higher level of accessibility among web sites surveyed than in many studies of the past (Lazar, Beavan, et al., 2010). These developments suggest a growing market for professionals with accessibility skills.

Some university programs address accessibility and design-for-all, but these “differ widely in scale and intensity” (Miesenberger, Hengstberger, & Batusic, 2010; see also Whitney & Keith, 2008), and most of these curricula target the minority of students who are already interested in disability issues to begin with (in special education, assistive technology, rehabilitation, etc.). Searching for various combinations of terms such as “ICT,” “web,” “accessibility,” “curriculum,” “case study,” “disabilities,” “disability,” “universal design,” “design for all,” “masters,” “degree” in ERIC, Academic Search Complete, Google Scholar, and Google revealed a few published articles about accessibility in the curriculum across a range of ICT disciplines, discussed below.

In the field of computer science and software engineering, Cohen, Fairley, Gerry, and Lima (2005) taught some basic principles of software accessibility in an introductory computer science class at the University of Massachusetts, Boston, requiring students to create simple accessible Java software programs, such as a number format converter, an accessible calculator, and an audio visualizer. In the paper, the authors explained the importance of teaching about accessibility and present some basic software accessibility guidelines. The authors claimed “accessibility can be explained in a few pages in a textbook and a few minutes in a lecture. Accessibility can be seamlessly embedded into any existing curriculum with little overhead.” By downplaying the effort required to teach accessibility, the authors seemed to be emphasizing the importance of including anything at all about accessibility, even if it means not covering the topic in much depth. Ludi (2002) described university classes in computer and web programming for majors and nonmajors in which accessibility was taught as a core component of the classes. Lectures covered basic HTML accessibility, assistive technologies, and accessibility tools. Students were required to adhere to accessibility guidelines when submitting assignments, and in some classes instructors asked students to write brief papers about accessibility. The authors said that the students “do seem to get the message, at least in the short term,” and that “at the end of the course, several students have expressed an interest in the topic as well as an appreciation of the discussion.” Rosmaita, Katherine, Cohen, and Egan (2006) published a brief position paper advocating for the inclusion of accessibility in the computer science curriculum. In three separate conference papers, Rosmaita (2006a, 2006b, 2007) explained a service learning approach to teaching an introductory computer science course to nonmajors in which the author taught “accessibility first...instead of teaching accessibility as an ‘add-on’” (Rosmaita, 2006a, p. 273). Rosmaita proposed “that [accessibility] be brought front and center and made the focus of the course. All aspects of web design should be taught from the standpoint of how they contribute to accessibility” (2006a, p. 273). The paper made the case that thinking about accessibility first fosters effective thinking about real-world problems that affect all aspects of design, promoting good general design concepts as separating content from presentation, designing for extensibility and interoperability, and the integration of computer science with the social aspects of computing. Ludi (2007) described an experiment in which one group of students had personal interaction with a person with a disability as a stakeholder on a design project, and another group of students did not have access to this person with a disability. Both groups were told to develop product specifications that met the needs of users with disabilities. The students who were able to interact with the stakeholder who had a disability demonstrated higher levels of accessibility understanding. The author advocated the inclusion of people with disabilities in the specification stage of product design. In a conference paper, Wald, (2008) described a 10 credit masters level module about assistive technologies and universal design. The paper lists the goals and learning outcomes of the module, and discusses the methods of assessment, which include a written report, a website design project, an online oral presentation, and online discussions.

In the field of web design and interface design, Harrison (2005) described a class at the University of Wisconsin-Eau Claire that taught accessibility principles as an integral part of all aspects of the class, rather than just address accessibility in a mere "lecture or two." The author described some of the basic accessibility issues that should be a part of any web design class, provided links to a few online accessibility tools and informational resources, and encouraged instructors of web design classes to follow the lead of this class, "opening the eyes of those who can see to the world of those who can't" (p. 23). A postgraduate program in accessible web design at one of the institutions included in this study—the University of Linz—was described by those involved with the curriculum in several papers (Miesenberger & Ortner, 2006; Ortner, Batusic, & Miesenberger, 2004; Ortner & Miesenberger, 2005). The focus of the program was entirely on accessible web design, making it unique in its mission and focus. A subsequent initiative at the same university created a general accessibility curriculum structure to be integrated in multiple universities across Europe (Hengstberger, Miesenberger, Batusic, Chelbat, & Rodriguez Garcia, 2008; Miesenberger et al., 2010). Both of these initiatives ended prematurely due to a combination of factors, which are explained in detail in the University of Linz case study later in this document.

In the field of computer engineering, Buckley, Kershner, Schindler, Alphonce, and Braswell (2005) described an undergraduate capstone course at the University at Buffalo, SUNY in computer engineering in which the instructors tasked the students with designing "an augmentative communications device for a 42-year-old male (David) who had suffered a stroke…. The best of the resulting projects were incorporated into a single device and given to David." The authors claimed that "he uses it today as his main means of communication." The next year, the students were tasked with creating augmentative communication devices for children with cerebral palsy, and the following year the students were tasked with creating devices to support special-needs students at a school in speech, language, and occupational therapy sessions. The authors extolled the virtues of assigning these meaningful projects to the computer engineering students as a way to motivate them to produce higher quality work and to engage in socially-relevant causes.

In the field of human-computer interactions (HCI), Liffick (2004) described a 2-year project called "Integrating Assistive Technology into an Undergraduate Computer Science Curriculum from an HCI Approach," funded by the U.S. National Science Foundation. In one of the phases of the project, the instructors taught one-to-three week modules about assistive technologies (AT) in a regular HCI class. The author explained that "many AT devices are poorly designed from a usability perspective (and rarely covered within an HCI course in any depth), resulting in extensive training needs for AT, poor utilization by AT clients, and the abandonment by the AT user." The author hoped that introducing HCI students to AT would increase the awareness among HCI professionals as to the needs of users with disabilities.

In the general field of information systems or ICT, Lazar (2002) explained why disability access to technology is important, and wrote that "there are a number of courses [in the information systems curriculum] in which accessibility would be an appropriate topic, including systems analysis and design, web design, e-commerce, human-computer interaction, and computer ethics. The author suggested that the topic also could be included in courses about business law or other related courses. A conference session described by Sloan, Nelson, and Sloan (2007) included position statements that reference the need to include people with disabilities in the teaching of ICT design. Carmichael, Newell, and Morgan (2007) discussed the use of an instructional video to demonstrate to students the "fundamental differences between older users of ICT interface, and the interface designers, who tend not to be familiar with the general perspectives and user requirements of this and other 'nontypical' target groups" (p. 588). The authors claimed that the video is effective in producing relatively long term awareness of the issues, and that the video is more practical than in-person meetings with older users or users with other design needs.

An additional notable contribution to the literature of accessibility within the ICT curriculum is a compilation by Keith and Whitney (2008) of programs across Europe that have taught accessibility in one way or another. The authors contacted a large number of programs and inquired about courses teaching accessibility. They describe the difficulty in identifying such programs because few classes or degrees were labeled in a way that made the accessibility component obvious. The authors had to contact individual people at the campuses to discover the information they sought. Some of the programs in the list teach very little about accessibility. Others teach much more. The paper provides a reasonably comprehensive list of programs in Europe that have taught accessibility, but the paper includes only brief summary descriptions of each location—mostly in bulleted list and table format—without an investigation into the history, rationale, or process of development and implementation of the curriculum as this dissertation does with its case studies.

In spite of the several instances of accessibility in the ICT curriculum over the past decade or so, the literature review yielded no studies directly comparable to the scope of this dissertation, which is a detailed international multi-case study detailing the history, rationale, and process of development and implementation of curriculum programs in ICT accessibility. To date, scholars have not documented any of the curriculum efforts in great detail. The literature is limited to mostly short conference presentation papers, posters, or panels.

The available literature published prior to this dissertation offered some level of assistance to those who were interested in adding accessibility into their own ICT curriculum, but with notable limitations in the depth of the narrative, the internationality of the scope, diversity of curriculum subjects, and/or the strength of the analysis of themes across multiple cases. This dissertation positions itself in those gaps, first by addressing the need for depth in the narrative by describing in detail the history, thought processes, rationale, challenges, and lessons learned in three case studies. Second, it addresses the need for international representation by including cases from Austria, the United States, and the United Kingdom. While this is hardly a comprehensive list of countries or world regions, it offers more of an international perspective than the vast majority of the literature, which is country-specific. Third, it addresses the need to represent a diversity of curriculum subjects by studying cases in the separate academic disciplines of web design, instructional technology, and digital inclusion. Fourth, it addresses the need for an analysis of themes across multiple cases by abstracting from the individual cases to identify common elements or concerns across the countries and academic disciplines in ways that may be useful to those creating their own curriculum, regardless of their geography or academic discipline.

## Theoretical Perspectives on Disability

How a society thinks of disabilities makes quite a difference in the way that society approaches the challenges facing those who experience disabilities. At one end of the spectrum, disabilities can be seen as merely biological defects (Rioux & Valentine, 2006) of an unfortunate minority (Shapiro, 1993) of individuals who must fend for themselves or depend on the unpredictable kindness of others. This creates an inconvenient state of dependency for individuals with disabilities, and when resources and/or willing helpers are not available, the personal freedoms of a person with disabilities can be extremely limited (Nussbaum, 2006). At the other end of the spectrum, disabilities are seen as normal variations of the human body. “Disability happens,” wrote Potok (2002). “It is not an aberration. It’s a reality, not an anomaly or abnormality” (p. 7). If disabilities, are normal, some contend that society ought to accommodate these variations, by employing universal design principles (Boyd & Moulton, 2004; Erlandson, 2002; Follette Story, 1998; Iwarsson & Stahl, 2003). A few examples of universal design in the physical environment include curb cuts on sidewalks, door levers that can be opened with elbows as well as hands (for those without hands or those with limited use of the hands), toilets which flush automatically, elevators, and crosswalk signals with sounds (for those with low vision or blindness) to supplement the visual information. Inevitably, providing such accommodations requires extra diligence and effort on the part of those without disabilities, which can be seen as inconvenient for the nondisabled majority. Anywhere along this spectrum, there will be some level of inconvenience, either for those with disabilities who must work around the obstacles of a society which privileges the needs of the nondisabled, or for those without disabilities who must put in the effort to create and maintain a society in which such obstacles are minimized (Doherty, 1995). Universal design can greatly reduce the level of inconvenience in accommodating disabilities, but it cannot eliminate it entirely. Accommodating disabilities takes work. There is no sidestepping this point. Determining how best to do this work, who should do it, and to what extent society should be structured to provide this is a matter of social and political philosophy, and different models of disability reflect different philosophies.

## The Biomedical Model

One of the most commonly articulated approaches to disability, especially in popular culture, is the biomedical model (MacPherson, Pothier, & Devlin, 2006; McColl, James, Boyce, & Shortt, 2006; Rioux & Valentine, 2006). The biomedical model deals with bodily limitations or impairments, and their corresponding treatments and interventions, often with the goal of transforming or curing the body to the extent medically possible. The bodies of people with disabilities are seen as different, defective, and in need of medical intervention. Disability is seen as a differentiating personal condition of separates “afflicted” individuals from the rest of the biomedically “normal” society. While there is value in the biomedical model in medical contexts, it is mostly irrelevant in the context of making technologies accessible to people with disabilities. Waiting for a universal cure for blindness or quadriplegia is hardly a useful approach to making web-based instructional materials available to people who experience these conditions now.

One of the consequences of the biomedical model of disability is that it seems to relieve society as a whole of any clearly defined collective responsibility toward ensuring that individuals with disabilities are able to live full and productive lives. Rioux and Valentine (2006) explained that, within a medical framework,

> the social responsibility, both professional and political, that has attached and continues to attach to this perspective on disablement is directed to the elimination and cure of disability, and where that is not possible, to ameliorate the condition and provide comfort to the individual, identifying as inevitable the disadvantage suffered by the individual. While the role of the state in regulating

> and correcting disadvantage and inequality may be either expansive, in this case, the privatization of the disadvantage justifies and perhaps even mandates a restrictive or passive engagement in its resolution. (pp. 50-51)

It may be unfortunate, so the logic goes, for those individuals (and the people who assist them) to have to deal with their disabilities and the inhospitable society in which they live, but since their bodies are so different from the norm, they will have to adapt their own lives to the conditions that are out there. Society has no sense of collective ownership of the issue under this model, and the disabling conditions of the social environment are likely to persist.

### The Social Model

An alternative to the biomedical model is the social model (Jackson, 1968; Longstreet & Shane, 1993; Margolis, 2001). The social model takes its cue from critical theory (J. Bohman & Zalta, 2010), including critical race theory and critical feminist theory. Critical disability theory acknowledges the biological realities of disabilities—just as critical race theory and critical feminist theory acknowledge the physical and/or biological realities underlying racial and sexual identities—but it looks beyond biology toward the larger societal context. In the same way that discriminatory attitudes and practices in a society can lead to social injustice for minority races (racism) or women (sexism), societal discrimination can lead to social injustice for people with disabilities (ableism). In fact, critical disability theory challenges the notion that disablement is intrinsically a characteristic of individuals at all (Hughes, 2010). Rather, it is the disabling conditions in society that create and define disablement. These disabling conditions make it difficult or impossible for certain individuals to participate fully in society. Critical disability theory makes a clear distinction between biological limitations or impairments—a characteristic of the individual—and disablement—a characteristic of the social environment. For example, the inability to walk is not necessarily a disabling condition as long as buildings have wheelchair-accessible entrances, hallways, doorways, restrooms, elevators, and so on. The absence of these features in a building—a factor that is independent of the individual—causes a disabling circumstance for the person who cannot walk. In contrast, the inclusion of these features in the physical environment would mitigate the individual's biological limitations, and allow the same degree of access to the building as anyone else without a disability. The individual's biological limitations would not preclude their capacity to access the building.

The social model of disability applies not only to physical environments, but also to virtual environments. Websites that are designed with accessibility in mind allow a wide range of individuals to use them, regardless of their disability status. In accessible contexts, the biological condition of blindness persists, but there is no associated disablement. In fact, when web sites are accessible, one's blindness need never be disclosed, nor would it be discovered without disclosure, because everyone, whether sighted or not, can make full use of the web site and participate in any interactions. Conversely, when web sites are inaccessible, they present a disabling environment to those who are blind, and one's blindness is front and center. From the perspective of the social model, the difference—and the cause of disablement—is in the design of the environment, not in the biological limitations of the individuals.

One of the strengths of the social model is that it provides a framework for rethinking the way we create physical and virtual environments, with a heightened sense of responsibility toward a wider range of people who will inhabit those environments. It can inform design decisions and public policy in ways that the biomedical model cannot. It surveys the scene from a wider vantage point, taking into account systems, structures, customs, assumptions, and attitudes. It can potentially transform society and improve the lives of all people with disabilities across the board, rather than focusing on them as individual cases—exceptions to the norm—to be dealt with only in an ad hoc manner, if at all.

The social model of disability is not without its weaknesses though. Some proponents of this approach have leveraged ableism as a divisive wedge issue of identity politics. As (Hughes, 2010) explained:

> Some disability activists have carried this critique of ableism to an extreme that I have dubbed 'pro-disability,' denouncing cures for disabilities and prenatal screening as contributing to ableism. They have attacked people like the late Christopher Reeve for advocating for cures for spinal cord injuries instead of focusing on antidiscrimination and funding for human and technological assistance. (¶ 3)

Some deaf culture purists similarly frown upon cochlear implants (medical devices that allow some level of hearing for the deaf) as an affront to deaf culture and their loyalty to sign language. A purely accommodationist social model promotes pride in disability while denouncing attempts to provide medical treatments or cures for those disabilities. A more balanced approach seems more appropriate. Certainly there is room for both social accommodation and medical enhancement. In fact there is way to tie the two models together.

**The Capability Approach**

A third model, the “capability approach” pioneered by Sen (Dreze & Sen, 2002; Sen, 1979, 1984, 1985a, 1985b, 1987, 1988, 1992, 1993, 1995, 2009) and Nussbaum (1988, 1992, 1995, 2002a, 2002b, 2003a, 2003b, 2006, 2011), strikes a balance between the medical and social model, in fact in some ways subsuming them both by recognizing the value of both personal biological enhancement as well as social accommodation and transformation. Even though “disability scholars recognize that no single model can totally explain disability” (Mitra, 2006, p. 236), the capability approach offers strengths worth taking into account within the context of this dissertation. These strengths include: (a) its broad interdisciplinary scope that extends far beyond the realm of disability studies, taking into account economics (in particular, questions of welfare economics, poverty, and inequality), political philosophy, and social philosophy; (b) its robust conceptualization of social welfare in terms of meaningful opportunities and freedoms available to individuals; (c) its inclusive ethical approach to questions of justice, insisting that all people—even those with disabilities—ought to have access to these kinds of meaningful opportunities and freedoms; and (d) the ability to use the capability approach as an evaluative framework for judging policy and practice within societies.

**Broad interdisciplinary scope**. The capability approach is not a disability-specific concept. It is a broadly conceived interdisciplinary approach to social justice, human well-being or welfare, social policy, political philosophy, and economic development. It emphasizes the need for “substantive freedoms” (Sen, 1999, p. 87) such as the freedom to live a long and healthy life, to gain knowledge, to engage in political processes, to form social relationships, to obtain economic commodities, and so on. All of these freedoms, or capabilities, increase the realm of what is possible, without guaranteeing that all people will achieve these potentials, and without specifying through what means they might achieve them. Choice and personal preference play a large role in the capability approach. The capability approach measures opportunity, not outcomes, which will vary, because the freedom to not do something is as important as the freedom to do it. As long as a freedom is real, the capability is meaningful. With regard to disabilities, whether the capability comes through medical advances or societal accommodation is immaterial to the capability approach. Both can lead to the same type of freedom and allow for the same type of fulfillment in life.

**Robust conceptualization of social welfare in terms of individual opportunities.** With the capability approach, the freedom to not choose a given outcome is as important as the freedom to choose it. As Sen (2009, p. 227) stated, “In assessing our lives, we have reason to be interested not only in the kind of lives we manage to lead, but also in the freedom that we actually have to choose between different styles and ways of living. Indeed, the freedom to determine the nature of our lives is one of the valued aspects of living that we have reason to treasure.” The exercise of agency in this way can result in less than theoretically “ideal” outcomes, such as a disproportionate under-representation of people with disabilities in politics, corporate management, or other positions of power and prestige. This outcome can easily result from discrimination and a dearth of real opportunities—as is often the case—but it can also be the natural result of the personal life choices of those with disabilities. Proponents of both critical disability theory and the capability approach have reason to be suspicious of outcomes of obvious inequality, but the capability approach is less likely to automatically categorize measurable inequalities as automatically undesirable. Such outcomes are undesirable if they are indicative of restricted freedoms. Superficial inequalities, in and of themselves, are neither good nor bad because "individual advantage is judged in the capability approach by a person's capability to do things he or she has reason to value" (Sen, 2009, p. 237), rather than in measuring up to theoretical averages of representation in all sectors of the population. The real menace, from a capability approach perspective, is any artificial restrictions on a person's capabilities and freedoms.

Using the vocabulary of the capability approach, opportunities and freedoms are labeled "capabilities." Outcomes, meaning what a person actually does or becomes, are labeled "functionings" (Sen, 1999, pp. 75-78). Sen (1999, p. 75) explained that "a person's 'capability' refers to the alternative combinations of functionings that are feasible for her to achieve. Capability is thus a kind of freedom: the substantive freedom to achieve alternative functioning combinations (or, less formally put, the freedom to achieve various lifestyles)."

**Inclusive ethical approach to questions of justice.** The ethical foundation that sets the capability approach apart from many of the alternative approaches to economic development, welfare, and questions of justice is the emphatic assertion that people with disabilities are fully human just as they are, and that their disabilities confer no exceptional status on them to diminish their centrality to the very notion of what it means to be human. At first this may seem like an uncontroversial assertion: that people with disabilities are fully human just as they are, but upon closer inspection, it is actually quite a departure from much of the previous literature about justice. Sen and Nussbaum repeatedly contrast the capability approach to the work of John Rawls, upon whom Sen (2009) simultaneously lavished praise as “the leading political philosopher of our time”—saying that Rawls’s Theory of Justice (Rawls, 1971) was “path-breaking” and “thrilling”—while asserting that some of the main planks of the Rawlsian theory of justice are seriously defective” (pp. 52-53). Nussbaum (2006) similarly referred to Rawls’s Theory of Justice as “the most powerful and influential theory of justice in the twentieth century” (p. 11) while concluding that “Rawls’s theory cannot in the end deliver satisfactory answers” to key problems, including the question of achieving social justice for people with disabilities (p. 23). It would go far beyond the scope of this dissertation to engage in a full examination of theories of justice, but it is necessary to understand at least some elements of alternative approaches to be able to appreciate what the capability approach has to offer.

Rawl’s theory of justice builds upon the premises of the “social contract” thinkers such as Hobbes (1651), Locke (1689), and Rousseau (1762). In Locke’s (1689) words, the basic idea behind the social contract is that people

> by Nature, [are] free, equal and independent, no one can be put out of this Estate, and subjected to the Political Power of another, without his own Consent. The only way whereby any one devests himself of his Natural Liberty, and puts on the bonds of Civil Society is by agreeing with other Men to joyn and unite into a Community, for their comfortable, safe, and peaceable living one amongst another, in a secure Enjoyment of their Properties, and a greater Security against any that are not of it.

People join together to form a society for the mutual advantages that such a society can offer, and in joining this society, they form a mutual agreement with each other—a social contract—that helps to manage and govern the affairs of the individuals within that society. The existence of a government, in this line of thinking, is entirely dependent upon the will of the people and the desire to forego some of their individual freedoms in order to take advantage of the benefits of social cooperation. Despite the many advantages of this approach, one its weaknesses is that it assumes that all individuals are roughly equally capable of entering into a social contract and of engaging in economic activity (Nussbaum, 2006, p. 14). These assumptions leave no room to include people with cognitive impairments, because they are incapable of entering into a social contract. Similarly, people with full cognitive capacity but limitations due to physical impairments may not be fully able to engage in economic activity to the same extent as people without physical impairments. Nussbaum (2006) noted that Rawls—whose incarnation of the social contract approach is more modern and nuanced than that of his predecessors) "acknowledges a gap in his theory at this point and worries about it" (p. 18).

The capability approach acknowledges the contributions of the social contract thinkers, then takes a step beyond them to broaden the concept of inclusion within a society so that it encompasses the complexities of the human condition, including people with mental and physical impairments, making the case that all human beings start out with exactly these kinds of limitations from the time they are born.

> In the design of the political conception of the person out of which basic political principles grow, we build in an acknowledgment that we are needy temporal animal beings who begin as babies and end, often, in other forms of dependency. We draw attention to these areas of vulnerability, insisting that rationality and sociability are themselves temporal, having growth, maturity, and (if time permits) decline. We acknowledge, as well, that the kind of sociability that is fully human includes symmetrical relations, such as those that are central for Rawls, but also relations of more or less extreme asymmetry; we insist that the

> nonsymmetrical relations can still contain reciprocity and truly human functioning. (Nussbaum, 2006, p. 160)

In response to the social contract emphasis of economic productivity, Nussbaum (2006) asserted:

> We do not have to win the respect of others by being productive. We have a claim to support in the dignity of our human need itself. Society is held together by a wide range of attachments and concerns, only some of which concern productivity. Productivity is necessary, and even good; but it is not the main end of social life. (p. 160)

From a capability approach, despite the inherent differences between individuals, all individuals have equal claim to the benefits of the social systems in which they live, and equal entitlement to the freedom to choose their own course in life. In other words, societies must be attentive to the freedoms and capabilities to all of the citizens, not just those who can enter into a social contract or engage in economically productive activity.

The notion of including people with disabilities in a theory of justice requires a conceptualization of societies as something more than strategic social contracts for mutual individual advantage. Some sense of societal obligation toward others is a requirement, As Sen (2009) explained:

> The basic general obligation here must be to consider seriously what one can reasonably do to help the realization of another person's freedom, taking note of its importance and influenceability, and of one's own circumstances and likely effectiveness.... The recognition of human rights is not an insistence that everyone rises to help prevent any violation of any human right no matter where it occurs. It is, rather, an acknowledgement that if one is in a position to do something effective in preventing the violation of such a right, then one does have a good reason to do just that - a reason that must be taken into account in deciding what should be done. It is still possible that other obligations, or nonobligational concerns, may overwhelm the reason for the particular action in question, but the reason is not simply brushed away as being "none of one's business." There is a universal ethical demand here, but not one that automatically identifies contingency-free, ready-made actions. (p. 373)

Sen distinguished between “perfect obligations” and “imperfect obligations,” acknowledging that practical concerns with such a wide-ranging approach to social responsibilities (2009, p. 376). A “perfect obligation” within a society could include the obligation to refrain from torturing other human beings. Most of what would be considered “disability rights” would likely be categorized as “imperfect obligations,” and could include legislation requiring ICT to be accessible to people with disabilities. Sen put forth the concept of social obligations within the capability approach, but stops well short of entering into the policy arena to define social obligations in a legal sense. Sen left that kind of work to others to interpret and implement.

**Assessing the true economic impact of disability.** On the economic side, the capability approach requires the examination of the full context to determine whether a person’s capabilities have been compromised. Civil rights activists are quick to rightly point out any salary disparities between people with and without disabilities as unjust. The capability approach takes such disparities into account, but also takes a step back to examine other factors that might also impact economic justice, noting that salaries are an imperfect surrogate measure of the underlying opportunities, and could misrepresent the situation. Sen (2009) explained:

> The capability approach focuses on human life, and not just on some detached objects of convenience, such as incomes or commodities that a person may possess, which are often taken, especially in economic analysis, to be the main criteria of human success. Indeed, [the capability approach] proposes a serious departure from concentrating on the means of living to the actual opportunities of living…. Primary goods are merely means to other things. (pp. 233-234)

The “other things” that Sen referred to are all of the things that a person can do or become. They are the things that the individual “has reason to value” (Sen, 2009, p. 231).

In many cases, it turns out that people with disabilities actually require *higher* salaries (or similar economic resources) than the average person, to account for the additional costs of assistive technologies, personal assistants, or medical care. "The impairment of income-earning ability, which can be called 'the earning handicap,'" wrote (Sen, 2009), "tends to be reinforced and much magnified in its effect by 'the conversion handicap': the difficulty in converting incomes and resources into good living, precisely because of disability" (p. 258). Even perfect equality of salaries would fail to take into account the different levels of actual need for economic resources, leaving many people with disabilities with a lower overall set of capabilities and liberties than their nondisabled counterparts. Sen (2009) explained this rationale in some detail:

> It is not hard to see that the reasoning underlying this departure in favour of capability can make a significant, and constructive, difference; for example, if a person has a high income but is also very prone to persistent illness, or is handicapped by some serious physical disability, then the person need not necessarily be seen as being very advantaged, on the mere ground that her income is high. She certainly has more of one of the means of living well (that is, a lot of income), but she faces difficulty in translating that into good living (that is, living in a way that she has reason to celebrate) because of the adversities of illness and physical handicap. We have to look instead at the extent to which she can actually achieve, if she so chooses, a state of good health and wellness, and being fit enough to do what she has reason to value. To understand that the means of satisfactory human living are not themselves the ends of good living helps to bring about a significant extension of the reach of the evaluative exercise. And the use of the capability perspective begins right there. (p. 234)

The capability approach attempts to move the discussion beyond simple acknowledgement of the needs of people with disabilities toward a more complete understanding of what it means to live with a disability, and the extra financial burden that disabilities impose. Sen (2009) cites a study of families of people with disabilities in the UK by Kuklys (2005) to illustrate the point.

> Kuklys found that 17.9 per cent of individuals lived in families with income below the poverty line. If attention is shifted to individuals in families with a disabled member, the percentage of such individuals living below the poverty line is 23.1. This gap of about 5 percentage points largely reflects the income handicap associated with disability and the care of the disabled. If the conversion handicap is now introduced, and note is taken of the need for more income to ameliorate the disadvantages of disability, the proportion of individuals in families with disabled members jumps up to 47.4 per cent, a gap of nearly 20 percentage points over the share of individuals below the poverty line (17.9 per cent) for the population as a whole. To look at the comparative picture in another way, of the 20 extra percentage points for poverty disadvantage for individuals living in families with a disabled member, about a quarter can be attributed to income handicap and three-quarters to conversion handicap (the central issue that distinguishes the capability perspective from the perspective of incomes and resources). (p. 258)

Disabilities are a double disadvantage. A person with a disability has a harder time earning money, plus a harder time converting that money into a decent living standard, because the disability itself exacts a financial cost that people without disabilities do not have to face. This double disadvantage is not restricted to the individual with the disability. The disability also negatively affects the earning potential and income conversion potential of the person's family.

One could argue that it is merely a fact of life that disabilities necessarily lead to decreased personal liberties. In response to this argument, advocates of both the social model of disability and the capability approach would point out that while the physical limitations of the disability may remain, the assistive technologies, personal assistance, and/or medical care are all already available within society, and their impact on the quality of life of the individual who needs them can be dramatic, so their availability is a question of access, irrespective of the amount of money a person with a disability may have. As Nussbaum (2006) has explained:

> No matter how much money we give the person in the wheelchair, he will still not have adequate access to public space unless public space itself is redesigned. Maybe a very rich person could afford a full-time chauffeur and a set of bearers who could carry him up the stairs of rampless buildings. But even if making people with impairments that rich were a sensible goal of public policy, as it is not, we would still have not gotten to the root of the matter, which is that this person should not have to rely on a chauffeur or on bearers. There should be wheelchair access on buses and sidewalks, and all buildings should have ramps and wheelchair-accessible elevators. That redesign of public space is essential to the dignity and self-respect of people with impairments. In short, the task of integrating people with impairments into public space is a public task, which requires public planning and a public use of resources. The relevant question to ask is not how much money do individuals with impairments have, but what are they actually able to do and to be? And then, once we have ascertained that, what are the obstacles in the way of their ability to function up to the appropriate threshold level? (p. 167-168)

With access, the capabilities and freedoms of the individual increase dramatically. Without access, the individual’s life is more limited.

**The capability approach as an evaluative framework.** The capability approach is not a prescriptive framework so much as it is an evaluative framework. Sen in particular has tried to steer clear of engaging the political arena directly with prescriptive lists or policy objectives (Nussbaum, 2011, pp. 19-20), preferring to focus more on the academic development of the theory and on provoking thoughtful discussion within economic development circles “for open deliberation and critical scrutiny…in the public domain” (Sen, 1999, p. xiv). The capability approach can serve as the basis for evaluating the impact of policies on individuals, taking into account the meaningful opportunities available to a given individual to do or become what that individual has reason to value. For example, the capability approach draws attention to such issues as the higher financial cost of equivalent opportunities for a person with a disability compared to a person without a disability, but does not prescribe precisely how to remedy this situation.

In Sen's (1999 p. 75) words, "The evaluative focus of this 'capability approach' can be either on the realized functionings (what a person is actually able to do) or on the capability set of alternatives she has (her real opportunities). The two give different types of information—the former about the things a person does and the latter about the things a person is substantively free to do." Sen acknowledged the value in recognizing actual conditions or achievements (functionings), while stressing the importance of "the freedom reflected in the capability set…since the value of a set need not invariably be indentified with the value of the best—or the chosen—element of it. It is possible to attach importance to having opportunities that are not taken up. This is a natural direction to go if the process through which outcomes are generated has significance of its own. Indeed, 'choosing' itself can be seen as a valuable functioning…" (1999, p. 76).

The end goal is not a purely libertarian maximization of all potential opportunities and freedoms for all individuals. That would be impossible because some freedoms necessarily impinge on others, such as the freedom to smoke in public spaces vs. the freedom to enter public spaces without having to worry about smoke. "No constitution protects capabilities qua capabilities," noted Nussbaum (2006). "There must be a prior evaluation, deciding which are good, and, among the good, which are most central, most clearly involved in defining the minimum conditions for a life with human dignity." The solution could come through higher salaries, government benefits, or any number of other sources of revenue or assistance. The capability approach frames the discussion without dictating specific solutions.

In somewhat of a departure from Sen's academic purism, Nussbaum, decided to attempt to make the capability approach more concrete and actionable by proposing a list of "central capabilities" as a tentative enumeration of capabilities that "a decent political order must secure to all citizens at least [to some] threshold level (Nussbaum, 2011, p. 33). These central capabilities are (a) *life* (not dying prematurely, "or before one's life is so reduced as to be not worth living"), (b) *bodily health* (access to health care, nourishment, and shelter), (c) *bodily integrity* ("being able to move freely from place to place; to be secure against violent assault...having opportunities for sexual satisfaction"), (d) *senses, imagination, and thought* (including access to education, freedom of thought and speech, and enjoyment of one's choice of religion, literature, music, etc.), (e) *emotions* (freedom to form attachments to others, "to love, to grieve, to experience longing, gratitude, and justified anger. Not having one's emotional development blighted by fear and anxiety"), (f) *practical reason* "being able to form a conception of the good and to engage in critical reflection about the planning of one's life"), (g) *affiliation* (the freedom to associate with others; also the avoidance of discrimination "on the basis of race, sex, sexual orientation, ethnicity, caste, religion, national origin"), (h) *other species* ("being able to live with, concern for, and in relation to animals, plants, and the world of nature"), (i) *play* (recreation and laughter), and (j) *control over one's environment* (in both the political sense and the material sense of being able to hold property; Nussbaum, 2011, pp. 33-34). Nussbaum (2011) defended this list as "irreducible," while also conceding that "the list is a proposal," that "may be contested by arguing that one or more of the items is not so central and thus should be left to the ordinary political process rather than being given special protection" (pp. 35-36). Whether Nussbaum's list is accepted wholesale, or merely as a starting point for discussion, it serves to at least draw attention to the types of human concerns that affect everyone at the level of personal fulfillment and well-being.

The strength of the capability approach for this dissertation is that it situates the discussion in a broader context of human and economic development, political philosophy, and social justice in which choice and freedom of opportunity are core components. In some ways, critical disability theory and the social model of disability discussed earlier offer a similar context, and I do not hesitate to draw on those insights when appropriate. Some subtle differences remain, though. The social model of disability is a branch of the civil rights movement, in which the predominant strategy is political positioning. Every action tends to take on political overtones, and success is often measured in terms of partisan political gains. While there are good and necessary reasons for taking such a stance, public political rhetoric—especially as sensationalized in the media—too easily devolves into an acrimonious battleground, unnecessarily pitting one social group against another and poisoning the well from which the best intentions are drawn. Accusing people of moral deficiencies and asking them to change their ways, as the civil rights movement often does, even when the accusations are accurate, understandably puts people on the defensive. This natural personal reaction of defensiveness is compounded when mixed with partisan politics, in which sides are already drawn, and one’s own political power and influence seem threatened. Some level of conflict is perhaps unavoidable. Personal and social empowerment would be incomplete without corresponding political empowerment, and entry into the public political sphere requires debate. The capability approach certainly has a political component as well, particularly as articulated by Nussbaum. Even so, the capability approach abstracts the political element somewhat, drawing its strength from its roots in economic theory and human development. The central concern in the capability approach is with individual liberties. It asks how to leverage social infrastructure to best maximize individual liberties for all individuals, and not just for some. The capability approach cannot be characterized under a single political banner. It contains elements that resonate with right-leaning libertarians on one hand—such as the emphasis on individual liberties—and elements that resonate with left-leaning progressives on the other hand—such as the emphasis on social and political structures to achieve a balance of social justice. Discussing the topic of accessibility within this expansive view of individual liberties and human development within an economic and societal context allows discussion of the issue from multiple political perspectives without dividing up into partisan camps quite so readily. This expansive view allows for a holistic analysis of the circumstances, with the goal of seeking comprehensive and inter-disciplinary solutions to complex problems.

## Perspectives on the Curriculum

### Defining Curriculum

With so many definitions available, and with each definition laden with implicit ideological assumptions, articulating a definition of the term *curriculum* is not a trivial task. At the most basic level, the idea of a curriculum usually implies some sort of structured learning environment in which learning is planned and guided (Kelly, 1983). Presumably there are instructional goals with corresponding materials and/or activities designed to accomplish those goals. Some definitions leave it at this. In fact, it is common to hear references to a set of instructional materials as "a curriculum," almost as if it were an object or commodity that could be packaged and delivered intact to all students. The instructional materials are a legitimate part of the curriculum, but there is more to consider than just the materials.

It can help to take a step back and think in broad terms. Cuban (1992) provided some terminology to help characterize the curriculum. The *intended curriculum*—or *curriculum-as-designed* (Barnett & Coate, 2005, p. 3)—is the overt or explicit agenda of what to teach and why. It may include the *written or formal curriculum*, which includes documents, texts, and other instructional media and activities. In the classroom, the intended curriculum is filtered through the personality, teaching style, and philosophy of the instructor, resulting in the *taught curriculum*, or the implicit, delivered, or operational curriculum, sometimes referred to as the curriculum-in-use or the "curriculum-in-action" (Barnett & Coate, 2005, p. 3). The *received curriculum* is what students actually learn. It can also help to think about the *hidden or covert curriculum* (Jackson, 1968; Longstreet & Shane, 1993; Margolis, 2001), which refers to the things that are not taught directly, but which students learn indirectly from the nature and organization of the learning environment and the behaviors and attitudes of their instructors. The *null curriculum* (Eisner, 1985) referred to that which is not taught, and purposely excluded from the instructional experience. Other considerations include what society teaches (the *societal* *curriculum*), what is taught at home or in environments associated with the family (the *concomitant curriculum*), and the mental processes and knowledge of the students themselves (the *internal curriculum*).

The curriculum-as-designed often can be subdivided into “core” or required elements, and “elective” or optional elements. The process of deciding which elements to designate as core and which to designate as elective—as well as which to eliminate completely—is one of the most basic and consequential acts of formal curriculum design. It is necessarily an act of discrimination and value judgment. Outside observers can learn much about the values of the curriculum makers by taking an inventory of the curriculum-as-designed. The inclusion of a particular topic in the core curriculum elevates the importance of that topic and suggests that learning it is essential within that knowledge domain. The designation of a topic as an elective or optional topic assigns it to realm of secondary importance, subordinate in the hierarchy to the required topics. Excluding a particular topic from the core curriculum relegates it to a realm of irrelevance, at least as far as the curriculum is concerned, making it part of the untaught null curriculum.

Deciding whether or not to teach a subject is only the first of many value-laden decisions in the process of designing a curriculum. The same topic can be taught in many ways and from many different points of view, informed by any number of widely divergent ideologies, value systems, or cultural politics (Apple, 2004). Sometimes the curriculum decisions reflect informed intentional choices from among a selection of well-understood options, with a deliberate goal of preferentially inculcating certain values.

Other times the options are ill-defined or poorly understood, and the curriculum developers may not be fully aware of the ideological consequences of their own decisions. Whether curriculum developers intentionally imbue their curriculum with carefully selected values and ideologies or whether they fail to consider values and ideologies at all, the curriculum conveys a valuation of the topics and ideas in the curriculum-as-designed and a devaluation of everything else in the untaught null curriculum.

Not all of the values and ideologies of a curriculum are taught or mentioned explicitly. Some are transmitted without commentary, without fanfare, and often without notice. Jackson (1968) coined the phrase “hidden curriculum” in reference to those parts of the curriculum that are taught somewhat surreptitiously in the sense that curriculum developers are unlikely to mention these parts. Jackson “argued that the hidden curriculum emphasized specific skills: learning to wait quietly, exercising restraint, trying, completing work, keeping busy, cooperating, showing allegiance to both teachers and peers, being neat and punctual, and conducting oneself courteously” (Margolis, 2001). Of more direct consequence to accessibility in the ICT curriculum are items such as the attitudes with which an instructor talks about people with disabilities and the enthusiasm and conviction with the instructor approaches the topic of accessibility. Even the skill level of the instructor sends a message to the students. An instructor with questionable mastery of the topic communicates a lackluster sense of commitment to the importance of accessibility and, by extension, a diminished level of respect for people with disabilities.

Society also plays a role in communicating values to both the curriculum designers and to the students. They way that people with disabilities are portrayed in the media and pop culture send messages, whether intentional or not, about the perception of disabilities in society. The media rarely include people with disabilities to begin with, and when they do, it is usually with a sense of “otherness” (Hevey, 2006) as a contrast to the presumably able-bodied majority in the audience. Individuals with disabilities may be portrayed as deserving charity, or pity, or admiration for having to face undesirable obstacles in life, or some combination of all of those sentiments. In the political arena, partisans may argue against laws that require accommodations for people with disabilities on the grounds that such laws would inconvenience the able-bodied majority or cause them undue financial burden. They may invoke political ideologies to justify their positions, or their concerns may be more practical-minded, but the message of otherness is the same either way, and the net result is to privilege the lives of able-bodied individuals over the lives of people with disabilities.

## Curriculum Theory

Kliebard (2004) identified four major curriculum philosophies as humanist (or mental disciplinarian), social efficiency, developmentalist (or child study), and social meliorist. Schiro (2007) adopted these same general categorizations, applying the labels of the scholar academic ideology, social efficiency ideology, learner-centered ideology, and social reconstruction ideology. The scholar academic ideology promotes the development of rational thought and reasoning through the study of a wide range of topics to obtain a liberal education—usually grounded in traditional western thought—for the betterment of the individual and the indirect betterment of society. The social efficiency ideology promotes education as a means to sort students by their natural talents and train them accordingly, so they can contribute effectively to the economic and structural needs of society. The learner-centered ideology promotes education as a way to focus on the emotional and behavioral development of individuals for their personal well-being. The social reconstruction ideology promotes education as a tool to identify societal flaws and empower students to change them, striving to build a better society through collective enlightened action.

Graduate education is complex and highly variable from one program to another. Even within this variability, some scholars assert that graduate education, by its very nature, tends to implicitly endorse the social efficiency ideology. Graduate schools seek out students deemed qualified and suited to excel in a narrow field of work, then train them and socialize them in the knowledge, skills, and attributes of working professionals in that field (Bridges, 2000; A. J. Jaeger, 2003). Students likewise expect graduate programs to prepare them for the job market, and graduate programs generally attempt to fulfill this role. One writer, who is less than thrilled with the strong tendency toward the social efficiency model, has referred to this arrangement as the process of “training capitalism’s foot soldiers” (Ehrsenal, 2001). Apple (2004) similarly criticized the way in which schooling in general is often treated as a producer of “human capital” for the purpose of “meeting the needs of the economy” (p. 8), alleging that this is part of its hidden curriculum that privileges an economic utilitarian interpretation of education over the more transformative interpretation of the social reconstructionist model.

The social efficiency model has its detractors, but its emphasis on career preparation can also be leveraged to achieve goals that are more socially reconstructionist in nature. Reconstructing society to better accommodate the ICT accessibility needs of people with disabilities requires a critical mass of professionals with accessibility expertise who put that expertise to use on a regular basis in their jobs. These working professionals must learn the expertise somewhere, and a logical place to learn it is in the ICT curriculum. Adding accessibility into the ICT curriculum on a large scale infuses the job market with individuals who know why accessibility is important and how to make it happen. Their influence on their colleagues has the potential to alter, or reconstruct society to be more inclusive. In most cases, the students learning about accessibility do not have disabilities themselves, so their knowledge and skills are focused outward on other individuals, and on the larger society. Creating a more accessible world can be a radically transformative and empowering experience for technology students and instructors (Zuga, 1992), as advocated by critical pedagogy theorists (Darder, 1991; Freire, 1972; Giroux, 1988; McLaren, Macrine, & Hill, 2010). Even less powerful personal experiences for these (mostly able-bodied) students can result in a transformation of the lives of people with disabilities in society if they simply implement accessibility techniques once they enter the workforce as working professionals.

# CHAPTER III

# RESEARCH METHODS

## Research Purpose and Questions

The purpose of this dissertation is to help faculty make informed decisions about integrating accessibility into the ICT curriculum by studying other programs that have already done so, analyzing themes across these cases, and presenting a theoretical framework to justify adding accessibility to the ICT curriculum. Accordingly, I divided the findings of this research into three main parts: (a) descriptive case study narratives, (b) a cross-case thematic analysis, and (c) a discussion situating the ICT curriculum within the theoretical context of the capability approach. The three parts of this dissertation were designed to be interdependent and somewhat sequential, with each purpose building on the previous one. The case study narratives contain the foundational data from which I developed the cross-case thematic analysis. The cross-case thematic analysis, in turn, articulates key points upon which I constructed the theoretical analysis.

While gathering the data for the first part of this study (the case study narratives), I focused on four main research questions.

1. How did the *context* (laws, institutional policies or conditions, faculty expertise, etc.) contribute to the development of the curriculum?

2. Why did the faculty integrate accessibility into the curriculum (what was their *rationale*)?

3. How did the process of creating the curriculum unfold (including any

successes or setbacks along the way)?

4. What choices did the faculty make about *instructional materials and strategies* (instructional media, topics covered, target audience, instructional methods, etc.)?

I organized my original set of codes in the qualitative research software (see Appendix D) according to these four research questions.

By the time I had concluded all of the interviews, a slightly different set of themes emerged, overlapping my original research questions somewhat, but not entirely. The final themes (see Appendix D) were: (a) curriculum goals and rationale, (b) the initial idea, getting the ball rolling, (c) defining the scope of the curriculum, (d) instructional materials and strategies, (e) instructional format and media, and (f) program sustainability. The last theme, program sustainability, turned out to be one of the most prominent themes of all, even though my initial research questions neglected the topic entirely. I aligned my thematic analysis with the six observed themes, rather than with the initial research questions, to portray the data as faithfully and honestly as possible. An accurate portrayal of the data is essential to fulfill the purpose of this research of helping faculty make informed decisions about integrating accessibility into the ICT curriculum.

## A Qualitative Approach

This research is qualitative in nature, seeking to provide an in-depth, multi-faceted analysis of specific cases. As such, though the research had specific purposes, it did not ask a targeted research question against which to test a null hypothesis, nor did it engage in any inferential statistical analysis designed to extrapolate predictive conclusions about hypothetically similar populations. The three research purposes, mentioned above, served as a starting point from which to engage in an open-ended inquiry, without attempting to define the most important themes beforehand or to answer a discrete set of pre-determined questions. The data presented here are unique to the cases studied, and do not represent the scientific sampling of any population of ICT curricula beyond the three cases included in this study. The absence of discreet research questions or scientifically-controlled experimental tests disallows statistical comparisons against hypothetical population distributions, but that was not the intent of this research. Rather, the approach taken here was designed to be descriptive and interpretive (Merriam, 1998, p. 38), integrating many points of data about multiple lines of inquiry. The goal was to tell the story of the three cases honestly and broadly on their own terms, in their own context, to enable a more complete analysis, grounded in a holistic understanding of all relevant information.

## An Interpretive Multi-Case Study with a Cross-Case Thematic Analysis

The case study approach was a good fit for the descriptive and interpretive purposes of this research. According to Kenny and Grotelueschen (1980), case studies are particularly appropriate when the researcher desires to "develop a better understanding of the dynamics of a program. When it is important to be responsive to convey a holistic and dynamically rich account of an educational program, case study is a tailor-made approach"

(p. 5). It is precisely this kind of rich or "thick description" (Ponterotto, 2006) that this dissertation was designed to achieve, so the case study approach was a logical choice in this context. "Case studies tend to spread the net for evidence widely," explained Bromley (1986), "whereas experiments and surveys usually have a narrow focus" (p. 23). Indeed, this dissertation drew from a variety of sources—including interviews, scholarly papers, curriculum materials, and web resources—to provide the data for interpretation. Merriam (1998) noted that "case study is a particularly suitable design if you are interested in process" (p. 32), which is one of the stated purposes of this study. Sanders (1981) similarly noted the suitability of case studies to the study of processes: "Case studies help us to understand processes of events, projects, and programs and to discover context characteristics that will shed light on an issue or object" (p. 44). Case studies are especially well-suited to answering the questions of *how* and *why* events and decisions happened as they did (Yin, 1994, p. 9).

Merriam (1998, p. 38) enumerated three main categories of case studies, according to their intent, saying they can be descriptive, interpretive, or evaluative. This dissertation has elements of all three of those categories. This dissertation is first descriptive, in that it presents a detailed history and context for each of the case studies individually. The descriptive approach is "useful…in presenting basic information about areas of education where little research has been conducted [as in the case of] innovative programs and practices" (p. 38). This dissertation is also interpretive, in that the "descriptive data...are used to develop conceptual categories…with the intent of analyzing [and] interpreting" the information (p. 38). The cross-case thematic analysis in this dissertation identifies major topics, or themes, in the data from all of the cases and explores some of the implications of these themes. The theoretical analysis is also interpretive. It situates the data and analysis within the context of the literature about the capability approach. This dissertation does not seek to pass judgment on any of the case studies, either in comparison to each other or on their own merits. This research is not an assessment of the particulars of the cases against a hypothetical ideal way of addressing accessibility within the ICT curriculum. In a sense, I had already given all three of these cases a "passing grade" on that characteristic before the actual data-gathering began, by virtue of their having met the criteria for inclusion in this study. It was never my intent to subject these cases to judgmental scrutiny or criticize any shortcomings of their programs. My intent was merely to tell their story, identify themes, and discuss their programs in the context of the capability approach.

## Case Selection Criteria and Process

Three cases were included in this study: (a) the Web Sciences program at the University of Linz, in Linz, Austria; (b) the Instructional Technology program at George Mason University, in Fairfax, Virginia, USA; and (c) the Digital Inclusion program at Middlesex University, London, UK. The selection of cases relied on criterion sampling (Miles & Huberman, 1984; Patton, 1990, 2002, p. 238), in which potential cases are matched to a predetermined set of criteria. Criterion sampling allows for the investigation of cases that "might be selected for [their] very uniqueness, for what [they] can reveal about a phenomenon, knowledge we would not otherwise have access to" (Merriam, 1998, p. 33). The five criteria set as the minimum requirements for inclusion in the study were: (a) the program must provide specialized semester-based classes in how to create accessible digital technologies for all; (b) the training in accessibility and design-for-all must be part of an academic degree-granting program; (c) the training in accessibility and design-for-all must be a core, required, part of the curriculum; (d) the program must be currently running; and (e) the faculty must speak English, and at least some of the curriculum materials must be available in English. Although not a part of my minimum criteria, I hoped to also represent a diversity of: (a) nationalities and (b) approaches and/or academic disciplines. I searched for programs that met the minimum criteria by talking to people in programs that I already knew met these criteria (at George Mason University and the University of Linz), by asking for input in accessibility related online groups and lists (the WebAIM listserv and the WAI listserv), by talking with my doctoral committee, by using google.com to search the internet and scholar.google.com to search scholarly databases (searching various combinations of terms such as “master’s degree,” “bachelor,” “accessibility,” “web accessibility,” “universal design,” “inclusive design,” “design for all,” “curriculum,” “course,” “program,” “ICT,” and “technology”). I conducted these searches, inquiries, and conversations between January and April of 2011.

Finding programs that met the selection criteria proved difficult. Some noteworthy programs met some, but not all, of the criteria (see Appendix B), so they were automatically excluded from the study. As Whitney and Keith (2008) discovered when they tried to compile a list of academic programs that teach design-for-all in Europe, most of the courses and classes that have design-for-all content are not labeled with recognizable or easily searchable terms, such as “accessibility,” “design-for-all,” “universal design,” and so forth. A class called “web design” may have a module on web accessibility, for example, but without knowing the instructor or the course content, it would be impossible to know that the class addressed accessibility at all. Whitney and Keith had to rely on their network of international contacts to clue them in as to who was teaching design-for-all in which classes. Whitney and Keith’s final list identified fifty classes or modules that addressed design-for-all in some way. Unlike the restrictive minimum criteria for inclusion in this study, the threshold for inclusion in their list was as expansive as possible. They wanted to identify all instances of accessibility and design-for-all in the curriculum, no matter how superficial the treatment, or how infrequently the training was offered, or whether it was part of a degree program, or whether it was required or optional. Their list of European programs was helpful as a starting point for identifying potential cases for this study, even though most of the cases they identified did not meet the narrower criteria for this study. I relied on the information available in Whitney and Keith’s report and on the web sites of the individual programs to determine whether the programs met my criteria. I did not contact the instructors or program leaders to confirm my conclusion, so if the information in the report and on the individual web sites was incomplete or inaccurate, or if I misinterpreted the information, it is possible that I mistakenly excluded some programs that did meet my criteria, despite my best efforts to interpret the available information as accurately as possible. I could not find a resource for other regions of the world comparable to Whitney and Keith’s report for Europe, so I had to rely on my own original research.

My first selection criterion—that the program must provide specialized semester-based classes in how to create accessible digital technologies for all—winnowed the field of potential programs considerably. While there were many programs with disability-related semester-based classes in fields such as special education, rehabilitation, disability studies, deaf studies, deaf education, disability law, and assistive technologies, most programs did not approach the issue from the perspective of *creating* accessible digital technology and information. They may have provided a general overview of the socio-cultural issues, training in how to use the existing technologies, or training in how to help people with disabilities use existing technologies, but they provided little or no professional training in the actual creation of accessible technology or information as a career path. My second criterion—that the training in accessibility and design-for-all must be part of an academic degree-granting program—excluded nondegree certificates or workshops. Many universities, conferences, consultants, businesses, government entities, and other organizations have offered some kind of small-scale accessibility or design-for-all training, but most of this training has been outside of academic degree programs. My third criterion—that the training in accessibility and design-for-all must be a core, required, part of the curriculum—cut the field of potential cases even further. Some degree-based curricula offered optional or occasional classes, workshops, or seminars on accessibility or design-for-all, but did not require their students to learn about it, did not make it a part of the grading criteria, or otherwise did not make it a priority. My fourth criterion—that the program must be currently running—excluded a master's degree program in universal design of ICT at Oslo and Akershus University

College of Applied Sciences, in Oslo, Norway, which begins in Fall of 2012. My last criterion—that the faculty must speak English and at least some of the curriculum materials must be available in English—excluded a program in Greece (see Appendix B), and perhaps in other locations that I did not become aware of through my search process. Limiting the cases to English-speaking faculty and materials undoubtedly compromised the international nature of this study by automatically excluding most of Asia, Central and South America, and parts of Europe and Africa. Without access to a team of translators and interpreters, this limitation was unavoidable on a practical level. English-speaking programs do not represent the world, but the different nationalities in this study at least represent more variety than a single-country study could.

Eventually, I was able to identify four potential cases that met my minimum selection criteria: Web Sciences at the University of Linz, Digital Inclusion at Middlesex University, Instructional Technology at George Mason University, and Inclusive Design at Ontario College of Art and Design. These programs happened to be in four different countries (Austria, UK, USA, and Canada, respectively), giving the study the diversity of nationalities that I desired. These programs also happened to satisfy my desire to represent a diversity of academic approaches or disciplines. After experimenting with programs dedicated to teaching only web accessibility, faculty at the University of Linz backed away from this specialized approach to create the more general-purpose web sciences program. They still teach disability accessibility principles in their classes about web design, policy, and leadership, but accessibility is not the main focus of the new program. The Digital Inclusion program at Middlesex University focuses entirely on techniques and leadership for digital accessibility and design-for-all. The Middlesex program teaches inclusion not just for people with disabilities, but also for other marginalized groups, such as rural populations, aging populations, immigrants, ethnic minorities, and so forth. The instructional technology program at George Mason University is a general-purpose education and technology curriculum that includes one required class in web accessibility. The inclusive design program at Ontario College of Art and Design approaches design-for-all from the perspective of the arts, product design, and the built environment.

I had intended to include all four of these programs in the study, but at the last minute before submitting my research proposal, I had to exclude the program in inclusive design at Ontario College of Art and Design (OCAD) from this study because one of the key correspondents would be unavailable during the time period of the research, due to some unexpected circumstances. Without the participation of this key correspondent, the quality of that case study would have been compromised, so I removed the OCAD program from the study.

The final list of cases consisted of: (a) the web sciences program at the University of Linz, in Linz, Austria; (b) the instructional technology program at George Mason University, in Fairfax, Virginia, USA; and (c) the Digital Inclusion program at Middlesex University, London, UK. The table in Appendix C maps the cases in this study to the selection criteria outlined in the research methods. After beginning the research, I learned that the human-computer interaction program at Dundee University, Scotland, UK also fit the criteria for inclusion in this study. Though the study would have been more complete with the Dundee program added to the list of cases, it was no longer practical to do so, due to scheduling and financial limitations.

After completing the interviews and writing the bulk of the dissertation, I learned that the Digital Inclusion program had recently been discontinued due to low enrollment numbers. The discontinuation of this program would disqualify it from my study criteria if I were to undertake a new study with the same inclusion criteria, but the program did meet the inclusion criteria at the outset of the research in the summer of 2011, so I have retained my analysis of the Digital Inclusion program in this dissertation.

## Data Sources

The data for the descriptive case studies were gathered from a combination of documents and interviews. The documents included course syllabi, curriculum plans, program web sites, course materials (books and online resources), published articles, and conference papers about the programs, where available. The interviews were conducted on-site with a minimum of three individuals for each case, selected for their key roles within their respective programs. The interviews were recorded and transcribed verbatim for inclusion in the data set. Email correspondence and follow-up questions supplemented the face-to-face interviews.

The data sources for the University of Linz case study consist of three interviews and ten documents about the three curricula related to web accessibility (Barrier-free Web Design, *web_access*, and Web Sciences), plus email correspondence with the interviewees. The interviewees were with Klaus Miesenberger (director of the projects and faculty member), Mario Batusic (curriculum developer, faculty member, and server administrator), and Barbara Hengtsberger (project manager). The documents were: (a) The Barrier-free Web Design web site (University of Linz, n.d.), (b) The *web_access* web site, (c) the Web Sciences web site, (d) “Accessibility: Education for Web Design and E-Learning: Introduction to the Special Thematic Session” (Craven & Klaus, 2008), (e) “BFWD and Assistec: Two University Degrees Relevant to Design for All: Accessible Web Design and Assistive Technologies” (Miesenberger, 2006), (f) “Improving Web Accessibility by Providing Higher Education Facilities for Web Designers and Web Developers Following the Design for All Approach” (Ortner & Miesenberger, 2005), (g) Postgraduate Course on Accessible Web Design” (Ortner et al., 2004), (h) “Raising the Expertise of Web Designers Through Training—The Experience of BFWD—Accessible Web Design (Barrierefreies Webdesign) in Austria” (Miesenberger & Ortner, 2006), (i) “Joint Study Programme on Accessible Web Design” (Hengstberger et al., 2008), and (j) “Web_Access: Education on Accessible Web Design” (Miesenberger et al., 2010).

The data for the George Mason University case study included 27 documents and 4 faculty interviews, plus insights of my own about the almost 6 years that I taught the Web Accessibility and Design class at Mason. The documents included Mason’s instructional technology web site and the 26 syllabi of the Web Accessibility and Design class from 2006 until the present. There were no conference papers or scholarly papers about the Web Accessibility and Design class. The interviews were with Kristine Neuber (the original instructor and designer of the Web Accessibility and Design class), Michael Behrmann (professor of Special Education and Endowed Center Director of the Helen A.

Kellar Institute for Human disAbilities), Nada Dabbagh (professor of instructional technology), and Kara Zirkle (the current instructor of the Web Accessibility and Design class). I included myself as a fifth informant because of my role as the instructor of the Web Accessibility and Design class from 2006 to 2011.

The data sources for the Middlesex University case study consisted of three interviews and seventeen documents, plus email correspondence with the interviewees. The interviews were with all three of the main faculty members of the Digital Inclusion program: (a) Gill Whitney (course leader), (b) Suzette Keith, and (c) Mark Springett. Each of the interviews were conducted one on one, and lasted approximately 1 hour. The documents included papers, reports, and other documents related to the Digital Inclusion program written by the interviewees and their staff members. Of note are eight curriculum guideline papers for master's level modules (abbreviated "CG-M" in the list below) written for the European Design for All e-Accessibility Network (EDeAN). Ms. Whitney and Ms. Keith prepared these papers, with input from other EDeAN members. The following is the list of documents reviewed for this study: (a) the Digital Inclusion program web site (Middlesex University, 2011a), (b) the MSc/PG Dip digital inclusion student programme handbook 2010/11 (Middlesex University, 2010), (c) programme specification and curriculum map for MSc/PG Dip digital inclusion (Middlesex University, 2009), (d) digital inclusion degree course info handout (Middlesex University, 2011b), (e) digital inclusion promotional video (Whitney & Keith, 2011), (f) design for all for einclusion progress report (project number IST CA 0033838; Keith, Whitney, & Kolar, 2009), (g) "European developments in the design and implementation of training for einclusion" (a conference paper; Whitney & Keith, 2008), (h) "Twenty-five years of training and education in ICT design for all and assistive technology" (Whitney et al., 2011), (i) CG-M: Overview of the full programme (EDeAN, 2010a), (j) CG-M: Accessibility in games (EDeAN, 2010b), 11 CG-M: Assistive technologies (EDeAN, 2010c), (k) CG-M: Research project (EDeAN, 2010d), (l) CG-M: Fundamentals of design for all in ICT (EDeAN, 2010e), (m) CG-M: Interaction design and user experience (EDeAN, 2010f), (n) CG-M: Overview of programme (EDeAN, 2010g), (o) CG-M: Regulations legislation and standards (EDeAN, 2010h), and (p) CG-M: Web accessibility (EDeAN, 2010i).

## Gathering and Coding the Data

Before conducting any of the interviews or analyzing the documents in detail, I used a qualitative research software tool called Dedoose to set up some codes (see Appendix D) that matched my four main research questions (the *context* in which the curriculum was developed, the curriculum *rationale*, the design and implementation *process*, and the nature of the *instructional materials and strategies*). These codes helped keep me focused as I conducted interviews and researched documents. I also added some codes related to the capabilities approach, to help in my eventual theoretical analysis at the end of the study.

Once these initial codes were in place, I began to enter the text of relevant documents into Dedoose as raw data. As I entered the text in the software, I highlighted notable excerpts of the text in Dedoose and linked those excerpts to the thematic codes.

At this early stage, I did not pay great attention to patterns in the data. My main concern was to make sure I had at least one relevant code for each excerpt of text. I found myself adding new codes regularly. The further I progressed, the more I found myself interested not in merely tagging the excerpts with codes, but in making sure that the organizational structure of the codes made sense. I did not get very far in the task of reorganizing the codes before beginning my interviews, but these first stages of preliminary data analysis helped to inform the questions that I asked during the interviews.

Whenever possible, I provided my interviewees with a brief description of the purpose of the interview (which was to construct a descriptive case study of their experiences in creating an accessibility-related curriculum) and the main research questions (i.e., the curriculum context, rationale, development/implementation process, and materials/strategies) in advance of the interview. In the two instances where I was not able to provide the interviewees with information about my intentions in advance (the interviews with Mr. Batusic at the University of Linz, and with Dr. Springett at Middlesex University), I discussed the purpose of the interview at the beginning of my meeting and told them the types of questions I would ask, to give them a few things to think about as the interview progressed. In all cases, I assured them that I did not intend to pass judgment on the quality of their programs. I told them that I wanted to tell their story from their perspective, so that instructional leaders in other programs and institutions could learn from their experiences.

I made sure to cover the main topics of inquiry during each of the interviews, without confining myself to a strict script. The questions and discussion evolved and emerged through naturalistic inquiry and iterative dialog. I kept the conversation fluid and relaxed, allowing the interviewees to emphasize the topics and points that they felt were most important. I did not force them to give equal time to each of my main topics of inquiry. The differences in emphasis in the interviews owed in large part to the different roles that the individuals played. When interviewing program coordinators, I focused more on questions related to program development. When interviewing instructors, I focused more on the instructional materials and strategies. This differentiated treatment admittedly created markedly unparallel interview structures, but this was an intentional strategy on my part to ensure that the interviews produced relevant information. A more systematically consistent approach would have sacrificed genuineness and meaningfulness merely for the sake of homogeneity. Throughout all of the interviews, I asked frequent follow-up questions and restated their answers in my own words to ensure accurate interpretation of their intent. Together, we attempted to fluidly negotiate meanings (Lincoln & Guba, 1985; Mischler, 1986) and to highlight the most important and richest details of the story (Denzin, 1989; Geertz, 1993).

I recorded the interviews using both a portable digital recorder and my laptop, as a protection against possible data loss or corruption. These files were saved on my computer and backed up immediately to a remote server. I did not need to resort to the backup recordings, but I had them just in case. Once I finished the interviews, I transcribed them all verbatim and pasted the text into Dedoose. I first tried using voice recognition software to do the transcriptions, but the software was unable to properly interpret the different accents (American, British, Austrian) in the same conversation, so I had to first re-record the entire interview in my own voice, then process it with the voice recognition software, then fix the errors, then add punctuation. The whole process was just as time consuming and less accurate than typing the transcript myself to begin with, so I abandoned the voice recognition software and resorted to typing everything by hand.

With the full text of the interviews and the documents in Dedoose, I continued the process of highlighting excerpts and linking the excerpts to the thematic codes I had created earlier. I used a constant comparative method to evaluate the information, interpreting and analyzing the data at all stages of the research (Charmaz, 2006). I found that I had to add new codes right away, and modify existing ones. I was constantly fine-tuning the codes, changing the wording, the order, the hierarchical structure, and other aspects from the beginning of the process until the very end. In my original list of codes (see Appendix D for a comparison of the original codes to the final codes), I tried to be as comprehensive as possible, not knowing which themes would later emerge as the most important among them. By the time I had finished the analysis, I had reorganized this long list of topics into six themes that I felt best characterized the data. This reorganization did not reduce the number of topics so much as it reclassified them to align more closely with my analysis.

## Scope of the Curriculum Analysis

The cross-case thematic analysis section of this dissertation addresses the intended or formal/written curriculum, without attempting to significantly address other aspects of the instructional experience, such as the taught curriculum, the received curriculum, the concomitant curriculum, or the internal curriculum (Cuban, 1992). I purposely avoided gathering detailed data to support a robust analysis of these other aspects of the curriculum, in order to bound the study and keep it manageable. Focusing on the intended and formal/written curriculum helped simplify the research design in terms of both logistics and clarity of purpose. Avoiding the taught curriculum allowed me to refrain from analyzing or passing judgment on the pedagogical skills of the instructors or on the interpersonal interactions between instructors and students. Avoiding the received curriculum allowed me to refrain from engaging in an assessment of learner outcomes, which would have shifted the purpose of this dissertation toward an evaluative approach, passing judgment on the effectiveness of the case studies. Avoiding the concomitant curriculum (the home environment) allowed me to refrain from home visits, home monitoring, or some other means of assessing the home environment, which would have complicated the research design unnecessarily, especially given that the students were graduate adults, most of whom were likely not living as dependents of other adults. Avoiding the internal curriculum allowed me to refrain from assessing the students' goals and rationales for participating in the curriculum.

Even in the absence of an analysis of these other aspects of the curriculum, the focus on the intended or formal/written curriculum still yielded a rich amount of data from which to construct a robust analysis of what the curriculum designers hoped to achieve. At the highest level, the analysis of the curriculum rationale investigated the overarching justification for the educational experience as a whole, its philosophical underpinnings, and its intended impact on society, the economy, academia, the professional accessibility field, and on opportunities for people with disabilities. On a more concrete level, the analysis of the curriculum discusses a wide range of topics, including the applicability of the accessibility curriculum to different academic disciplines, the task of defining the depth and breadth of the curriculum, the benefits of mainstreaming accessibility vs. creating accessibility-specific programs, the type of credential to offer, external collaboration and joint degrees, internal collaboration and interdisciplinary degrees, strategies for sparking the interest of students, curriculum topics and assessment methods, ideas for accommodating different levels of technical skills among students, and the consequences of different format and media choices on the curriculum.

## Quality and Rigor of the Research

Qualitative researchers understand the importance of rigorous research quality control, especially in light of the more open format when compared to the strictly-defined scientific controls of quantitative research. Historically, many quantitative researchers have questioned the rigor of qualitative research, putting qualitative researchers on the defensive. Thankfully, most quantitative researchers now recognize that both quantitative and qualitative research can play equally valid roles in discovering and describing phenomena. Even so, because the vocabulary and methodologies differ substantially between the two approaches, quantitative researchers sometimes have difficulty understanding the methodological merits of the qualitative approach. The explanation of the quality and rigor of this dissertation that follows is included here for the benefit of quantitative researchers with limited exposure to qualitative research. Qualitative researchers will likely find this section somewhat redundant and perhaps even unnecessarily apologetic, but I have included it here as a way to bridge the gap for those who come from quantitative research backgrounds.

Shenton (2004) discussed criteria for judging the quality and rigor of qualitative research by elaborating on four key concepts first identified by Guba (1981). These concepts are credibility (analogous to "internal validity" in quantitative research), transferability (analogous to external validity), dependability (analogous to reliability), and confirmability (analogous objectivity). The following sections discuss how I have applied these principles to the research in this study.

### Credibility

A research study should study what it says it is studying, and do so in an honest and straightforward way. This is the essence of what it means to have a credible, or internally valid, study. The findings should also be congruent with reality (Merriam, 1998), and thus offer some external validity. Shenton (2004) suggested 14 provisions that can enhance the credibility of qualitative research. The following section addresses these suggested provisions in the context of this dissertation.

**1. The adoption of well-established research methods**. The case study method is a well-established method within qualitative research. Conducing site-based interviews is a common method of gathering data from key informants across many different research styles. The use of qualitative research software to find, code, and sort themes, in text-based data (interviews and documents, in this case) is popular among qualitative researchers as well. This study does not propose any new research methods or novel ways of analyzing the data. The methodology is rather straightforward within the tradition of case studies and qualitative research.

**2. The development of an early familiarity with the culture of participating organizations.** I have been active in web accessibility circles for over ten years, and I was in a higher education environment the entire time, at two different universities. One of those universities is a case study in this study. This background gives me reasonably good insight into the area that I am studying. I also know some of the interviewees personally through professional channels.

**3. Random sampling.** This study uses criterion sampling, rather than random sampling, as discussed previously, so it does not conform to this suggested provision. Criterion sampling fits the purposes of this study better because the goal is to create a portrait of the specific cases in the study, rather than compare the cases to hypothetical statistical assumptions.

**4. Triangulation.** This study involves methodological triangulation (by using a combination of interviews and written document analysis), source triangulation (by interviewing multiple people per site, plus including documents written by multiple authors, whenever possible), and site triangulation (by employing the same basic methods at three different sites).

**5. Tactics to help ensure honesty in informants.** Each interviewee was given the opportunity to refuse to participate or withdraw at any time. Those who did participate were told that there is not any one right answer that I'm looking for, and that I would attempt to tell their story from their own perspective to the best of my ability. At the beginning of each interview, I attempted to build rapport by discussing some of my own involvement in accessibility and higher education. The interviewees seemed comfortable discussing things with me, and did not seem to hold back their criticisms or concerns with their own programs or institutions. One of the interviewees, whom I had not met until the interview, expressed some concern that I might use the dissertation as a way to criticize their efforts. I assured this interviewee that the purpose of my research was not to pass judgment on their institution, but to present the experiences of their institution to the scholarly community as a way to disseminate information about accessibility and design-for-all in the curriculum, which is something the interviewee is interested in doing anyway, so the tension dissipated. This interviewee talked freely and openly during the interview, so there did not seem to be any lingering effect of this preliminary tension.

**6. Iterative questioning.** During the course of the interviews, I often asked questions, and then summarized the answers of the interviewees in my own words to make sure I understood what they had said, and that my summary accurately reflected the intent of their words. I also returned to topics multiple times at different points in the interview to ask similar questions or to ask follow-up questions about topics that we had discussed previously. I tried to analyze the conversation to some degree as it was happening. I visualized how their comments would fit into my list of research questions and themes. When I realized that the current topic of discussion did not fit into the themes that I had identified (this happened frequently), I made a point to identify the theme during the interview by trying to give a name to the theme while talking to the interviewee. After the conclusion of the interviews, I added the new themes to the codes in the Dedoose software.

**7. Negative case analysis.** This research does not involve hypothesis-testing, nor does it involve the construction of a theoretical construct to fit the data, so I did not engage in negative case analysis.

**8. Frequent debriefing sessions.** Shenton (2004) recommended discussions and collaborative sessions "between the researcher and his or her superiors, such as a project director or steering group." My discussions with my doctoral committee co-chairs were admittedly infrequent, but the discussions we did have were instrumental in keeping me on track as I navigated the research process.

**9. Peer scrutiny of the research project.** The primary peer scrutiny for this dissertation comes from my doctoral committee, which has evaluated my logic, research design, and conclusions throughout the process of conducting this study, from the research design and proposal through the analysis and final report.

**10. The researcher's "reflective commentary."** A large part of this dissertation is the section with the thematic cross-case analysis, which contains my reflective commentary on the case study narratives. I discuss my reasons for identifying the themes, and reflect on their significance. Before beginning any of the research, I also engaged in reflective commentary during a bracketing interview conducted by another doctoral student. The interview helped me articulate the purposes and motives of my study, and to identify potential biases that I could introduce into the narrative (see the bracketing interview in Appendix E). Similarly, while writing this dissertation, I have also tried to identify my own biases clearly, and I have tried to make it clear when I am expressing an opinion as opposed to an objective fact. (See the section on “confirmability” for more details.)

**11. Background, qualifications and experience of the investigator.** My prior experience of over 10 years in the accessibility field and in higher education should lend some weight to the analysis, or at least show that I am not a newcomer. I have been involved and employed in the field long enough to know many of the key figures personally, and to have collaborated with them on some projects, including my involvement as a member of the international working group for the Web Content Accessibility Guidelines 2.0 (Caldwell et al., 2008).

**12. Member checks.** I sent the transcripts of the interviews to each of the interviewees and gave them the opportunity to correct anything that they felt was in error or misleading. Most of them reported that the transcripts looked fine to them, without any corrections. Some of the interviewees provided me with clarifications on a few points that they felt needed further explanation. I also sent the interviewees copies of my case study narrative of their respective programs. The case study narratives are meant to be a presentation of factual events, with little interpretation on my part, though I have included references to the interviewee’s own interpretations of those events. The feedback on my history sections was positive, with some minor requests for clarifications. Not all of the interviewees reported having read the histories, though, despite my requests to them, so it is possible that my histories still contain some misinterpretations or factual errors attributable to partial or incorrect knowledge on my part.

**13. Thick description of the phenomenon under scrutiny.** The case study methodology used in this research provides the opportunity for a reasonably detailed description of the context and findings with enough specificity to ground the narrative in detailed narratives of actual people and the institutions where they work.

**14. Examination of previous research findings.** The literature review draws on important previous research and writings on the topic of web accessibility, disabilities, and the ICT curriculum. I am not aware of any studies directly comparable to this dissertation that analyze the curriculum of programs that teach accessibility or design-for-all curriculum in higher education, but I have compared my observations with some of the conference papers that have been published on certain aspects of the programs being studied (written by people at those programs).

In addition to the provisions suggested above, some qualitative researchers also insist that the study should serve some sort of useful purpose—that it be worth doing—and that this is an important component of credibility. The most important argument for the usefulness of this research lies in the potential impact in the lives of people with disabilities. Programs that teach ICT accessibility contribute to improved access to information and technology, which can lead to an improved quality of life, by virtue of increasing the freedom and capability of people with disabilities to access these resources on their own, without the need for assistance or intervention from others. By highlighting programs that advocate for this kind of change, as this dissertation does, it raises the profile of the issue and provides information to other programs that they may find useful if they decide to create a similar program at their own institution. Indeed, I hope that institutions will use the information in this dissertation that way, because the ultimate goal is to increase the knowledge and capacity of ICT professionals worldwide in accessibility knowledge and skills so that the accessible products they create will allow people with disabilities to participate more fully in society. If this dissertation can play a small role in leading toward that ultimate goal, it will be useful, and in that sense it will have been a credible and worthwhile endeavor.

## Transferability

The transferability of a study refers to the degree to which the observations and conclusions can be useful as a way to characterize other similar situations outside of the study. In quantitative research, this type of research objective is usually called "external validity." A quantitative study is deemed externally valid if the results can be applied to situations outside of the experimental setting. Claims about the external validity or transferability of the results of this study would be unwarranted because the main goal of case studies is not to apply the results to outside situations, but rather to accurately describe the phenomena at hand, within the context of the phenomena themselves. The specific, context-bound nature of case studies is actually one of the strengths of this method, despite its limitations in predicting future outcomes beyond the bounds of the study.

Even with these important caveats, some of the observations reported in this study are likely relevant to other contexts to some degree or another. One factor that contributes to the possible external relevance is the nature of the institutions that are included in the study. All of them are large, well-established universities, and part of mainstream academia. These universities participate actively in the international community of educators and scholars, and they encourage their faculty to adhere to international standards of scholarship and professionalism. The universities in this study have similar, though definitely not identical, processes in place for creating and implementing new curricula. In other words, though it would be a gross overstatement to say that all universities are the same and to thereby conclude that the results of this research are replicable or transferable elsewhere, it would still be accurate to say that most universities have a great deal in common with each other on many levels. Universities have curricula. These curricula have been designed and approved for use within the university, and the curriculum designers had to take into account the current best practices of the corresponding industries and academic disciplines when designing these curricula. The exact experiences of the curriculum developers during that creation and approval process will vary, perhaps greatly, but the underlying need to go through that process is common enough to warrant some comparisons, and may make parts of this study transferable to other institutions.

Taken as a whole, this study includes observations from three different institutions in three different countries with three different kinds of academic programs. Aside from the obviously case-dependent observations, the discussions in this study attempt to abstract the observations into themes that make sense across the three cases. This cross-case analysis of themes adds to the potential transferability of the findings to other contexts. The successful application of the themes to the three institutions in this study implies that at least some of the themes will likely apply to other institutions.

**Dependability**

The concept of dependability is analogous to “reliability” in quantitative research, which is a measure of the consistency, replicability, and predictive value of the research findings. In a case study such as this, the goal is not to create replicable results at other case sites or to try to predict the outcome of similar situations in the future, because the case study is not structured to test a hypothesis. Replicating the methodology here might yield a similar set of themes when analyzing other cases, but even if it does not, the value of this study would remain intact, because the meaning of the analysis belongs in the context of the cases studied, and not in the comparison of these cases to other cases in other studies. The importance of dependability, then, is not in the replicability of the results, but in the internal consistency in gathering and reporting the data within this study.

To ensure a parallel methodology between the cases in this study, I set and followed the same basic protocol with each case. I contacted key faculty members, received permission to conduct the research, held interviews, and gathered relevant documents to include in the data set. During the interview process, I started out by introducing myself and explaining my role in the disability field over the last decade, and asked them to explain about their involvement in the disability field. I then began to ask questions about the history of their program, and proceeded to discuss the research questions that I had prepared ahead of time. I did not adhere strictly to a question an answer protocol of always asking the same exact questions in the same exact order, but I always made sure to cover all of my research questions during the interview. Our conversations were free-flowing, which means that the level of consistency between them was quite low, which I acknowledge reduces the dependability of the data set to some degree. This was a conscious decision on my part to tailor the interviews to the individuals and institutions in an attempt to better understand their point of view on their own terms, rather than rigidly stick to an impersonal set of questions and not stray from them. If I had taken that kind of clinical approach, I never would have been able to find out as much about the cases as I did. It would have increased the dependability of my findings, but at the cost of credibility, trustworthiness, or validity. In other words, the study would not have meant as much and would not have been as useful.

Case studies present the opportunity for a great deal of variation at the stage of data analysis. The end product is a highly subjective interpretation of the data gathered. Another researcher may decide to emphasize different themes using the same data set, so the goal of dependability does not necessarily imply that another researcher would produce the same report under the same conditions. Rather, the emphasis is on making the methodology clear so that the researcher's subjectivity can be understood within its proper context.

**Confirmability**

The concept of confirmability takes into account the researcher's level of objectivity, including pre-existing biases. Every researcher approaches a research topic with some underlying assumptions and biases. The very act of choosing a topic is biased in and of itself, because it is an act of focusing on one topic to the exclusion of all others.

The task for the honest researcher is not so much to rid one's self of biases as it is to recognize what those biases might be and to disclose them so that readers understand the connection between the researcher and the research data and analysis.

One way to reduce the impact of the writer's bias, though, is to use what Johnson (1997) called "low inference descriptors." This means to use verbatim quotations from interviewees whenever possible, rather than restate their words or attempt to summarize their meaning or intent. I transcribed the interviews verbatim, which gives me the ability to quote the exact words of the interviewees as a primary data source for my analysis. I still make inferences and summarize concepts in my own words, because that is my role as a case study researcher, but the presence of the verbatim quotations gives the participants a direct voice in the research. This reduces the extent to which readers can question the degree to which I am making unsubstantiated claims, and allows readers to draw their own inferences about the quotations, if they feel the participants' words do not quite match with my analysis.

Before gathering data, I had a fellow doctoral student conduct a "bracketing interview" with me (see Appendix E) so that I could talk through my research objectives and explain some of my reasons for conducting the study. The idea of a bracketing interview comes from phenomenology, which emphasizes the role of personal perception in the study of experiences, or phenomena. The goal was to make my own motives transparent by reflecting on experiences, thoughts, and emotions that shape my worldview, and to place these in the context of my research. The interview was helpful in working toward this goal, even if not every issue surfaced during the interview itself.

My main proposition as I conduct this research is that the information infrastructure of today's society ought to be available to all people, and that people who create technologies and who publish information using those technologies, ought to take the extra steps to ensure that the technology and content are accessible to people with disabilities. The underlying assumption, and bias, in this proposition is that I believe people ought to value inclusiveness, especially toward people that face natural obstacles to inclusion, such as people with disabilities. Creating an accessible digital information infrastructure can increase the inclusion of people with disabilities in society by allowing them to interact with the information and resources that the general population often takes for granted. Creating this kind of accessible information infrastructure requires people to take active measures. They have to learn why it is important and how to achieve it. Accessibility cannot be achieved through passive measures, which means it requires people to work to achieve it. This presents a potential conflict between those who would rather not do the extra work and those who cannot use technologies unless this extra work is done. In this conflict of interest, I recognize the concerns of those who feel that the extra work can be burdensome, but I side with those who will be excluded unless the work is done. There are valid arguments on both sides of this potential conflict, so it is a matter of giving preference to one valid argument over another. This is a choice of values. I value structurally inclusive societies, so I favor taking approaches that increase social inclusion. Creating accessible technologies for all people is one way to increase social inclusion, so that is why I have chosen this topic for my dissertation.

In this study, there is also potential for bias of a different kind. I have chosen to study a curriculum—the instructional technology curriculum at George Mason University—in which I was personally involved as an instructor. This presents some advantages as well as some methodological challenges. The main advantage is my intimate familiarity with the class and how it fits in the program, which can lead to a rich description in the data. This is also the main methodological challenge. The temptation will be to present a narrative that shows me in the best possible light, downplaying or purposely excluding any negative data, while possibly exaggerating positive data. If a different researcher not personally involved in the GMU program performed this research, it is reasonable to suspect that this other researcher would be able to uncover and analyze data more objectively, and with more reliable consistency in relation to the other cases in this study.

To a certain extent, these conflicts of interest will be unavoidable in this situation, but certain safeguards will help minimize their impact. First, by openly acknowledging the potential conflict of interest, I can at least be honest that the conflict exists, even if I cannot eliminate the bias that comes with it. This allows readers to place my comments about my involvement with the program in their proper context, knowing that my words have been filtered through my own experiences. Second, the types of data to be gathered in the GMU case will be no different than the other cases, as spelled out in the case study protocol, and any conclusions drawn will be traced to the relevant data sources, just as with the other cases. Third, the part of the data perhaps most susceptible to criticism of researcher bias, the self-interview, will be supplemented by two additional interviews beyond the three required by the case study protocol, for a total of five interviews. The two extra interviews will be with the previous instructor of the class, and one more administrator who was instrumental in shaping the curriculum design. These two interviews will provide additional perspectives to complement or to counter my own perspective, and will dilute the influence of the self-interview in the overall context of the case. Fourth, this is a multi-case study by design, so the three other cases will temper any undue influence of my own case in the overall cross-case analysis. I am aware that any glaring differences between my own case and the other cases would raise suspicions. This should make me more vigilant, to ensure consistency across the cases. Fifth, I will allow the interviewees to review the analysis to ensure that I have represented the case and their opinions accurately. Taken together, these five safeguards will help establish reduce the conflict of interest within the GMU case and across the collection of cases.

## Methodological Notes About Part I: Case Study Narratives

The case study narratives of the three programs are my attempt to reconstruct the histories of the three cases, based on the information shared with me during the interviews. Much of the information is factual and straightforward, as a chronology of events. In places where the narrative leans toward interpretation, my narrative is meant to reflect the interpretations that the interviewees themselves offered as an explanation for the events, rather than my own interpretations. In the specific case of George Mason University, separating my own interpretations from those of the interviewees is somewhat problematic, because I am one of the main informants providing the data. Nevertheless, I have made a conscious effort to ensure that the interpretations I provide are faithful to the interpretations of those I interviewed. I generally avoided lengthy quotations from the interviews in the case narratives, choosing instead to save the bulk of the quotations for the thematic analysis in Part II.

## Methodological Notes About Part II: Thematic Analysis

The thematic analysis in Part II of this dissertation is the heart of this research study. It describes some of the main issues, concerns, and dominant trends in the interviews and documents that I reviewed for this dissertation. It is in this part of the dissertation that I focus more on my own interpretations, still strongly grounded in the research data, providing quotations from the interviews or documents where appropriate to provide direct confirmation of my interpretations. After processing the data, I designated six main themes, each of which has multiple subtopics. The topics and themes emerged organically, so to speak, through an evolutionary process over the course of the research. Some of them were always a part of my research agenda—though perhaps worded differently—even before conducting any of the interviews. Other ideas made their way into my list of research questions only after I began to interview people and explore the themes in the documents. Still others arose as important and distinct themes only after I had completed the interviews and reviewed the documents as I was coding the information in the qualitative research software.

The process was iterative, with certain findings or insights causing me to go back through the data to reanalyze information that I had already examined, to see if I could uncover more instances or clarifying ideas about my new insights. In a sense, the research process itself became a dialog with the data. I would ask questions of it. It would provide answers while at the same time asking questions of me. Some of this dialog would occur almost instantaneously. There were times during interviews, for example, when I recognized new insights as the interviewees were talking to me, and I followed up on those insights with additional questions in that moment. Other times, I would have to methodically pore over the information until the themes began to make themselves manifest and until I was able to draw inferences and connections between ideas. By the time I had finished the process, I had traversed through the data forwards and backwards, from the coded excerpts in the qualitative research software to my writing and back again many times. My coding influenced my writing, and my writing influenced my coding. My keyword coding in the qualitative software changed considerably between the start and the finish of my dissertation, as shown in Appendix D, "Original Qualitative Software Codes vs. Final Codes."

This kind of emergent, iterative evaluation and re-evaluation is at the heart of qualitative research. The intent is to let hypotheses emerge from the data, rather than limit the data analysis to the clinical testing of pre-conceived hypotheses as in most quantitative research. Both methods have their place, but the qualitative approach described here is particularly well suited to the study of open-ended lines of questioning that seek to elucidate topics without necessarily arriving at dogmatic prescriptive conclusions about them.

## Methodological Notes About Part III: Theoretical Context of the Capability Approach

The last section of the dissertation is less directly tied to the research data than the previous two sections. The purpose of this section is to explain the theoretical basis for undertaking this research in the first place, and to provide a vocabulary and a logical argument with which to justify incorporating accessibility into the ICT curriculum. The capability approach informs every aspect of this dissertation as the theoretical lens, rather than as the focus of the research questions or the data analysis. Indeed, I never asked any interview questions in which I explicitly invoked the capability approach, and the capability approach never came up in discussions or in any of the documents that I analyzed. The capability approach was *my* theoretical frame of reference, not necessarily the frame of reference of anyone else in this study. Even so, it turns out that the themes that emerged in the research align well with the capability approach, which is why I devote an entire section of the dissertation to discussing the ICT curriculum as a practical application of the capability approach in action. I used the capability approach because I found it useful, not because I wanted to make the case that it is the only valid theoretical lens through which to view disability or access issues. Adherents to other theoretical perspectives—or even those who adhere to no particular theoretical perspective—can arrive at similar conclusions about the data as the ones I derive from the capability approach. Still, I couch my observations in the language of the capability approach as a way to organize my own thoughts and situate my assertions within an existing body of literature.

# CHAPTER IV

## PART I: DESCRIPTIVE CASE STUDY NARRATIVES

The first part of this dissertation provides descriptive case study narratives of ICT curricula at three institutions: The University of Linz, in Linz, Austria, George Mason University in Fairfax, Virginia, USA, and Middlesex University in London, UK. I have presented them in sequential order, starting with the program that began teaching accessibility in the ICT curriculum first, and ending with the program with the most recent initiatives in this area. In each case, I begin with a broad overview, followed by a brief biography of the interviewees, a few highlights of the legal context, the main historical narrative, and a summary of some of the main points of each case.

## Case 1: Johannes Kepler Universität Linz (University of Linz), Linz, Austria

### Overview

So far, the University of Linz (2005) has started three separate accessibility-related curricula. The first, Barrierefreies Webdesign (Barrier-free Web Design; University of Linz, n.d.), began in 2005, offering a post-graduate academic certificate. Only one group of about 20 students completed the curriculum before it was discontinued due to several factors, including low enrollment. The second curriculum, *web_access*, was a 2-year cooperative effort starting in the fall of 2007 between six European partners to create international curriculum standards and materials for teaching accessibility, including at a master’s degree level. The implementation by the partners’ institutions proved problematic, failing to garner sufficient support at the administrative level of many of the institutions, so the materials were eventually released online as open source content. The third curriculum, the master of web sciences (Masterstudium Webwissenschaften) program, was different, in that its main purpose is to train web developers, not accessibility experts. The accessibility component is integrated throughout the curriculum as one of many topics that students must learn. The first students entered the web sciences program in the fall of 2011. This last curriculum effort—the master of web sciences—is the only one that qualifies for inclusion in this study according to the research selection criteria, but the story of that curriculum would be incomplete without also telling the story of the previous curriculum efforts at the University of Linz. The lessons learned during the two previous efforts shaped the direction and emphasis of the next curriculum effort that followed. In creating my case study narrative of the University of Linz, I included a history of the first two curriculum efforts as a necessary prelude to understand the rationale and design of the current Web Sciences curriculum.

### About the Interviewees

Klaus Miesenberger received his PhD in Business Informatics from Johannes Kepler University in Linz, Austria, and has been a professor of Human-Computer Interaction at the University of Linz since 2001. He has been a prolific researcher and writer on the topic of web accessibility and other topics related to disability, technology, and education. He organized and chairs the International Conference on Computers Helping People with Special Needs (ICCHP), the International Cross-Disciplinary

Conference on Web Accessibility (W4A), and the Association for the Advancement of Assistive Technology in Europe (AAATE). He cofounded the International Computer Camps for Blind and Partially Sighted Students (ICC), an association for stakeholders supporting blind and partially sighted people in Austria (Association "Blickpunkt"), an association for counselors of students with disabilities in universities (Association Uniability), and several other similar organizations and associations. He heads the Institute of Integrated Studies (Institute Integriert Studieren), which supports people with disabilities as they prepare for university studies, during their university studies, and as they prepare to enter the workforce. He oversaw the development of the academic program Barrier-Free Web Design at the University of Linz, and the European-wide Web Access curriculum. Some of these materials are integrated into the new Web Sciences degree program at the University of Linz. His dedication to the needs of people with disabilities has spanned his entire career.

Barbara Hengstberger received a degree in Sociology and Social Economics at the University of Linz, Austria. She worked at the Institute of Integrated Studies for eight years with Dr. Miesenberger. During that time, she was a researcher and project coordinator, helping coordinate the conferences that the Institute runs (ICCHP, AAATE, W4A), and participating in the development of the curriculum for the Barrier-free Web program and the Web Access program. She researched the sociological impact of technology, university education, and the labor market in the lives of people with disabilities. In 2011 she left the University of Linz and became a researcher at the University of Applied Sciences in Austria, where she studies value judgment, empirical social research, and market research.

Mario Batusic studied philosophy and received a master’s degree in theology at the Theological Institute of Philosophy in Zagreb in Croatia. Along the way, he also learned a completely different skill set in programming and computer science. He has worked at the University of Linz since 1996, initially in mathematics projects. During the last 10 years, he has been heavily involved in various international projects with Dr. Miesenberger in the field of accessibility of both the internet and computer software. Mr. Batusic is blind, so the projects are personally relevant to him, and he has considerable experience using assistive technologies because for him they are his only way of independently accessing computers and information technologies. He teaches classes in computer science and web accessibility and worked with Dr. Miesenberger and Ms. Hengstberger in developing a web accessibility curriculum and setting up the web site to host that curriculum.

Superficially, Mr. Batusic’s pathway into the disability field would seem the most natural of all, considering that he is blind. His educational background was in theology and philosophy, though, and his expertise was in computer science and web server administration. He became more involved in disability issues when he started working at the Institute for Integrated Studies at the University of Linz with Dr. Miesenberger. Mr. Batusic’s technical skills were a natural fit for some of the projects on which they embarked, and his intimate knowledge of accessibility issues, by virtue of his blindness, enriched the quality and credibility of those projects.

**Legal Context**

In 2000, the European Union issued two antidiscrimination directives: (a) Directive 2000/43/EC (also known as the "Racial Equality Directive"), which required equal treatment of people irrespective of race or ethnicity (European Commission, 2000a); and (b) Directive 2000/78/EC (the "Employment Equality Framework Directive"), which prohibited discrimination on grounds of disability, sexual orientation, religion or belief, and age in the workplace (European Commission, 2000b). European Union member states had until 2004 to implement their own antidiscrimination laws in conformance with these directives. Austria amended the Equal Treatment Act of 1979 with provisions that meet or exceed the requirements of Directive 2000/78/EC (Equal Treatment Act [Gleichbehandlungsgesetz, GlBG], 2004). Nevertheless, in 2010, the federal government ministries and most federal government institutions were granted permission to delay implementation of some accessibility measures until 2019 (European Network of Legal Experts in the Non-Discrimination Field, n.d.). The Act on Employment of People with Disabilities (Behinderteneinstellungsgesetz, 2005a) protects people with disabilities from workplace discrimination, and requires reasonable accommodations. The Federal Disability Equality Act (Behindertengleichstellungsgesetz 2005b) prohibited disability-based discrimination in the supply of goods and services available to the public, with provisions phasing in over time, with a deadline of 2015. Other laws at both the national and province level provide legal protection to people with disabilities. Legal interpretations will likely vary, but Dr. Miesenberger interpreted this combination of laws to include web accessibility for all entities in the public sector, as well as in the consumer sector, for any entity that engages in commerce or the publication of consumer-related information. The forthcoming European Commission Mandate 376 will require European member states to comply with procurement guidelines, similar to Section 508 in the United States, but as of yet these requirements are not official or binding.

### A History of the Web Accessibility Curriculum at the University of Linz

Dr. Miesenberger and his team, including Barbara Hengstberger and Mario Batusic, have spearheaded numerous initiatives in disability issues throughout many years at the University of Linz. In two of those initiatives, the Barrier-free Web Design academic certificate program, and the *web_access* initiative, the team created curricula dedicated to teaching web accessibility. These two initiatives were unique because they represented the only full-fledged university-level curricula initiatives devoted entirely to training students in the detailed technical skills of web accessibility at the level of the markup and code. The curricula targeted students with backgrounds in computer science, web design, or other similar technical skills. By way of contrast with the other case studies in this dissertation, George Mason University's Instructional Technology program offers just one class in web accessibility, and Middlesex University's Digital Inclusion master's degree addresses the topic on a much less technical level. The Barrier-free Web Design program and *web_access* initiative at the University of Linz have since been discontinued (though the *web_access* materials are still available online at http://www.bfwd.at/ and http://www.webaccess-project.net/, respectively), but parts of those curricula live on in the newly created web sciences degree at the University of Linz. This case study traces the history of the web accessibility curriculum efforts at the University of Linz from those first early programs to the current web sciences degree.

Dr. Miesenberger conceived the Barrier-free Web Design program in the early 2000s, anticipating what he perceived to be the growing market for web accessibility experts in the wake of the publication of the W3C Web Content Accessibility Guidelines (Hengstberger et al., 2008; Miesenberger, 2006; Miesenberger et al., 2010; Miesenberger & Ortner, 2006; Ortner et al., 2004; Ortner & Miesenberger, 2005) and the trend toward policies and legislation in Europe and requiring government web sites to be accessible to people with disabilities. Austrian laws were not yet in place when Dr. Miesenberger began to pursue his web accessibility curriculum plans, but they were on the horizon. One law specific to Austria, the e-Government-Law (Österreichiches Parlament, 2004), was enacted during the curriculum development phase. This law requires that all web sites offered by the Austrian government adhere to international web accessibility standards. After a 4-year adjustment period, the law took effect in 2008. Another Austrian law, “Behindertengleichstellungsgesetz,” was enacted 2 years later. This is an antidiscrimination law protecting the right of people with disabilities to access all public sector areas including web pages (Miesenberger, 2006).

Dr. Miesenberger procured funding through the European Social Fund (ESF) and the Federal Ministry for Education, Science, and Culture in the Austrian government to develop the curriculum. His team at the Institute Integriert Studieren (Institute of Integrated Studies) began developing the curriculum in the fall of 2003. Dr. Miesenberger, Ms. Hengstberger, and Mr. Batusic, decided to put the bulk of the instructional materials online in the Moodle learning management system. Most of the instruction would occur in an online environment, but the students would meet with the instructors and their fellow students for two days at the beginning of the program to meet each other and provide a social context for the course, go over the course schedule and goals, and introduce students to the Moodle platform.

The curriculum covered a wide range of topics in web accessibility (see Appendix F), using version 1.0 of the Web Content Accessibility Guidelines (version 2.0 did not exist yet) as the guiding set of principles. Topics included technical basics (HTML, CSS, XML, document preparation, web programming, and internet security), assistive technology, human-computer interaction, policies and laws, accessibility techniques, evaluation and repair tools, software accessibility, multimedia accessibility, authoring tools and user agents, usability engineering, user interaction design, and an internship or practicum in accessible web. The curriculum was ambitious and about as comprehensive as it could be within the topic of web accessibility.

The program would last for 2 years and, as originally conceived, would offer a master's degree. Unfortunately, the university did not approve the program at the master's level because the number of students expressing interest in the program did not meet the minimum level of 50 to 100 students set by the university. The program could offer an academic certificate, but not a master's degree. Disappointed, but undeterred, Dr. Miesenberger and his team decided to go ahead and offer the program as a two-year postgraduate certificate academic program.

From the start, not being able to grant a master's degree after 2 full years of study made it more difficult to attract students, which, in turn, made it difficult to present a case to the university that the program ought to be accepted as a master's program, in light of the requirement to have a minimum of 50 to 100 students expressing interest in the program. Mr. Batusic recounted his early concerns during the planning stage.

> There were two problems. First, the course was too long. I said it before we started. I thought it was too long. The second problem was it was too expensive. This was a postgraduate course, and you have to pay for it. Anything that is not free in Austria is too expensive, because our schooling is free.

If the program had been accepted as a master's degree, it would have been free to all students, just like all other master's degrees in Austria. As it was, the program needed to charge students tuition in order to help cover the administrative costs.

In short, the program had three significant strikes against it before it even began: the inability to confer a master's degree, the length of the program, and the cost to students. Dr. Miesenberger acknowledged these challenges, but decided to forge ahead with the full curriculum anyway. The first group of about twenty students started the program in fall of 2005. These students were motivated and received the curriculum well, but it turns out that this first group would also be the last group. The difficulties in attracting and enrolling students continued, for the aforementioned reasons, making it that much more difficult to convert the program into a master's degree. Mr. Batusic's practical concerns turned out to be more significant than Dr. Miesenberger had anticipated. Dr. Miesenberger also began to realize that he had overestimated the market demand for web accessibility experts. Some laws were in place, but these laws were apparently too limited in their scope or enforcement to affect widespread changes or create a vibrant market for web accessibility experts. Years later, when I interviewed him, Dr. Miesenberger admitted that while some of the students found employment in the accessibility field, many of them found jobs only in the more general market of web development, without any specific accessibility duties in their job descriptions. Some government entities or associations of people with disabilities, or other similar organizations, “might need a dedicated web accessibility expert,” he explained, “but not 20 graduates in Austria each year. There is simply no job market, and it would be wrong to expect such a job market” in small countries like Austria. In the face of multiple challenges, it was not long before he knew the Barrier-free Web Design program would not last. The program was not entirely a failure, because the first group of students was able to finish the program successfully, but the goal of making the Barrier-free Web Design program a permanent part of the curriculum did not materialize.

Despite the setbacks from the Barrier-free Web Design program, the team still felt that it was important to teach web accessibility in the university curriculum, so they took a more expansive approach to the problem and in 2007 forged partnerships with several institutions throughout Europe to develop instructional materials in English that could be adapted to the curricular needs of any academic program that wanted to incorporate the materials (Miesenberger et al., 2010). They dubbed this new project *web_access* (“Joint Programme on Accessible Web Design [‘web_access’],” 2009). Funding came from the European Commission Erasmus Programme (EuRopean Community Action Scheme for the Mobility of University Students) and the project got under way in fall of 2007. The partners in the program were: (a) the Johannes Kepler University of Linz, Institute of

Integrated Studies, Austria; (b) Manchester Metropolitan University, Department of Information and Communications, UK; (c) Dublin City University, School of Computing, Ireland; (d) University of Pannonia, Department of Image Processing and Neurocomputing, Hungary; (e) Univeritaet Karlsruhe (TH), Studienzentrum für Sehgeschädigte (SZS), Germany; and (f) Baobab Association, Spain. These partners had already demonstrated some interest and experience with web accessibility, though the amount of experience varied widely between partners.

Collectively, the *web_access* partners produced a web accessibility curriculum (see Appendix G for a list of topics), teaching and training materials, guidelines on how to implement the curriculum, concepts for business models of academic and training programs, public relations materials, and study skills materials. The partners divided the responsibilities among themselves according to their areas of expertise and interests. Ms. Hengstberger wrote a general introduction to the *web_access* curriculum as a whole and provided project management throughout the process. Mr. Batusic wrote about techniques for accessible web design, rich internet applications and multimedia accessibility (including WAI-ARIA), and other topics. Dr. Miesenberger wrote about software accessibility, and the process of redesigning a web site for accessibility. The partners at the other institutions wrote the other modules. Once completed, the materials were made available in an accessible online e-learning format. Topics in the curriculum included the fundamentals of web accessibility, assistive technology, guidelines and legal requirements, accessible content creation, design and usability, and project development.

One of the challenges that the *web_access* project sought to address was the inconsistent way in which web accessibility was taught across Europe. At one end of the spectrum, some institutions, such as the University of Linz, offered highly technical classes in web accessibility. At the other end of the spectrum, other institutions merely helped to make students aware that web accessibility was an issue, without going into any technical detail. Most institutions taught at a technical level somewhere between these two extremes. This variability made it difficult to compare the offerings of the different institutions with any sort of consistency, or to be able to judge which programs would provide what kind of instructional expertise.

To address this challenge, the *web_access* partners assigned European Credit Transfer System (ECTS) points to each of the modules within the curriculum and provided a list of topics that each module should cover. This way, there would be less of a mystery as to what was taught, or how much work the students had to put into the class. Also, the credits would be transferable between institutions, making it possible to start one's studies in one institution and finish in another, or to take classes from more than one institution and apply them all to a degree at the student's home institution. One possible outcome would be the creation of an international European degree, with classes offered from several participating institutions.

Each institution would still have a fair amount of latitude in designing the courses. Despite providing a list of topics for each module, the curricular materials were not designed to be a "plug-n-play," ready-made product that could be implemented without modification. Rather, the intent was to provide a framework of topics and classes, give an overview of what each class should teach, and provide guidance on how the curriculum could be implemented. As Mr. Batusic explained:

> The big difference between the Barrier-free Web Design curriculum and the *web_access* curriculum was that in Barrier-free, the materials were developed directly for the students, and in *web_access*, we developed the materials for the teachers, not for the students. The teachers have to re-make it and choose what they need and [adapt it] for the students.

The curricular materials do not prescribe pedagogical strategies, assessments, grading policies, or other similar instructional decisions. The latitude offered within the *web_access* framework respects the autonomy of the institutions, while still providing comparable educational experiences for students across the institutions.

After 2 years of development, the curriculum was ready to go, but none of the partner institutions had adopted it yet. Even the universities that eventually went on to adopt parts of it—the University of Linz and the University of Pannonia in Hungary—found that the bureaucratic processes involved in approving new curricular programs required more time than they had anticipated. According to Ms. Hengstberger, the approval process took about two years, which was a problem, because the total funding period for the *web_access* initiative lasted only 2 years, including the development time. They had not budgeted enough time for both the development and the approval process. By the time the funding period had ended, discouragingly, it almost seemed as if they had nothing to show for it. It was at about this time that Ms. Hengstberger took a position at a different university, after about 8 years of working with Mr. Batusic, Dr. Miesenberger, and other staff in the Center for Integrated Studies at the University of Linz.

The original vision behind the *web_access* program was to have as many of the partner universities as possible adapt the curriculum and offer it in academic programs.

The hope was that the collective effort across several countries would propel the cause of accessibility forward and generate the kind of momentum that had been lacking in the Barrier-free Web Design Program. Even though it was behind schedule, the *web_access* project moved toward this goal, with the University of Linz adopting parts of the curriculum into its new web sciences degree program (more on this later) and the University of Pannonia in Hungary adopting part of the curriculum into a graduate certificate program. Interest and momentum among the remaining partners stalled, though, and did not reach the tipping point necessary to achieve the kind of integration originally anticipated. This is not to say that the other institutions were necessarily disinterested. Many of the partners ran up against the same problem that had earlier caused problems for the Barrier-free Web Design program: the partner institutions found it difficult to demonstrate to university administrators that there was sufficient interest among potential students. Additionally, in some cases the academic programs of the partner institutions were simply not the best match for the curriculum. In other cases, other initiatives at the partner institutions, unrelated to the *web_access* project, were granted a higher priority by the institutions' leaders and administrators, leaving fewer resources available to implement the *web_access* goals. For a variety of reasons, the original high hopes for the *web_access* program ran into some discouraging setbacks. In the absence of systematic adoption by most of the other partner institutions, the *web_access* project had failed to achieve its main goals. Cooperative teaching agreements between partners failed to materialize as envisioned, and without many classes in web accessibility across Europe, there would be no European master's degree in web accessibility as a result of the *web_access* initiative.

As it became increasingly clear to the partners that the *web_access* curriculum was falling short of its ambitions, they were faced with the dilemma of what to do with the materials they had spent so long working on. Most of the partner institutions were not really using it as they should or could, and they were not allowed to share the curriculum with anyone else, because it was a closed curriculum owned by its main funding source, the European Commission. Not only that, but, according to Ms. Hengtsberger, “We would have problems at our university [if we released the curriculum] because the students of Barrier-free Web Design program were paying a lot for the content and the teaching.” After some complex international legal negotiation, and after the Barrier-free Web Design program had finished, the European Commission and partner institutions agreed to make the curriculum openly available to everyone rather than have all of the work go to waste completely. All of the materials are now available online at http://www.webaccess-project.net/. Even though it was not until after the end of the *web_access* funding, the Universities of Pannonia and Linz did eventually approve curricula that included some of the *web_access* materials.

The University of Pannonia created a 60-ECTS (60 European Credit Transfer System points) academic certificate in accessible web design. Dr. Miesenberger characterized the program in Pannonia as a program geared toward educational professionals rather than web developers, “supporting students with disabilities in the classroom, accommodating their needs, getting the information, preparing the materials, the content, etc.” They had originally attempted to create a master’s degree program, according to Ms. Hengstberger, but found it too difficult to receive approval, so they opted to create a certificate program instead. In fact, all of the partners ran into similar approval challenges, so the goal of creating master's degrees at multiple institutions was downgraded to a goal of incorporating 60 ECTS points into the curriculum at multiple institutions.

At the University of Linz, once it was apparent that a master's degree was not feasible, the next best option was to incorporate accessibility materials into the new Web Sciences program, which was still under development, in the Computer Science Department. The Web Sciences program held its first classes in fall of 2011, offering both a bachelor's and a master's degree. The Web Sciences degrees are not specific to web accessibility. They focus on web technologies in general. The program offers three different concentrations (see Appendix H). The first is a technical concentration focusing on web design, development, and programming, including HTML, XML, CSS, JavaScript, AJAX, and other common web markup, scripting, and programming languages and techniques. The second is a legal concentration, focusing on internet and technology laws. The third is a business concentration, focusing on project management, IT leadership, and integration of web technologies in the workplace. Students in these three concentrations take many classes together, in an interdisciplinary educational environment. There are also specialist classes only for students in each of their respective concentrations. The students in the legal and business concentrations will not learn the technical intricacies of web programming, for example, nor will the students in the technical concentration learn all of the nuances of legal or business perspectives. They will learn and work together much of the time though, and the culmination of the program consists of a collaborative final project in groups of five to ten students in which the business students provide project management, the legal students provide a legal perspective, and the technical students develop the product.

To increase the potential appeal of the program to international audiences, the University of Linz encourages the instructors to offer as much of the content and instruction online as possible. The trend toward putting class materials online in web-based or blended online/in-person learning environments allows universities to expand their pool of potential students beyond the limited geographical boundaries of the campus buildings. Interestingly, in another not toward expanding the appeal of the program to international audiences, the University of Linz also encourages the instructors to teach the classes in English. The trend toward teaching classes in English, even in non-English speaking countries like Austria, is indicative of the wider trend in Europe to allow for greater integration and cooperation between countries, as the world becomes ever more globally connected and interdependent. Of course, the classes in English present a language barrier problem for students who do not speak English (just as German classes present a language barrier for English speakers). This creates an accessibility issue of a different kind, not related to disability, and while worth noting, language accessibility is beyond the scope of this dissertation.

All students in the Web Sciences program receive at least some instruction in web accessibility. According to Dr. Miesenberger, accessibility topics in the web sciences curriculum include “1) awareness, [including] the social, ethical, political, and legal issues, including procurement laws, antidiscrimination laws, etc., and 2) the technical part, where we bring in the understanding of WCAG 2.0 and WAI-ARIA, and how to bring them into the different [accessible design] techniques." The program included a class dedicated to web accessibility, a class on WCAG, a class on WAI-ARIA, and lectures on other accessibility topics interspersed throughout the curriculum. The sum total of the accessibility instruction will not be as comprehensive as the Barrier-free Web Design Program or the *web_access* initiative, so the web sciences curriculum alone is insufficient to product true web accessibility experts. Even so, the fact that *all* students are required to learn about web accessibility, whether they are interested in it or not, is in some ways a major achievement. Students who would not have otherwise been exposed to accessibility will learn about it, and some may become interested in it through this exposure. At the very least, graduates of the web sciences program will enter the workforce having learned that what they do impacts the lives of people with disabilities and they will have some knowledge of how to design for accessibility. Whether they choose to act in accordance with this knowledge when making design decisions in their future jobs remains to be seen—and anyway is out of the hands of curriculum designers—but graduates of the web sciences program will not be able to plead ignorance about accessibility.

When I conducted my interviews in the summer of 2011, the Web Sciences program had not begun. The first class of about 160 students began the program in the fall of 2011. In email conversations with Dr. Miesenberger early in the summer of 2012, after the first two semesters of the program, I learned that enrollment in the program for the next incoming class was not quite as high as he and his colleagues had hoped or expected, but he did not give me exact enrollment numbers. When I asked him if the disappointing enrollment for the second year had anything to do with the accessibility component, he answered that it did not. The program was not being marketed as an accessibility program, and students were not basing their decision on the accessibility component of the curriculum. Rather, Dr. Miesenberger felt that students were aware of the weak global economic conditions and were choosing more traditional academic paths, such as computer science, business, and law, rather than taking a risk on an innovative interdisciplinary program that combined elements of those three more traditional disciplines. Even though the web sciences program draws from these traditional disciplines, it also pushes into new and innovative directions, unrelated to the accessibility component of the curriculum. Dr. Miesenberger and his colleagues considered these innovations to be the strengths of the program, but in difficult economic times, students have apparently been somewhat reticent to risk their own careers on a new program with an unproven track record in job prospects for graduates. Even so, the program has completed its first full year and a new cohort of students will enter the program in fall 2012.

Even with its innovative interdisciplinary nature, the Web Sciences program is still meant to be a mainstream program. Rather than target a niche audience with the specialized topic of accessibility—as the Barrier-free Web Design program and the web_access curriculum—the web sciences program teaches topics—computer science, web design, business, and law—that should appeal to a broad range of students. Accessibility was always an important integral component of the web sciences program, but it was never the main purpose for it.

Despite its lower-than-expected enrollment in the first year, the web sciences program at the University of Linz is a model of a program that attempts to introduce mainstream ICT students to accessibility. In one sense, the web sciences program falls short of the original grand goal of the *web_access* initiative to create a permanent curriculum with the narrow focus of training accessibility experts. In another sense, though, the web sciences is the embodiment of a goal that is perhaps even more ambitious: the goal of training all ICT students in at least the basics of accessibility. Dr. Miesenberger still holds on to the vision of creating an international European master's degree in web accessibility as a joint venture with other universities, but this vision is on hold for the time being. After watching two of his curriculum projects—the Barrier-free Web Design program and the *web_access* initiative—fail to achieve many of their goals, he is somewhat reluctant to try again too soon. When he does try again, he will bring in different partners that align more closely with his vision for a European master's degree, and will take the lessons he learned from the early projects into account as he plans his next foray into the web accessibility curriculum.

**Summary**

The University of Linz has been involved in three major web accessibility curriculum design initiatives: Barrier-free Web Design, *web_access*, and web sciences. The Barrier-free Web Design program was a 2-year academic certificate. It was offered only once, due to low enrollment, likely as a result of the cost, length of the program, and the fact that it did not offer a master's degree upon completion. The *web_access* initiative was an international collaboration between several European partner institutions to standardize a web accessibility curriculum and pave the way for a European master's degree. The curriculum development is complete, but it did not gain much traction at most of the partner institutions, so the curriculum was released in the public domain in the hope that it could still be useful to other institutions. The web sciences program is a new master's degree for students interested in the technical, legal, and/or business aspects of web design. The program requires all students in this program to take classes and attend lectures about accessibility. Of the three initiatives, the web sciences program has the farthest reach, in the sense that it provides at least some accessibility training to the largest number of students, many of whom had no initial interest in accessibility topics. The Barrier-free Web Design program and the *web_access* initiative approached the subject in greater depth, but even before their premature demise, the reach of these programs was limited only to those who already had an interest in accessibility, which is a much smaller subset of those who are interested in web topics in general.

## Case 2: George Mason University, Fairfax, VA, USA

### Overview

The instructional technology program at George Mason University "prepares graduates to leverage the use of learning technologies in achieving educational and training goals within schools, community, corporate, government, and higher education settings" (George Mason University, 2011). The program offers master's degree concentrations in (a) instructional design and development, (b) integration of technology in schools, and (c) assistive technology, plus a doctoral degree and four graduate certificates. Starting in 2004, the program offered a class in web accessibility as an elective. In 2006, this class, called Web Accessibility and Design—became a core component of the curriculum for two of the concentrations (instructional design and development, and assistive technology) and two of the graduate certificates (e-learning and assistive technology).

## About the Interviewees

Michael Behrmann received his Ed.D. in special education from Teachers College, Columbia University, in the United States, and has long been interested in the use of technology to improve the lives of people with disabilities. He has worked at George Mason University since 1979, where he is now the director of the Helen A. Kellar Intitute for Human disAbilities, the principal investigator of the Region 4 Training and Technical Assistance Center (T/TAC), director of the Division of Special Education and Human Disabilities, coordinator of the Special Education program, and professor of special education.

Nada Dabbagh received her Ph.D. in instructional systems from The Pennsylvania State University in the United States, and has been at Mason since 1999. She has focused on instructional design and theory, the social and cognitive consequences of learning systems design, hypermedia/multimedia learning environments, student self-regulation in online and blended learning environments, and case-based learning. She is currently the director of the Division of Learning Technologies, overseeing the instructional design and development (IDD) concentration and the e-learning certificate.

Kristine Neuber received her M.Ed. from George Mason University in the United States, and is currently a Ph.D. student in special education with an emphasis on disability policy. She has a joint assignment as professional faculty with the College of Education and Human Development and the Office of Equity and Diversity Services, and is the coordinator of the Vision Impairment Teacher Training Program Consortium. She teaches classes in assistive technology and special education, and was the first instructor of the web accessibility class at Mason. Previously she was the coordinator of Mason's Assistive Technology Lab, and was a teacher for the visually impaired in the public school system. Although irrelevant to ICT accessibility, Ms. Neuber has a minor motor disability requiring a leg brace to support her in her walk, which she does very ably with the brace. She is completely able to access computers without any issues, so her disability is not directly relevant to the topic of this dissertation, but it does give her an insider's perspective on what it means to live with a disability.

Kara Zirkle received her M.A. in education from West Virginia University. She is currently the IT accessibility coordinator at Mason, which is a position associated with the assistive technology and the Office of Initiative and Equity and Diversity Services. She trains Mason webmasters in web accessibility techniques, works with faculty to make their online course materials accessible, and tests software for Section 508 compliance. Recently she began to teach the Web Accessibility and Design class.

The final informant that I should acknowledge in this case study is myself. It may be somewhat unusual to consider one's self as an informant in scholarly research, but because I taught the Web Accessibility and Design class for just over 5 years, I have unique first-hand knowledge of the class within the instructional technology program context. This case study draws from this knowledge where appropriate, supplemented by the perspectives of four other individuals, to help minimize the impact of my own biases.

My own entry into the disability field was based on happenstance as much as anything else. I was completing my master's degree in instructional technology and got a part-time job translating curriculum materials into Spanish to help pay my tuition. It just so happened that this job was at the Center for Persons with Disabilities at Utah State University, which is a large disability-focused research and service organization. Two of my supervisors applied for a grant to provide web accessibility training materials to higher education entities. They were awarded the grant, but the person who was to be the technology coordinator took a job somewhere else right before the funding was scheduled to begin. I applied for the role of technology coordinator and got the job. That grant-funded project in 1999 evolved into the initiative now known as WebAIM, where I worked for the next 6 years. I have continued to work in the field of web accessibility, even after leaving WebAIM, because I recognized its importance and potential impact in the lives of people with disabilities. I had found an area that needed some work, and I was willing to do it. Before being presented with the opportunity to enter the field, I admit to being unaware of the issues that I would come to embrace and promote. My own experience of teaching web accessibility over the last decade or so shows that many people are similarly unaware of disability issues, through no fault of their own, and need little, if any, persuasion to believe in the issue's importance. Not everyone is so easily persuaded, of course, but I found the field to be a great match for my personal values and desire to make a positive difference in the world.

## Legal Context

Section 504 of the Rehabilitation Act of 1973 prohibits discrimination against individuals with disabilities by any entity receiving federal funds (U.S. Department of Labor, 1998). Section 508 of the Reauthorized Rehabilitation Act of 1998 (U.S. Access Board, 2000) spells out a list of technical standards for information and communications technologies that federal government entities must take into account when procuring technology products or services. The standards, which went into effect in 2000, cover a broad range of technologies, including web pages, software, computers, telephones, office machines, and so forth. The Americans with Disabilities Act (ADA) of 1990 prohibits discrimination against people with disabilities in employment, access to buildings, participation in activities, and other contexts. The Americans with Disabilities Act does not mention the web or other digital technologies explicitly, but the law has been invoked in several lawsuits respecting inaccessible web and digital content (WebAIM, n.d.), and the U.S. Department of Justice has solicited input on "what standards, if any, it should adopt for website accessibility" (U.S. Department of Justice, n.d.). Other laws offer various protections for people with disabilities in employment, education, and other contexts, but generally assert a lesser impact on the larger picture for web accessibility than Section 508 or the ADA, which tend to take center stage in legal discussions of the topic.

**History of the Accessibility Component of Instructional Technology Curriculum at George Mason University**

The Division of Learning Technologies (LT), within the College of Education and Human Development (CEHD) at George Mason University (GMU, or “Mason”), offers three master’s degree (MEd) concentrations and one doctoral degree (PhD) in Instructional Technology (IT). The master’s level concentrations are: (a) instructional design and development (IDD), (b) integration of technology in schools (ITS), and (c) assistive and special education technology (IASP, also known as the AT program). The doctoral degree falls under the instructional design and development heading (the same as the first master’s degree concentration), with a concentration in learning technologies design research (LTDR). The LT Division also offers an undergraduate minor in assistive technology, and graduate certificates in four areas: (a) e-learning, (b) integration of technology in schools, (c) the online academy for teachers, and (d) assistive technology. The breadth of academic offerings belies the program’s youth. The university itself was founded as a branch of the University of Virginia in 1957 and did not become an independent entity until 1972. The programs in instructional technology are even younger, but their fast pace of growth has allowed for, and even required, innovation in the curriculum as the academic offerings expanded.

One of these innovations—a 3-credit-hour class titled Web Accessibility and Design—is the reason for the program’s inclusion in this dissertation. This class is a required element of the curriculum for four of the academic programs, specifically, for (a) the MEd in instructional design and development, (b) the MEd in assistive and special education technology, (c) the graduate certificate in e-learning, and (d) the graduate certificate in assistive and special education technology. The fact that the class exists at all is noteworthy, since academic classes about accessible design are rare to begin with. Among instructional technology programs, Mason is the only university to offer a stand-alone class about accessible web design as a required component of a degree program, according to my pilot review of the course descriptions of instructional technology and educational technology programs in October 2011. Some *certificate* programs at other universities teach accessible design, but a preliminary search through the online course listings of English-speaking universities (see Appendix B) suggests that Mason stands alone in teaching accessible design to all students in a master's level degree program. It is possible that other universities teach principles of accessible web design in the context of their other classes (perhaps in classes about web design or the diversity of learners, for example), but information about the accessibility content of their courses is not readily available in their online listings.

The Web Accessibility and Design class was the result of an evolutionary process within the Instructional Technology program. According to professors Michael Behrmann and Nada Dabbagh, the need to teach accessible design principles arose in the late 1990s in the context of government grants and industry sponsorships for the Instructional Technology Immersion Program. The Immersion Program provides scholarships to a small number of full time master's level students to complete an accelerated 1-year master's degree, funded by the grants and sponsorships. Half of the students' time is spent in coursework. The other half is spent working on designing an instructional product for the funding agency or industry sponsor. The specifications for many of these instructional products included the requirements that the products be accessible to people with disabilities, especially the projects funded through the federal government, government contractors, or the Training and Technical Assistance Center (T/TAC) of Virginia, a project headed by Dr. Behrmann, which provides information resources for people with disabilities in Virginia. The disability-centered nature of many of these projects reflects Dr. Behrmann's career focus on disability issues.

Having so many projects with accessibility requirements meant that the Instructional Technology program had to provide accessibility training to the Immersion students. This training came in the form of workshops and presentations by faculty, staff, and outside experts as the need arose in the context of the projects the students were working on. There still was no class in the course catalog about web accessibility though, and students who were not involved in Immersion projects in which the funders required an accessible final product usually did not have an opportunity to learn much about accessibility.

At about the same time that the Immersion students were involved in these projects, Kristine Neuber—who was affiliated with the campus's Equity Office and the Assistive Technology Initiative—was working with the faculty in the Assistive Technology program to develop a class in internet technology as a part of the Assistive Technology graduate certificate. They soon realized that their own web sites were not accessible, so they called on the web accessibility consultants from WebAIM (disclosure: I was one of those consultants) to provide a 2-day workshop in web-accessibility techniques. Kristine knew very little about HTML at the time, so after the workshop she took the beginning and advanced HTML classes offered by the College of Education and Human Development, with the intent to develop a web-accessibility class for the assistive technology certificate curriculum. As she was taking those classes, Kristine reflected on WebAIM's assertion that accessibility ought to be taught as an integral part of any class that teaches HTML or web design. "I shouldn't teach the web accessibility class," she thought. "It should just be a part of the [existing] HTML class." She was unsuccessful in her efforts to persuade the instructor of the existing HTML class to incorporate accessible design principles into the class though, so in 2004, with the approval of Dr. Behrmann and other faculty in Instructional Technology and Assistive and Special Education Technology, she ended up designing and teaching Mason's first semester-length course in accessible web design, titled "Assistive Technology and the Internet." The 2-credit-hour course was dual-listed under both Instructional Technology (EDIT) and Special Education (EDSE) designations. The course catalog described the class as follows:

> EDIT 526/EDSE 526: Assistive Technology and the Internet (2:2:0). Provides an overview of the World Wide Web/Internet. The focus is on accessibility issues and solutions. Students perform web searches and design and produce an informational web page. Knowledge and awareness components of this course may be delivered via distance education.

The students in the class were not training to be web developers. Despite the dual listing, all but "maybe one or two" of the five to ten students per semester came from a special education or assistive technology background, according to Kristine. These were the students already interested in disability issues, and they were training to be service providers to people with disabilities, so Kristine did not go into great technical detail about the HTML techniques. Rather, she gave a broad overview of accessibility for the web, taught some HTML techniques, introduced students to Section 508 and other relevant laws and standards, and focused on the assistive technologies available to help people with disabilities use the internet. The assignments for the course included: (a) planning a web site design, (b) evaluating the accessibility of an existing web site, and (c) creating an accessible web site as a final project. Instructional materials included the book “Building Accessible Web Sites” (Clark, 2002) and web resources by WebAIM, and W3C.

In 2005, the class was renamed “Web Accessibility” to reflect the more commonly used terminology of the field. A new prerequisite of “HTML experience” was added to the description, so that less time would be spent teaching the basics of HTML and more time could be spent teaching accessibility and assistive technologies. The updated course description mentions that the course covers “related laws” and “evaluation and critique of web sites.” The course design itself remained essentially the same as before, with the same topics listed in the syllabus and the same assignments. The required text was dropped, though, and a different book, “Constructing Accessible Web Sites” (Thatcher et al., 2006) was recommended, but not required. The rest of the materials were available online.

It was in this same year, 2005, that the faculty of the Instructional Technology program redesigned the entire Instructional Design curriculum. Dr. Dabbagh recalled that Dr. Behrmann advocated making web accessibility a more prominent part of the curriculum; the rest of the faculty agreed without much debate or dissent to speak of. As Dr. Behrmann explained:

> I almost always had a team working on something related to disabilities and special needs. So it was always a component. By the time the program matured, we had things from the National Forest Service, and the Bureau of Mines and Land Management, private nonprofit organizations…we had a bunch of different projects going on. It had really become part of the ingrained process of how we did business in doing our development through instructional design and development immersion teams. So it was gradual, it was natural. I don't think anybody ever felt pushed or pressured into saying this needs to be a part of the program. It just became a part of the program. And then when we re-did the program and finalized it, it was decided this needs to be part of it. So I never felt like there was pushback.

The College of Education already had classes in Beginning HTML and Advanced HTML, plus the class in Web Accessibility that Kristine taught. They decided to discontinue the two HTML classes and infuse the Web Accessibility class with more technical training in HTML. There was no way the Web Accessibility class could teach all of the content across the other three classes (Web Accessibility, Beginning HTML, and Advanced HTML), but they felt the change was warranted in their efforts to streamline the curriculum. They elevated the Web Accessibility class to 3 credit hours, renamed it "Web Accessibility and Design," and made it a required element of the master's degree specialization in Instructional Design and Development, the graduate certificate in E-Learning, the master's degree in Assistive and Special Education Technology, and the graduate certificate in Assistive and Special Education Technology.

There were four main reasons for making the class a required part of the curriculum. First, the faculty felt that it was an important topic for ethical reasons. The close association of the Assistive and Special Education Technology faculty with the Instructional Technology faculty contributed to this collective interest in the ethical impact of technology on people with disabilities. Some of the faculty, including Dr.

Behrmann, had already invested a large portion of their careers to disability issues, so it was natural for them to envision a curriculum that fit in with their own career and ethical interests. Second, as mentioned previously, they already had a practical need to teach accessibility to students in the Immersion Program who were working on projects that required accessibility. They could have continued to address accessibility on an ad-hoc basis, but they felt it was better to make the instruction a more integral part of the curriculum. Third, they felt that accessibility expertise gave their graduates a comparative advantage in the job market, especially in the Washington DC area where federal government jobs and government contractor jobs often require accessibility expertise to meet Section 508 requirements. In Dr. Behrmann's words, requiring the students to learn accessible design techniques and Section 508 "has actually been a big plus, because you put somebody from [another] university in instructional design and development, and you compare them to a GMU student that has 508 capacity. Well, you're sitting there looking at the resumes, and our guys get [hired] faster than the other guys, we think. And that's the feedback that we've gotten." Dr. Dabbagh also recognized this comparative advantage, saying, "Initially we had a course that used to be just about web design so you would learn basic HTML, WYSIWYG, Dreamweaver, and how to design a website with an instructional goal or purpose, but we figured students can learn this pretty much anywhere in any curriculum, so the differentiating criterion for us [was] 508 compliance. We already had an assistive technology concentration, and it's all about accessibility, so why don't we merge the two? I think it was a good decision at the time, and I still think it is." Fourth, they wanted to have a class more tailored to the needs of Instructional

Technology students, focusing more on the technical aspects of web design so that students would be able to create web-based portfolios of their work and have a marketable set of technical HTML skills upon graduation. This last reason required a diminished emphasis on assistive technologies in order to increase the time allotted to teaching the technical skills. Other less technical classes, tailored to the interests of students in the Assistive and Special Education Technology program (such as EDSE 529: Internet as an Assistive Technology Tool), would still be available for students to learn more about assistive technologies. Dr. Behrmann reasoned that trying to combine technical HTML development techniques along with detailed information about assistive technologies in just one class in one semester was impractical, due to the amount of material to cover and to the divergent backgrounds and career expectations of the students of the students in the different concentrations.

Because of her background and expertise in assistive technologies, the de-emphasis on assistive technology came as somewhat of a disappointment to the original instructor, Ms. Neuber, but she understood the need to give the Instructional Technology students more of the technical HTML development skills. As it turns out, her responsibilities and schedule were undergoing some changes at about that time, so she did not end up teaching the class again after the curriculum redesign. I had recently left my position at WebAIM and taken up a new position at Mason, so they asked me to take her place as the instructor of the Web Accessibility and Design class. I still taught about assistive technologies, but only to make students aware of some of the most common ones, and how to design web sites to be compatible with them. I did not teach how to use assistive technologies or how to help people with disabilities use the internet.

With the class now part of the required curriculum of two masters degrees and two certificates, enrollment increased significantly up to an average of 25 to 30 students per semester. Ms. Neuber had said she “felt lucky to get 8 to 10” students before. For the next three years, I taught two classroom-based sections per semester. Starting in the fourth year, one section was taught online and the other section remained classroom-based. During my final year teaching the class, the teaching load was reduced to one section per semester and it was taught only online. Enrollment decreased to about 15 students per semester, due in part to the decreased number of sections available, but also due to a smaller number of students enrolled in the academic programs requiring the class.

Teaching the class online meant that the class itself had to be web accessible. For the most part, that did not present any particular challenges, considering that I developed most of the course materials and I knew how to make them accessible. Over the years, I taught a few students with disabilities including blindness, deafness, motor disabilities, and even emotional disabilities. All of these students were able to complete the course successfully. Most of the course content consisted of web-based text and graphics and was not particularly challenging to make accessible. I did venture into making screenshot videos at one point, and had to provide synchronized captions and a transcript. That was not difficult so much as it was time consuming. In a subsequent semester, I created new versions of a couple of these screenshot videos, and, embarrassingly, I did not finish making the captions in time due to my work load, but decided to go ahead and post the videos anyway. The irony of the situation was painfully apparent to me, and while most of the students did not seem to mind or even notice, at least one student let it be known how hypocritical it was when he/she submitted his/her course evaluation after the class was over. The student was right, of course. I never did go back to update those videos, because there were a few other technical problems requiring that I redo them completely, so I took those videos out of the course materials entirely. One could argue that removing the videos deprived all future students of their benefits, which is true, but providing a model of an accessible class seemed more important than providing the extra content in the videos. The videos were not critical to the class, because the content existed in written web pages with illustrations, but the videos did provide a useful, enhanced alternative to the text, which arguably could have enhanced accessibility to students with learning disabilities or reading disabilities. In the end, time and resource constraints limited the amount of multimedia I was able to develop for the class.

The instructional approach varied somewhat during the 16 semesters that I taught it from January 2006 until April 2011, but the main instructional topics and goals remained essentially the same (see Appendix I for a list of topics taught in the course). From the beginning, I required students to learn XHTML 1.0 strict (nonvalidating, sloppy HTML was not allowed!), cascading style sheets (CSS), and web-accessibility techniques. The technical demands were rigorous, especially for students without prior web design experience. The vast majority of the students, though, rose to the challenge, irrespective of their technical expertise, or lack thereof. This held true despite dropping the prerequisite that students already have some knowledge of HTML. I knew that not everyone in the class—in particular not most of the Assistive and Special Education

Technology students—would go on to create web sites on a regular basis in their jobs or personal lives, but I treated them all as if they were learning to become web professionals, and I tried to be available to provide extra help when needed.

The assignments always included a final project of designing an accessible web site, as in the previous version of the class taught by Kristine. Most semesters also included an accessibility evaluation of an existing web site, which was another point in common with the previous class. In a few semesters—particularly during accelerated summer classes—I had students take a web accessibility test rather than submit a web site evaluation. The test was highly technical, but I made it open book (and open notes and open internet), and told students that they had to get an "A" on the test for the score to count at all, and that they were allowed to take it as many times as necessary to achieve an "A." The intention was to emphasize a high standard of expertise, but also provide students every opportunity to learn the correct answer. After all, part of learning, especially in today's digital world, is knowing how to find the answers when you do not have them yet. In fact, I took this approach with most of the assignments. When students received grades less than an "A," I usually provided them an opportunity to resubmit the assignment with corrections to improve their score. This created more work for me, but it also increased the chances that the students would actually learn the material. This approach also helped minimize problems later on in the class. The technical material was cumulative, much like math, so if students fell behind early, they were likely to only fall further behind unless given the chance to catch up.

Another factor that I took into account in grading was the students' participation in class discussions, either in person or online, depending on how the course was taught that semester. The discussions were critical because they provided a way for me assess the extent to which the students were considering the personal and social ramifications of web access barriers, the legal requirements, and other social aspects of accessibility that are difficult to assess with technical projects alone. I asked them to react to videos, articles, and other materials. The majority of students knew little or nothing about web accessibility before taking the class, so many of their first posts discussed how they had never given the matter any thought. Some mentioned how surprised they were that people with disabilities, for example a blind person, could even use computers at all. They were similarly amazed at the technologies available to help people with disabilities. They often expressed dismay that some people would oppose accessibility regulations and that so many web sites contained such a large number of accessibility errors. Some of the surprise, amazement, and dismay may have been a case of the students telling the instructor what they thought the instructor wanted to hear, but most of their comments seemed genuine. As the semester progressed, students had to face the challenge of learning the technical behind-the-scenes code of web design, and their initial responses of "of course they should make the web accessible to people with disabilities!" soon met with the reality that it takes time and expertise to make the web accessible. This added a dose of realism to the class discussions. The ongoing discussions were a helpful barometer of the students' progress, perceptions, and learning processes.

Starting with the summer 2011 semester, Kara Zirkle took over the duty of teaching the Web Accessibility and Design class. Ms. Zirkle is Mason's IT Accessibility

Coordinator, within the Assistive Technology Initiative (ATI) associated with the campus's Office of Equity and Diversity Services (OEDS). Her normal duties at Mason include training Mason's web developers in accessibility techniques, ensuring that Mason's information technologies comply with Section 508, testing web applications for accessibility, working with instructors to make online classes accessible, and various other accessibility-related tasks. Teaching the Web Accessibility and Design class has been a new and challenging experience for her, but also a valuable one because it has allowed her to better understand the instructor's point of view. "It was interesting," she said, "because I finally fell on the other side of what I was trying to talk to others about. And I realized how difficult it really is to sometimes find accessible videos" or other accessible instructional content. "Of course, it's also convenient that I'm working here in [the Assistive Technology Initiative] office, because I can just submit the video and say: I need this captioned. But that's the goal that we eventually want to get to for any other faculty. So now I've turned to be the guinea pig in that aspect for this office."

Ms. Zirkle looked at the syllabi for past versions of the course for inspiration, and then created her own course design. As in previous iterations of the course, she asks students to design an accessible web site for their final project, and she asks them to write an accessibility evaluation of an existing web site. Since Ms. Zirkle has to evaluate the accessibility of Mason web sites as a part of her main job, she wisely decided to have her students evaluate Mason web sites for their assignment. There are far more Mason sites than she'll ever be able to evaluate formally on her own, so assigning Mason sites to students saves her some of the effort, and gives her students the experience of formally analyzing the accessibility of someone else's web site.

Ms. Zirkle also includes class discussions in the grading criteria. She asks students to participate in the online discussion forum in Blackboard, as I did when I taught the class. In addition, she allows extra credit for students who post peer reviews of other student projects in the class. The discussions and peer reviews help foster a social atmosphere and a sense of community, or at least a sense of collective task engagement, in an otherwise solitary online learning experience.

Dr. Dabbagh and Dr. Behrmann both remain committed to keeping web accessibility as a core part of the curriculum, and indicated that the other faculty members generally support accessibility in the curriculum as well. With Dr. Dabbagh as the Director of the Division of Learning Technologies and Dr. Behrmann as the Director of the Division of Special Education and Human Disabilities, every student who enrolls in the programs in these divisions will take the Web Accessibility and Design course. Approximately 300 to 400 students have already taken the class. Some of them have even gone on to specialize accessibility in their careers. At a minimum, these students became aware of the need for accessible technologies, and with this knowledge, they at least have the opportunity to influence the accessibility of the technologies they work with on the job or in their personal lives. This will continue to be true for increasing numbers of students for as long as Mason continues to include a class on Web Accessibility and Design as a required part of the core curriculum.

**Summary**

The idea for the Web Accessibility and Design class at Mason emerged out of the practical need to train students in web accessibility principles and skills, in large part because of the sponsored projects that Dr. Behrmann brought to the Instructional Technology program, many of which included disability access requirements. The Instructional Technology program needed some way to provide the training to their students in order to fulfill the requirements of the projects. At first this training was provided on an ad-hoc basis, but Ms. Neuber eventually took the initiative to hire web accessibility consultants, learn HTML herself, and teach a semester-based class on web accessibility. When the curriculum committee restructured the curriculum in 2005, they voted to promote the web accessibility class from an optional 2-credit class to a required 3-credit class. At that point, the department hired me to teach the class, with more of an emphasis on the technical design skills. I taught the class for about six years, after which Ms. Zirkle took over the teaching responsibilities. The current Director of the Division of Learning Technologies, Dr. Dabbagh, has said that she recognizes the value in teaching accessibility, both for the ethical reasons and for the practical reason that many of the employers in the Washington DC area value Section 508 expertise, in order to meet federal government requirements. The Instructional Technology program's history of supporting disability-related initiatives, combined with its close association with the Special Education and Assistive Technology programs demonstrate that the faculty in the Instructional Technology program have successfully sustained their commitment to ICT accessibility, and have ingrained it as a core value in the curriculum.

## Case 3: Middlesex University, London, England, UK

### Overview

The digital inclusion master's degree program at Middlesex University in London, UK, was designed for professionals already working in fields such as web accessibility, technology policy and ethics, or other aspects of digital inclusion, or who work in a digital environment and are interested in increasing their knowledge about digital inclusion issues. This part-time degree was delivered in a blended learning format, with most of the content being taught online. The program took about two to three years to complete. According to the program's web site, "The course will enable you to have the relevant knowledge, personal and professional skills and competencies to design, develop, implement, evaluate and manage a wide range of information and communication technology systems, products and services that adhere to the principles of social inclusion. You will cover the legal and regulatory framework, web accessibility and inclusive design." The first set of 12 students enrolled in fall 2010. Enrollment in the program declined, though, and I found out in early summer of 2010—after writing most of this dissertation—that the program had been discontinued because of the low enrollment.

### About the Interviewees

Gill Whitney received a master's in information engineering from City University in London and a bachelor's degree in electronic engineering from the University of Kent. She is a principal lecturer at Middlesex University and was the course leader of the university's Digital Inclusion master's program. She teaches courses in computer hardware and input/output devices, including the use of assistive technologies by people with disabilities. Ms. Whitney is the head of the Design for All Research Group, the UK partner of the European Design for All e-Accessibility Network (EDeAN). She is also chair of the Design for All and Assistive Technology Standardization Coordination Group (DATSCG, a working group of the ICT standards group), and a member of the Special Needs Working Group of ANEC (the European Association for the Co-ordination of Consumer Representation in Standardization), and is involved with other standards organizations and initiatives. Previously, she worked as a principal researcher at the Royal National Institute of Blind People (RNIB) for 13 years, and has long been an advocate for people with disabilities and a supporter of assistive technology initiatives and research. Ms. Whitney talked about her involvement with a disability-related research project creating thermometers with audible output for blind people as a part of her work with her advisor during her graduate studies. Apparently that project whetted her appetite enough to continue along that path, despite admitting in the interview that, in hindsight, "the entire project was useless" and failed on a practical level to accomplish its goals. Modern incarnations of this same idea are much more useful, she said. For her, the entry into a disability-related career was a natural progression from the starting point of the work that she did as a graduate student.

Suzette Keith received a master's in ergonomics from the University of London. At the time of the research for this dissertation, she was a research fellow at Middlesex University, where she engaged in research initiatives related to web accessibility, human-computer interaction, technology and aging populations, and assistive technologies. She also taught the web accessibility component of the digital inclusion master's degree and worked closely with Ms. Whitney throughout the curriculum planning process for the digital inclusion degree. Before working at Middlesex University, she was a human factors consultant for ITT (a telecommunications company) and Phillips (an electronics company). She is a Fellow of the Ergonomics Society and a member of the HCI and Disability groups of the British Computer Society (BCS). She is currently an independent consultant on accessibility, usability, and digital inclusion. Ms. Keith's interest in disability issues began as a master's student researching blind people working as telephone operators. She did not go into detail in the interview as to what prompted her to study blind people in the first place, but this early interest has apparently not abated in her, because she has dedicated her professional career to the study of digital inclusion, from the perspective of both disabilities and aging populations.

Mark Springett is a senior lecturer at Middlesex University. During his Ph.D. research, he studied user modeling and the evaluation of direct manipulation interfaces. Since then, he has worked and published extensively in the field of usability and user experience across a wide range of systems, including tools for design, tools for evaluation, and how to understand both product and process. He taught a class in inclusive design and user experience as a part of the Digital Inclusion master's degree. He is the Vice Chair of the EU COST Action IC0904: Towards the Integration of Transectorial IT Design and Evaluation. He is keenly interested in ensuring that devices are not merely accessible or even usable, but that they also meet the criterion of being "fit to purpose," meaning that the intended user actually wants the device, and the device serves its purpose in the way that the user wants it to, rather than just having a device that conforms to standards of accessibility or usability. Dr. Springett's pathway into disability-related studies began with his interest in human-computer interaction (HCI). His early work was not disability-specific. He published papers on interface design, the psychological and affective components of human-computer interaction, and the modeling of user needs, among other things. His association with Ms. Whitney and Ms. Keith at Middlesex University heightened his awareness of disability issues, and the three of them began to collaborate on projects, allowing him to apply his HCI expertise to disability-related scenarios. He is still more likely to characterize himself as an HCI expert than as a disability expert, but his work with the Digital Inclusion program extended the reach of his career into the disability field.

**Legal Context**

The legal context in the UK includes the Disability Discrimination Act (DDA) of 1995 (Disability Discrimination Act 1995, 1995), which made it illegal to discriminate against individuals with disabilities in terms of employment, the provision of goods and services, education and transportation. The code of practice for the Act specifically mentioned the need to make websites accessible. Most of the DDA was superseded by the Equality Act of 2010 (Equality Act 2010, 2010), which protects a broad range of categories of UK citizens, specifically age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, and sexual orientation. The European Union directives 2000/78/EC and 2000/43/EC also played a role in setting the tone in the UK, as it did in Austria, but the enactment of the DDA prior to the release of the European Union directives meant that those directives did not require as significant a legal change as they did in Austria. The forthcoming European Commission Mandate 376 will require European member states to comply with procurement guidelines, similar to Section 508 in the United States, but as of yet these requirements are not official or binding.

## A History of the Digital Inclusion Curriculum at Middlesex University

The idea for the Digital Inclusion master's degree at Middlesex University had its origin in the international collaborative projects in which Ms. Whitney and Suzette Keith were involved. They formed the Design for All Research Group at Middlesex University as the UK partner with the European Design for All eAccessibility Network (EDeAN), a network of 160 organizations in Europe that promotes design-for-all efforts and provides a forum for sharing ideas between the member organizations. Discussions with the EDeAN partners about the need for more accessible digital technologies led to the consensus that, in Ms. Whitney's words, "It's no use insisting that things be designed accessibly if people don't know how to do that." Louder or more forceful calls to make things accessible would be a waste of effort unless there were a way for people to learn what digital accessibility means and how to implement it. The EDeAN partners agreed that current education and training resources were insufficient to meet the need, so they identified four strategic areas where they could make a difference in accessibility education: (a) undergraduate education, (b) master's level education, (c) training the trainers, and (d) training the support and sales staff of technology companies to be able to address the needs and concerns of clients with disabilities. Ultimately, the ideal would be to teach accessibility at some level to everyone who has a hand in the creation and distribution of digital content and devices. As a step in that general direction, Ms. Whitney and Ms. Keith—Joined later by Mark Springett—decided to take on the challenge of creating a master's level curriculum. This curriculum eventually became the Digital Inclusion master's degree at Middlesex University. The first group of twelve students began the program in the fall of 2010.

The goal of the master's degree in Digital Inclusion was to produce specialists and leaders in the field of inclusive design and accessibility of digital technologies. The program taught some technical design techniques, as would be expected, but because this was a master's degree, it needed to approach the subject matter from an academic vantage point, and not merely train the students to be technicians, as a bachelor's program might do. Students in the Digital Inclusion program were expected to engage in research and to communicate research findings verbally and in writing, in addition to learning the practical skills of creating inclusive digital content. The small scale of the program (twelve students in the first group) allowed students and instructors to get reasonably well acquainted with one another and engage in dialogue about the instructional content.

The curriculum included four 12-week modules, plus a final thesis. See Appendix J for the list of topics. Only one module is taught per term, which spreads the coursework out over two years of part time academic work. The four modules in the Digital Inclusion curriculum were: (a) fundamentals of digital inclusion (taught by Ms. Keith); (b) design-for-all regulation, legislation, and standardization (taught by Ms. Whitney): (c) inclusive design and user experience (taught by Dr. Springett); and (d) accessible web design (taught by Ms. Keith). To some degree, the modules followed an incremental sequence, with the teachings of each module building upon the teachings of the previous module(s), but because students were allowed to enroll at any point in the program, the modules needed to be flexible enough to accommodate learners with only limited background knowledge. New students needed to be able to dive right into the current module and not feel completely out of step with the other students in the program. When I interviewed the instructors, this scenario had not yet presented itself to the them, but they each felt confident that they could accommodate students in this situation should the need arise.

The module on the fundamentals of digital inclusion provided an introduction to the program as a whole and gave an overview of the major concepts that comprise the concept of digital inclusion. Students learned some of the basics about types of disabilities, assistive technologies, web accessibility, laws and standards, social implications, and in general the students got a feel for what they would study more in depth in the other modules of the program.

The module on design-for-all regulation, legislation and standardization covered technical standards, such as WCAG 2.0, and gave a broad overview of relevant laws around the world. Even though the Digital Inclusion program was based in England, Ms. Whitney felt it was necessary to discuss the legal picture from an international perspective, partly because the instructors hoped to attract students from many countries, and partly because of the global reach of digital technologies. The course covered laws in the UK, Ireland, Australia, Europe, the United States, and other countries and regions. Section 508 of the Rehabilitation Act in the U.S. received particular attention because of the wide-reaching impact the law has had in industry and in influencing laws in other areas. Mandate 376 in Europe, for example, follows the lead of Section 508 by affixing accessibility standards to government procurement procedures. If the course materials had limited the discussion only to English law, students would have missed out on the global context.

Beyond just making students familiar with existing laws and standards, the module on design-for-all regulation, legislation and standardization sought to make students competent at participating in the process of writing new laws, standards, policies, and procedures. In some cases, the legal and standards work that graduates of the program will do will affect whole countries or regions, or even have a global reach. More commonly, though, graduates will be called upon to write internal policy and procedure documents for companies, organizations, and government departments. These documents will interpret and operationalize existing standards and laws, simplifying them into understandable action items, and perhaps affixing personnel resources and line items to them in the budget. It is these internal policy and procedure documents that have the potential to distill the most salient elements of the often complex laws and standards into manageable processes within organizations.

The module on accessible web design began with some instruction in the basics of web site creation, such as HTML markup, how to use FTP to upload files to a web server, and so on. The class did not go into much detail about CSS, JavaScript, or other technologies that are more particularly the domain of dedicated professional web developers and programmers. Ms. Keith talked about the challenge of teaching web accessibility to a mixed audience with widely divergent technology backgrounds.

> I'm trying to set the assignment so it can be completed at a master's level, but they can play to their strengths within those assignments. I'm not asking them to design a fully accessible web site. They've only got 12 weeks, and they're only part time, so that would be impossible. So I'm aiming more for competence at the management, commissioning sort of level, so they'll have a deep enough understanding of the major issues, and where the barriers are to accessibility. They'll understand enough that they can plan and commission a web site and be confident that they know what the accessibility issues are that should be covered, that are defined by the web content accessibility guidelines, obviously, but also other materials that support issues that are not covered in there. The guidelines don't necessarily cover things like cognitive issues so well, and they're not as strong on aging as they are on some of the other conditions.

Ms. Keith recognized that what she teaches in the class would be insufficient if the goal were to turn all of the students into web developers specializing in accessibility, but she pointed out that there are other ways of acquiring web development expertise, such as through books on the subject, online resources, workshops, and so on. The approach in her class was to look at the issue from a higher level of leading and coordinating design projects. Leadership in this area requires some familiarity with the general concepts, but does not necessarily require in-depth knowledge of the techniques and technologies themselves.

The module on inclusive design and user experience explored human-computer action, usability, and the social implications of designing technologies for special needs populations. Dr. Springett explained that designing products for a positive user experience involves more than simply meeting the minimum requirements of accessibility or usability guidelines. It even went beyond making sure that the target user group can use the products.

> When we look to the design of domestic technologies, for example, including entertainment technologies for people with visual impairments, or kinetic disorders, there were quite often tradeoffs between the most accessible solution that would satisfy a set of guidelines and what people actually wanted. And working around that can be quite difficult. For example, you would get these remote control designs for people with visual impairments…so you can imagine you've got something of that size [holding an object of 12" by 6" by 6"], and it would be a big clunky thing that you've got a real problem manipulating. But the bigger problem for some people was that these were sitting in their living rooms, and when people came around to visit, there was this artifact that screamed "this person is disabled!" So when you were trying to understand requirements, there were clearly aspects that you would never get at. The non-functional grounds would include: is it socially acceptable? Does it have an emotional value? Is it going to be accepted by the person? And clearly, there are a number of designs that, while they satisfy all of the on-paper criteria, aren't fit for purpose, which in this case means fit for the person's experience, temperament, or sense of identity. So when you add the experience factor into inclusive design, the inclusion doesn't stop at inclusion into an enabled user group. It goes beyond that to what the technology represents. It's inclusion in a social group. It's inclusion in the wider world. It's a much wider context.

Dr. Springett challenged his students to think creatively about the target audience and to involve the target audience throughout the design process, from conceptualization, to planning, to prototyping, to manufacture and distribution. He wanted to make sure that the students address the actual needs and desires of the target audience. Too many times, people outside of the target audience think they have a great idea to solve someone else's problem, only later to find out that they misunderstood what the problem was in the first place, or that their proposed solution misses the mark.

The Digital Inclusion program attempted to address a wide spectrum of technologies and situations, not just web accessibility. The program investigated the impact of digital technologies not just on people with disabilities, but also on aging populations, people in rural areas, and people in other categories who may experience social and/or economic exclusion with respect to digital technologies. Web-based information technologies fit within this scope, as do such products as interactive television, mobile telephones, computer hardware and software, game controllers, and so on. The program did not address issues with nondigital technologies, such as the built environment (e.g., the need for wheelchair-accessible buildings, or blind-friendly train station platforms), biomedical issues, mechanical assistive technologies (e.g., page-turners to help people with limited manual dexterity read books), or personal care for people with disabilities.

The instruction was taught in a blended format. Students met with the instructors on the Middlesex campus for one week at the beginning of each semester, then returned to their homes and places of work for the rest of the semester, during which time the instructional interactions occur online. In principle, the entire curriculum could have been taught online, but the instructors felt it was important to meet the students personally and allow them to meet each other. Despite the many advances in technology facilitating online learning, the instructors felt that face-to-face discussions could still often feel more natural, providing immediate feedback and reciprocity in conversations, which can be difficult to achieve with off-site technology-mediated communication. The periodic face-to-face interactions at the beginning of each semester helped everyone to feel more comfortable with each other and establish professional relationships, hopefully making it easier and more likely that the people would continue to interact with each other later in the semester when the internet is the main medium of communication. The face-to-face time also allowed for hands-on demonstrations of assistive technologies or other topics that similarly involve visual or kinesthetic learning.

The degree was designed to be a 2- to 3-year part-time program, in order to attract and accommodate students who are already working in the field and who wish to receive an academic degree to validate their expertise, or who simply wish to receive additional training and network with other digital inclusion professionals. Many of the students enrolled in the program already worked in capacities that require inclusive design expertise. Many of them worked for the government. Others worked for private enterprises, including at least one who was self-employed in accessibility-related work. The instructors often found that they learned from their students at least as much as the students learned from them, especially in the case of students in the program who have disabilities. Their first-hand experiences of living with a disability gave a sense of immediacy to the subject matter, and enhanced the experience for everyone. Dr. Springett hoped that the students would continue to collaborate with and seek the opinions of people with disabilities in their future work, because, as Dr. Springett explained:

> In one sense, [people with disabilities are] immediately experts, because they're fantastically knowledgeable about coping with the world through their own experience, so they're an absolute mine of information. Whenever you do knowledge solicitation, or requirements solicitation, you've got various different flavors to it. Interviewing a domain expert is different from interviewing Joe Public. The nature of the solicitation, the sort of information that you're likely to get, the perception of where you're coming from, you know. If you get a hundred kids and ask them about mobile phone designs, that's very different than getting a single domain expert in a room and eliciting their highly specialized knowledge. And of course, with people who have disabilities themselves, you've got an absolute mine of expert knowledge. So those people have a particular perspective, even if they're not working in the area themselves.

The admission requirements did not specify any technical prerequisite knowledge, so there was quite a variety in the skills and knowledge sets of the students enrolled.

Some of the students were familiar with HTML and web design, for example, and others had never designed a web page before, such as the students who were more interested in the legal and administrative dimensions of digital inclusion. As Ms. Keith explained:

> We deliberately encourage students who are from different backgrounds, so there are one or two from web accessibility or web design issues. We have someone who builds their own accessible websites. We've got somebody who teaches people who are socially disadvantaged, who, as far as I know, doesn't have much understanding of what goes on underneath. We've got to find an approach that allows for that mixed ability. And we wanted that mixed ability, because web design is complex, so we need to come into it from all sorts of directions.

This kind of variability contrasts with what one might expect in more explicitly technical programs such as computer science or systems engineering. The wide variability among students in the Digital Inclusion program meant that there was room for interpretation as to what the outcomes would be for a given student. The students chose projects that aligned with their particular career trajectories, especially for their final thesis.

Teaching such a diverse set of students presented its own challenges. Instructors had to adapt the materials to the specific students in the program, taking into account all of the variables that this entails. They could not take for granted that students had any particular knowledge base. Teaching the HTML content in the web accessibility module can be a particularly tricky and "interesting challenge," as Ms. Keith called it. Some of the students were already HTML experts. Some even made a living as web accessibility specialists. The students who were more interested in policy, standards, or administration, however, may never create another web page after finishing the course. At a minimum, she wanted all of her students to be able to "speak intelligently about web accessibility" and have some knowledge as to what is involved in the process of accessible web design, so she had everyone create and evaluate web content as a part of the class. After all, these are master's level students, presumably fully capable of understanding many kinds of information, and presumably self-motivated enough to spend additional time learning about areas in which their knowledge is weak. The instructors saw the student diversity as a challenge, to be sure, but they did not worry about the students' capacity or motivation to learn. Dr. Springett actually took the time to point out that

> it's been a small but highly motivated market. Sometimes in university courses you get a deluge of students who are not necessarily all that motivated. It's numbers, and it's quantity over quality, so you get an awful lot of people registering. It can be difficult to administer, and to give people the service and attention, and quite often you find that a third to a half of them aren't that interested, and you've got to poke them with a stick all the time.

Dr. Springett claimed that no poking or prodding was necessary with these students. They wanted to be in the program and they want to learn.

Unfortunately, interest and enrollment in the program dropped precipitously, and by spring of 2012—after I had nearly completed this dissertation—it had been discontinued. The first sets of students were passionate about the program, but apparently the pool of passionate students was too shallow to sustain the program on a continuous basis. The untimely demise of the program echoes the experiences at the University of Linz several years earlier. The first students in Linz's Barrier-free web design program were passionate about the topic, and enrolled in the program despite the cost and time investment. After the first set had enrolled, though, only a small number of potential students remained who were similarly passionate about the topic enough to want to enroll in the program in the future. Faculty at Middlesex University hoped they could succeed where the University of Linz had failed, but ultimately fell victim to the same fate.

## Summary

The idea for the Digital Inclusion master's program emerged as a consequence of the involvement of Ms. Whitney and Ms. Keith in European-wide committees and standards groups, in particular their involvement with EDeAN. The members of EDeAN identified the need for training as an important area of focus, and Ms. Whitney and Ms. Keith took it upon themselves to create a curriculum to meet that need. They designed a new master's degree program that specializes specifically in inclusive ICT technologies, rather than incorporate accessibility components into an existing curriculum. The curriculum addressed a wide range of topics within inclusion, such as rural access, aging populations, people with disabilities, and other underserved groups. Classes covered legal topics, web accessibility, policy, leadership, hardware and software, and user experience. Students in the program typically already worked in some aspect of the field and were looking to receive an academic qualification or certification to further their professional goals. To the great disappointment of all of the faculty members involved, enrollment declined and the program had to be discontinued after a brief run of only about 2 years.

# CHAPTER V

# PART II: CROSS-CASE THEMATIC ANALYSIS

The second main task of this dissertation is to discuss themes that emerged from the case studies as I gathered data, wrote the case study narratives, and analyzed recurring ideas within the data. The list of themes here represents my own interpretation of the information available in the data sources, which include interviews, syllabi, conference papers, web sites, and other documents. I have included quotations from the interviews or documents in my analysis, to provide an evidential basis for my interpretations. Nevertheless, because of the subjective and qualitative nature of this analysis, other readers—including the interviewees in the case studies—may have reason to interpret the results differently. With that caveat in mind, I present this cross-case thematic analysis as a starting point for discussion about the topics and a representation of how I view the data that I gathered.

## Topic 1: Curriculum Goals and Rationale

### Overview

It seems fitting to start this thematic analysis by first asking what the goals and rationale of an accessibility curriculum would be. Why would a curriculum about accessibility or digital inclusion be worth teaching in the first place? The most straightforward answer is that everyone I interviewed wanted to improve the lives of people with disabilities. They thought it was a worthy endeavor. None of the interviewees chose to enter this career field for either fame or money, both of which have always been in short supply within disability-related fields. Four main themes, or lines of thought, emerged in the interviews and documents that I reviewed regarding the original motivation for creating the curriculum. First, people in this field want to transform society to make it more accessible and inclusive. Second, they want to meet the demands of the job market. Third, they want to infuse accessibility and digital inclusion into a wide range of interdisciplinary curricula. Fourth, they want to raise the bar in the accessibility field, academically and professionally.

Before jumping directly into the themes that motivated the creation of the curricula, it is helpful to keep in mind one kind of motivation that is conspicuously absent in the list of motivators: external mandates, directives, or pressure. Not once did any of the interviewees mention that they were told to create the curriculum by university administrators, lawmakers, accrediting bodies, professional organizations, or anyone else in a position of authority. Not once did they say they felt pressured, coerced, or prodded into creating the curriculum. Not once did they say that outside organizations would judge them by the existence or absence of an accessibility curriculum, nor judge the curriculum's quality. No funding sources were at risk for failing to teach accessibility. All three of these institutions could have continued as they were without an accessibility curriculum without suffering consequences imposed from outside. In fact, several of the interviewees made a point of explaining how difficult it was to get others to buy into their vision for a curriculum about accessibility and digital inclusion. The experiences of the people that interviewed suggest that accessibility, if it is considered at all, is usually relegated to a rather low priority. The motivation and the hard work of implementing the curriculum at all three of the institutions in this study came from within.

### Theme 1.1: Transforming Society to Make it More Accessible and Inclusive

The main rationale expressed by the interviewees for creating a curriculum to teach accessibility and digital inclusion is to transform society to improve the lives of people with disabilities by ensuring they have “full access...to information and knowledge-based society...promoting social and economic inclusion” (Hengstberger et al., 2008). The people that I interviewed believe that accessibility and digital inclusion are worthy goals, and that creating curricula to teach accessibility and digital inclusion will move society closer to that goal. As Ms. Neuber said, “To me it was all about my passion, which is making sure that people with disabilities can do what they want to do to reach their potential.” Variants of the phrase “it’s the right thing to do” appeared in all of the interviews. The interviewees are driven by an internal desire to move the world toward a better balance of justice and inclusiveness. This is the goal in the broadest sense, and it is this goal that situates the topic within discussions of human rights, human capabilities, and personal empowerment. They all spoke in terms consistent with the capability approach to human development as articulated by Sen and Nussbaum, though none of them invoked it by name. As stated in a European-wide report prepared for the European Design for All e-Accessibility Network (EDeAN), to which two of the interviewees—Dr. Miesenberger and Ms. Whitney—contributed:

> The socially inclusive and universally accessible Information Society is a critical quality target and a global requirement that entails coping with diversity.... Access to information is a basic right and the increasing amount of publicly available information is even more important for people with disabilities and other groups

> at risk of exclusion.... [There is a] growing demand expressed nowadays for online services and tools that are universally accessible and usable, so that the entire population can benefit and be(come) active. This attitude towards the development of accessible and usable goods is an ethical and political necessity. (Klironomos, Antona, Basdekis, & Stephanidis, 2006)

In a promotional video for the Digital Inclusion program, Ms. Whitney explained that "Digital inclusion is the way, both theoretically and practically, that technology can be designed to enable people to participate in society, to enable them to have fun with technology, [and] to work" (Whitney & Keith, 2011). The interviewees want to help compensate for the disabling effects of biological limitations and exceptionality. They want to expand the availability of accessible technologies to help mitigate the effect of actual physical disadvantages caused by disabilities. The Digital Inclusion program expanded the scope to "older people, and disabled people, as well as other socially, economically or geographically disadvantaged groups" (Middlesex University, n.d.). Beyond this, they want to transform societal expectations about disabilities by removing the socially constructed barriers of ignorance, prejudice, and apathy that artificially constrain the lives of people with disabilities. In short, as stated in a paper to which Dr. Miesenberger and Mr. Batusic contributed, they want to improve the lives of people with disabilities by teaching making "global and local public information available for all citizens, independent of their social status or disability" (Ortner et al., 2004).

There is much room for improvement, as Dr. Miesenberger pointed out when he discussed the work of a doctoral student who developed tools to automatically benchmark web accessibility across different countries. Dr. Miesenberger explained that the study reported that a mere 1% of the web sites met basic accessibility standards at level A of the WCAG guidelines. This abysmal percentage improved to about 10-15% when analyzing government and public sector web sites. Dr. Miesenberger saw the significant (though insufficient) improvement among public and government web sites as evidence that conditions are improving, and that pushing for accessibility can make a difference, even if that difference is smaller than he would like.

The idea of creating a curriculum to teach accessibility or digital inclusion fits into the broader societal goals by providing a systematic method for increasing accessibility expertise among web developers, Ortner and colleagues (2004) wrote;

> The more web designers have consolidated knowledge about accessibility issues and the ways of overcoming them, the better the inclusion situation for people with disabilities and the bigger the chance of an independent living. The graduation of this course offers a new vocational field where especially disabled graduates can scoop out their experience and propose new, better solutions. (p. 184)

Strictly speaking, no academic curriculum is necessary to learn about accessibility or inclusive design. Interested individuals can turn to books and web-based resources on the subject, or learn directly from accessibility consultants, without ever setting foot in a college classroom. In truth, the same could be said of nearly any topic imaginable. There are always alternative avenues for learning about most anything, outside of university degree programs. Creating a university degree program adds a sense of legitimacy to the learning though. Working professionals and employers understand that receiving a degree or certificate in a subject means that the person has achieved a certain level of proficiency in that subject. Certificates and degrees validate a person’s knowledge in ways that self-study does not. An academic program also requires the collaboration of faculty to create the curriculum, promote the topic, research it, and write about it. It creates a community of practice among working professionals who may otherwise engage in the topic on a more solitary or sporadic basis. Academic programs raise the bar of expectations on the faculty as well as on the students. The interviewees consistently expressed their “hope that our project is also going to bring a portion of awareness in this area at universities. This would cause by and by that—in the field of web and software design—one or another seminar or even a whole module of our course becomes part of the university’s regular studies” (Ortner et al., 2004, p. 184). This brings the discussion back to the main rationale for creating a curriculum in the first place. The greater the number of universities teaching accessibility and digital inclusion, the greater impact their collective curricula will have on society as a whole, making it more inclusive for people with disabilities.

During the interview with Dr. Dabbagh, I reflected on the way that it is sometimes hard to measure or anticipate the impact of accessible design decisions when creating instructional technologies.

> Accessibility is one of those interesting things because you don’t always know if your learners are going to have disabilities or not, so, for example, if you’re a government contractor designing some training materials for, say, the employees of the Department of Motor Vehicles (DMV), or something like that, potentially you could have someone with a disability, but you might not. You know, it could be either way. But personally, I tend to look at it kind of like an architect who has to design for disability access to a building. The chances of someone with a disability coming in may be high, or may be low, depending on what type of building it is, but you just kind of don’t know. But your intended audience could be—let’s say it’s an office building for lawyers that you’re designing—and you know for a fact that none of the lawyers and none of their current clients have disabilities. It’s kind of beside the point in some ways, because eventually down the road, who knows if they hire someone with a disability? Who knows if they have a client with a disability at some point, and they’re going to need a bathroom that has accessible stalls, you know? So accessibility becomes one of those things that may or may not even be in your current audience—and you may not even

> know—but it's just one of those things that someone has to take care of, just like an architect does for a building. You do it as a matter of course.

It would be better to create the expectation that all digital content adheres to accessibility standards so that it is never a question of whether a person with a disability can access the content or not. All content would be accessible, just as all buildings should be accessible to wheelchairs. This change of attitude among those who create digital content would drastically change the digital information landscape and neutralize the threat of disablement by exclusivist technology design. That is the ideal.

### Theme 1.2: Meeting Demands of the Job Market

In addition to believing that an accessibility curriculum is the right thing to do, the interviewees also believed that graduates of these curricula would fulfill a crucial role in the job market. The creators of the Barrier-free Web Design were confident that interest in web accessibility was on the rise in the wake of the publication of the Web Content Accessibility Guidelines (WCAG) 1.0, Section 508 in the United States, and other developments at the time. In a conference paper about the start of the Barrier-free Web Design program, Ortner and colleagues (2004) wrote:

> The...endeavour to establish awareness towards the need to design and keep the Internet based on its basic principle of openness towards all users has shown impact all over the world. Web designers more and more [become] aware of this basic necessity. The public sector advocates that public information has to be accessible to all citizens and launched accessibility legislation accordingly. Industry and business also learn how design-for-all supports the general usability and thereby has a positive impact on reaching their goals. Due to that, an increasing demand for education, consulting and support in design-for-all can be seen. (p. 183)

Other early papers and literature about the Barrier-free Web Design program seemed equally certain that the market would support an academic program offering web developers the opportunity "to gain a comprehensive education in the field of Web Accessibility" (Ortner & Miesenberger, 2005). After listing several recent disability-rights laws across Europe Ortner and Miesenberger (2005) confidently contended that

> a trend towards integrating the need for Web Accessibility in the legislation can be recognized. As it is expected that Austria will follow this trend, the need for experts in the field of Web Accessibility will increase. That confirms the need for an educational offer in the field of Web Accessibility, so the postgraduate course is situated right regarding time and place.

This confidence in the demand for accessibility experts would prove to be a bit overly optimistic in the case of the Austrian job market, as will be discussed in the section on program sustainability, but the perceived market demand was one of the main original motivations behind the Barrier-free Web Design program.

Even as it became clear that the market demand in Austria was lower than they had anticipated, Dr. Miesenberger and his team thought that the demand across Europe would be sufficient to sustain an accessibility curriculum, so they launched the *web_access* initiative with a team of European partners. As that initiative got under way, he continued to make the case that the market would support an accessibility curriculum, saying that the proliferation of laws about accessibility "underlines the need for training for practitioners but also for more comprehensive and intensive education at academic level for experts in accessible web design" (Hengstberger et al., 2008). Unfortunately, the *web_access* initiative met with a lukewarm reception among the partners and potential students, eventually resulting in the discontinuance of the initiative, like the Barrier-free Web Design program before it. The perception of market demand did not match up with the realities of the marketplace, especially as the world markets entered into a sustained downturn.

The most recent attempt at the University of Linz to integrate accessibility into the curriculum is the Web Sciences program. Accessibility is woven into the fabric of the curriculum in multiple places, including dedicated classes on accessibility, workshops, lectures and presentations. The Web Sciences degree is not disability-specific though, and this is by design. The University of Linz feels that a Web Sciences program will attract a much broader base of students because it is easier to demonstrate the market demand for web site designers and programmers. Rather than concentrate on individuals interested in disability issues, the Web Sciences program takes the tactic of teaching all students about disability issues whether they are interested in it or not. It is too early to tell how this will play out, but all of the interviewees at the University of Linz expressed cautious optimism that this arrangement would fare better in the Austrian and European job market than the Barrier-free Web Design program or the *web_access* initiative.

The story is a bit different with the Web Accessibility and Design class in George Mason University's Instructional Design program. Because of Dr. Behrmann's involvement with multiple disability-related projects, there was a need for web accessibility training before the class itself existed. The funding for the projects came from organizations that requested accessible products, so there was no need to convince the funders of the need for accessibility. Dr. Behrmann had managed to successfully merge his interest in disability issues with the need for funding. He found a market and tapped into it repeatedly, purposefully seeking funding for disability-related projects.

This created a constant need to train students in accessibility principles, which led to the creation of the class, and eventually led to modifying the curriculum, making the Web Accessibility and Design class mandatory. Dr. Behrmann recalled some of the effects that all of this disability-related funding had on faculty and students.

> What happened is that the awareness of the importance of accessibility increased for the instructional development and design faculty. The second thing that happened is that our students who are graduating...got experience in actual development in development teams, so at the end of the year, they were going out in the government and public sector to look for jobs, and one of the big highlights that they had on their resumes was that they had been trained in 508 accessibility. Well, they were just sucked up by government and by contractors immediately, because they had no resources to meet the 508 requirements for their development people. That was really the reason that the instructional design faculty found this to be a critically important element in the training...The people who were hiring our graduates gave us lots of feedback: “we need people with this training. It’s important to us.” If it becomes important to the clients, the people who are hiring our graduates, it becomes an important element of providing it in the program.

Dr. Dabbagh recalled the perception among the faculty that a class about web accessibility would provide a market advantage to graduating students.

> We wanted to differentiate our web design course. All...people involved with technology design for learning should know something about web design. Initially we had a course that used to be just about web design so you would learn basic HTML, WYSIWYG Dreamweaver, [etc.], and how to design a website with an instructional goal or purpose, but we figured students can learn this pretty much anywhere in any curriculum. [Adding a strong accessibility component to that class became] the differentiating criteria for us...The government is all about 508 compliance, and we have an assistive technology track, and it’s all about accessibility, so why don’t we merge the two? I thought at the time it was a good decision and I still think it is.

Even though the most recent instructor of the Accessibility and Design course, Ms. Zirkle, was not involved in the decision to make the class a mandatory part of the Instructional Technology curriculum, she too mentioned market demand as a reason to teach accessibility principles as part of an academic program.

> More and more, you start to see, as students go out into the workplace, if it's going to be instructional design, or if it's going to be web development, or anything within an IT field of any kind, they are now asking questions about accessibility: their knowledge of it, can they code for web accessibility, and so on. And if we're not trying to influence that, then we're not preparing students as well as we could.

Overall, then, the perception among the Mason faculty is that a genuine market for students with accessibility experience exists, because employers have expressed a need for it.

Ms. Neuber, the first instructor of the Web Accessibility and Design class, had thought the job market, especially in the Washington DC area, would be a selling point for the class, even before it became a mandatory part of the curriculum. As she explained:

> We live here in the Washington DC area and people, when they graduate, sometimes want to get government jobs where they have to know what section 508 is, so I think that helps to push this into the curriculum in this area...I thought that it was a plus and a selling point...I would say that graduates are going to need to know [web accessibility] even if they're not working for the government. It's becoming more and more required under the Americans with Disabilities Act which makes it a public accommodation. I would be surprised if there are a lot of agencies that aren't requiring now that their web designers know 508, and not just web, but it covers, as you know, all the different technology pieces.

Apparently the rest of the faculty agreed with her, because 2 years after Kristine began teaching the class, it became a core requirement in the Instructional Technology program.

An important point of contrast between the Mason and the University of Linz is that Mason's students learned accessibility *in addition to* the rest of the curriculum about instructional technology, whereas the Linz's graduates focused *only* on web accessibility, making a direct comparison between them problematic. Perhaps the market for web accessibility experts is not as strong as the market for instructional technologists who happen to also know about accessibility. Another confounding variable is the difference in location: Austria vs. Washington DC. The demand for employees with Section 508 expertise may logically be highest in the city with the largest U.S. Federal government presence.

Whatever the reasons, the market for graduates of the Barrier-free Web Design program proved weaker than anticipated—or at least the program was not able to take advantage of the market—while the demand for Mason Instructional Technology graduates with web accessibility expertise proved solid.

The Digital Inclusion program at Middlesex bore a greater resemblance to the program at Linz than to the program at Mason. Both the program at Middlesex and the program at Linz sought to create expertise in a disability-related field, whereas the program at Mason seeks to create expertise in a field not specific to disability issues (instructional technology) while also addressing the needs of people with disabilities. It turned out that the market for the Digital Inclusion more closely resembled the Austrian experience or the Mason experience, because, like the Linz program, the Middlesex program had to be discontinued due to low enrollment. At the time that I conducted the interviews though, the creators of the Middlesex program touted the growing job market as one of their motivations for starting the degree program. As the program's web site explained:

> The new Digital Inclusion Masters is...a groundbreaking programme designed to meet the existing and continuing demand for experts in eInclusion. The relevance of this course is demonstrated by the increased focus on enabling digital inclusion both in the UK and EU, and the need for a professional workforce. The Council of the European Union in their conclusions on the accessible information society called on stakeholders to "provide information, training and support to relevant ICT developers, implementers and deciders in the public, private and non-profit sector." (Council of the European Union, 2009)

Despite the confidence expressed on the web site, the Digital Inclusion faculty members were fully aware that their program has positioned itself in a rather precarious position, being the only master's degree of its kind in Europe (especially after the demise of the Barrier-free Web Design program). "The worry always is with these courses," admitted Dr. Springett, "that you can validate it, and it can be a very good and well-designed degree, but then you need to worry about whether you're going to find a market." At the time of the interview he said:

> It's been a small but highly motivated market. Sometimes in university courses you get a deluge of students who are not necessarily all that motivated. It's numbers, and it's quantity over quality. So you get an awful lot of people registering. It can be difficult to administer, and to give people the service and attention. And quite often you find that a third to a half of them aren't that interested, and you've got to poke them with a stick all the time. Whereas we got a small number of people who...have been active in the area.

Ms. Whitney reflected on the relatively small student enrollment in the first cycle of the program.

> It's a small number [of students, but] we're pleased it's running. It got nominated for an award by the International Standards Organization. It's been praised by the government—the representative in this area. It's got a lot of kudos attached to it. But yes, it's a small course. We'd love to be teaching it to two times the number, three times the number, four times the number. But it costs money, and it's a commitment, and we're not in economic times when people necessarily are going to try something which is slightly risky.

This dose of realism helped temper the enthusiasm that the faculty had, and motivated them to seek creative ways to continue promote their programs and tap into as many sectors of the market as they can. In the end, their premonitions and worries proved to be better predictors of the future than their hopes and enthusiasm. Enrollment declined, and the Digital Inclusion program was discontinued after only a couple of years in existence.

**Theme 1.3: Infusing Accessibility and Digital Inclusion into a Wide Range of Interdisciplinary Curricula Throughout the World**

A common theme in the interviews is the desire to influence the technology curriculum elsewhere, across other academic institutions and across as many academic disciplines as possible. This sense of evangelism pervades the documents and interviews that I reviewed in my research. Dr. Miesenberger expressed his interest in the dissemination of the curriculum from the beginning. In one paper, he explained that the curriculum could be adapted to other academic disciplines: “The curriculum is designed following a modular approach, which allows that single lectures can be changed and also used for other teaching purposes. Some lectures could for example be easily integrated into the regular lectures for computer science students or to provide training for interested companies and organizations” (Ortner & Miesenberger, 2005). Soon thereafter in another paper he wrote about his ambition of spreading the curriculum to other universities: “After successfully starting the course in Austria first considerations and negotiations have been started to offer the course also in other countries and languages. This of course asks for localizing the content. Such co-operations should guarantee the offer in the long run and an efficient and cost effective organisation and updating” (Miesenberger, 2006). From the earliest stages, the curriculum was “designed following a modular approach, which should guarantee that single lectures can be used also for other teaching purposes. Some lectures could for example be easily integrated into the regular lectures for computer science students or to provide training for interested companies and organizations” (Ortner & Miesenberger, 2005). In my interview with him, he explained;

> My plan was to run it for 2 or 3 years at our university, then step by step develop cooperations [or partnerships] with other universities, sharing the teaching load with German universities, and we would develop something like a joint master. A joint master is much easier to run if you have a master at one university and then the other universities jump in. It's a chicken and egg problem. If it would run properly at one university, I'm quite sure that other universities would start to jump in and...share the financial risk.

He reasoned that if other universities adopted all or part of the curriculum, that would increase the acceptability of accessibility among universities, employers, and students, thus helping ensure the longevity of his own program.

In his second attempt to establish a web accessibility curriculum, Dr. Miesenberger reached out to six partners across Europe (five universities and one company), with the express purpose of having as many of the partners as possible adopt parts of the curriculum. He wanted the *web_access* initiative to serve as a model to educators throughout Europe and across the world. Only two of the partners ended up creating a curriculum based on the *web_access* materials.

Even after the disappointing end of the *web_access* initiative, in the interview, Dr. Miesenberger continued to express his desire for the accessibility curriculum to spread. "We are considering launching a new initiative," he said, "which intends to set up a European master in this field with different partners, based on the materials which we already have." In reference to my own work in the United States, he said:

> It might also be a possibility to look for partners in the United States. Why not, if it's a blended learning experience? They could do the practical training here, but they could do a course in whatever part of the curriculum. They could do it at George Mason if we have an agreement and it's accredited for the master here. And vice versa. The lectures we're doing here, we have it in English. Students could do it online together with us. It could be accredited, and this might be a possibility to come to a master.

For the time being, though, Dr. Miesenberger is content to work on the accessibility component of the Web Sciences degree. In some ways, this is a step down from his grand plan to host a master's degree specializing in web accessibility, but in other ways it is a step forward, because far more students at least will be exposed to accessibility, even if they do not learn enough in the classes to become accessibility experts. He would be equally content to see this model of accessibility curriculum spread across the teaching of all technologies.

The Digital Inclusion curriculum grew out of the involvement of the faculty at Middlesex University in European-wide initiatives supporting disability rights. Ms. Whitney recounted:

> The idea for more training, for the masters, came from the European Design for All eAccessibility Network (EDeAN), and also from a meeting instigated by the European e-inclusion unit (an organization which now called Digital Europe, but which used to be called EICTA—the European ICT organization)...and with EDF: The European Disability Forum.... Together we decided that it's no use, in the European Disability Forum, insisting that things be designed accessibly if people can't do that.

They committed to create a set of European-wide curriculum guidelines that could be implemented at the local level. The overall concept was very much in line with the University of Linz's *web_access* curriculum, and indeed the curriculum topics overlap. The difference was that the *web_access* curriculum focused exclusively on web accessibility, and the ideas of the EDeAN partners extended beyond web accessibility to include rural populations, aging, and other accessibility concerns that are not necessarily disability-specific. The Digital Inclusion curriculum took this broader—and often less technical—approach. Continuing in her explanation of the goals of EDeAN, Ms. Whitney explained:

> [We need to develop a curriculum] not just the people who can code accessible web sites, but the managers and higher-up are demanding accessible web sites, so that people know what to request, what to demand, and how it can be done. So we're seeing a complete, layered approach to education. Looking at this layered approach to education, who needs to be trained? The discussions [at EDeAN] between these groups identified four levels of training, of which masters is one...The ultimate aim of EDeAN is that all students have some introduction to design-for-all in their undergraduate course, and this will be a short element. What we're writing at the moment at EDeAN is a book on how to do that, and that will be a European 6 credit course.

When I asked her if she literally meant "everybody" who's learning something in ICT, she responded:

> That would be our ultimate aim. Practically, that would be an incredibly hard thing to do. But if we produce a short course that can be used by people, we can at least get it out there. So at the undergraduate level, we'd encourage everybody in the course to have some instruction about who the users are, in the widest possible way. The purpose of the masters, obviously, is to get specialists in this area.

In a paper describing the role of EDeAN in promoting a design-for-all curriculum, Whitney and Keith (2008) noted, "Most training in this field appears to be led by people with special interests in disability or ageing. With the increasing importance of standardization and antidiscrimination legislation it is becoming essential that design-for-all elements are included in mainstream computing and engineering programs" (p. 157). They wanted design-for-all to be mainstream and commonplace, rather than relegated to the obscure corners of special interest groups in academia. In the 2010 EDeAN Progress Report for Work Page W6 (Training Activities), Keith and colleagues (2009) affirmed the expansionist vision affiliated with the creation of the Digital Inclusion program when they wrote, "The MSc Digital Inclusion is the first pilot course and will set an example to others seeking to set up national courses or wanting to work in collaboration to establish joint Master's programmes." The EDeAN partners have been casting a wide net, hoping at the very least to expose as many people as possible in the technology sector to accessibility and digital inclusion issues.

The George Mason example is a bit different. The Web Accessibility and Design class was always part of an existing curriculum from the first semester that Ms. Neuber taught it. Ms. Neuber created the class to fill a knowledge gap for an existing set of students, not to try to tap into a new untested market. She was still an accessibility evangelist, but her evangelism was mostly restricted to the local context within the university. She enriched an existing curriculum rather than build a new curriculum from scratch. When the instructional technology faculty reconfigured the curriculum and made the Web Accessibility and Design class a required core component, their primary motivation at the time was in ensuring that their own students received the training that they felt was relevant. This curriculum realignment was a natural end product of faculty discussions and negotiations based on perceived needs and priorities, and not out of the sense of needing to fulfill an accessibility agenda. No one published a conference paper about the class or tried to hold it up as an example of "the right thing to do." The faculty simply made the decision to require the class, then moved on to other things.

When I asked Dr. Behrmann if he had ever been in any conversations with other departments at Mason—like computer science or other technology disciplines—that could benefit from a web accessibility class, he responded "Oh, yeah, different places. We've got some people over at Human Factors. They really haven't gone very far, but yeah, we have, over many, many years.... It's that curriculum expansion [problem], you know. How do you do it? And the focal points are different. It's possible, but everybody has got their plates pretty full." Dr. Behrmann is certainly an advocate for accessibility, and has dedicated his professional life to disability issues, but the web accessibility class has not been his focal point, nor has it been the focal point of the career of anyone else at Mason.

When I took over teaching the Web Accessibility and Design class, I likewise spent my energies on teaching my students rather than publicizing the class or trying to hold it up as an example of a successful implementation of accessibility within a technology curriculum. I look at this now as a bit of a lost opportunity on my part, that perhaps the publication of this dissertation will help rectify in some measure.

Ms. Zirkle's main job as the point person for Section 508 issues at the university requires her to promote accessibility on a daily basis, but she focuses her evangelism mostly on the tasks immediately at hand within the university. Now that she has had some experience teaching the Web Accessibility and Design class, she has begun to think in somewhat broader terms than before, but did not mention any specific plans of reaching out to other universities to showcase the class or promote it as a "best practices" model.

The humbler, less ambitious origins of the class at Mason in comparison to the sweeping international goals of the University of Linz and Middlesex University should not be interpreted as a reduced level of interest in accessibility issues at Mason. On the contrary, Ms. Neuber went so far as to say that "the [faculty] that I've worked with are equally dedicated, in my mind, to people with disabilities. They understand that people with disabilities are everywhere, and that it affects everyone in some way. I really believe that our instructional technology faculty [members] are there. I don't feel like we're trying to convince them of it." The reason for the quieter, lower profile, then, may be because of the decreased need to convince people of accessibility's importance. Even with this low profile, all of the interviewees at Mason agreed that the message of the importance of accessibility ought to be spread beyond the limits of the local university context. They just did not see themselves as the people to engage in the discussion at this high profile level, at least for now.

In some ways, the class at Mason is one of the types of outcomes that the advocates at Middlesex University and the University of Linz hope to achieve. They want to see accessibility become a part of "regular" curricula. As a conference paper about the Barrier-free program at Linz concluded:

> Last but not least we hope that our project is also going to bring a portion of awareness in this area at universities. This would cause by and by that—in the field of web and software design—one or another seminar or even a whole module of our course becomes part of the university's regular studies.

The Mason curriculum was not directly influenced by the efforts at the University of Linz, but it would appear that Mason's class has become a clear example of exactly the kind of result the Linz program was hoping to achieve.

### Theme 1.4: Raising the Bar in the Accessibility Field, Academically and Professionally

The web is dynamic field, consistently on the leading edge of technology. The early days of the web were especially prone to exuberant development of experimental, incompatible proprietary technologies. The developers often had little or no formal training in the technologies they were working with, because little or no formal training was available anywhere. People tended to learn from each other and from the hodgepodge of resources they could find for themselves online or in publication. Those concerned with accessibility found it difficult to keep up with and respond to the rapidly changing field, and they had even fewer options for learning about accessibility than about web technologies in general. A small but dedicated core of individuals beat the drum of accessibility, despite the dearth of reliable resources about accessibility.

Over time, universities began to formalize training in web technologies and to cultivate professional career paths for their students, made possible by the exponential growth of interest and jobs in industry. Dr. Miesenberger recognized that the same type of academic formalization of the accessibility curriculum would be necessary to achieve a respectable level of professionalism to advance the field to higher levels of influence and achievement. In the interview he explained, “Having it as a masters and seeing it growing in terms of interest of students is simply a quality factor for the field itself. This was the intention: to contribute to the field with an educational program.” He wrote about the need for an accessibility curriculum in an early paper about the Barrier-free Web Design program.

> In [recent] years, people [have become] aware of this problem [of inaccessible web sites], and the keyword “Web Accessibility” has become rather popular. But to really make progress and make the Web more accessible again, the problem has to be solved at the root: Web developers have to be aware of how to build accessible sites. In Austria, there is currently no possibility for Web developers to gain a comprehensive education in the field of Web Accessibility. Therefore, the Institute Integriert Studieren [Institute of Integrated Studies] started to develop a postgraduate course in order to fill this gap. (Ortner & Miesenberger, 2005)

Craven and Klaus (2008) echoed these sentiments, saying that “much advice and guidance is available on the design, development and commissioning of accessible websites. However, evidence of the continued in-accessibility of websites leads to the conclusion that providing advice and guidelines is not enough to significantly improve the situation." A few years later, as the team in Linz was working on the *web_access* curriculum, they published a paper in which they emphasized the role of the accessibility curriculum in enhancing the professionalism and influence of the field.

> Similar to the lack of an EU-wide [web accessibility] standard or certificate the situation in Europe can be characterised by a lack of a common European curriculum in the area of web accessibility which would build the basis for a standard profile of a [web accessibility] expert on an academic level. There is growing need for education going beyond an in-depth knowledge on accessibility guidelines and application of corresponding techniques. The fast development asks for experts able to push accessibility forward, to do research and development and also to develop leadership to manage the change of workflows and organisational structures. To sum up, courses or modules on accessible web design definitely exist across Europe. Nevertheless, the fact is that they are offered locally with a widely differing scale and intensity. Accessibility also needs to be addressed through more formal education and training throughout Europe leading to a professional qualification, certificate or degree in accessible web design that is recognized by industry...The "web_access" project will give recognition to, and enhance the status of, accessibility experts at national and European level. It strives for harmonisation and internationalization of continuing education regarding Accessible Web Design, also taking in account the national characteristics. Hence, the model of the European Programme "Joint Programme on Accessible Web Design" should evolve a standard in Europe and therefore the "web_access" project intends to initialise a cascade effect. (Hengstberger et al., 2008)

Craven and Klaus (2008) similarly lamented the lack of professionalism in accessibility training and education opportunities.

> Whilst there is evidence of the inclusion of design for all in ICT teaching, as well as the provision of free and commercial tutorials and workshops, provision is quite fragmented and none to date has been identified as leading to a professional qualification or certificate in barrier free web design that is recognised by industry.

The goal of achieving a unified "standard in Europe" proved somewhat elusive, as the *web_access* initiative garnered less institutional support than the planners had hoped. Some consolation can be found in knowing that parts of the *web_access* curriculum are alive and well in the Web Sciences curriculum at the University of Linz, and the materials are publicly available for any institution to use.

The faculty members at Middlesex University were equally committed to raising the profile of digital inclusion by professionalizing it in the university curriculum. The interest in creating a curriculum grew out of the involvement of Ms. Whitney and Ms. Keith in The European Design for All e-Accessibility Network (EDeAN). This collaboration of European partners under the European Commission created an action agenda that included the infusion of design-for-all principles across the ICT curriculum. The group identified the need for training materials at several levels: vocational, undergraduate, graduate, and training the trainers. Whitney and Keith (2008) published a conference paper explaining the need to raise the standard of accessibility training materials across Europe.

> Change is needed in ICT education to address the increasingly social, economic and political contexts in which technology is used. The promotion of the European Union of the ideals and benefits of eInclusion will depend on students throughout Europe developing knowledge and skills of ICT Design for All. To do this successfully will require the creation and promotion of good quality courses throughout Europe for both the students and also for their teachers. For these courses to be of maximum benefit to the students and the end users of ICT products and services it is imperative that these courses develop appropriate best practice in knowledge and skills and that potential employers recognize the added worth of these skills. Such courses will need to be harmonized across Europe and professionally recognized.

The call for professional recognition of the courses and curricula can come to fruition only if the courses merit such recognition, by virtue of their quality and rigor. To some degree, the job market will determine how the curriculum is received, but there is also some hope that the courses can prime the pump of the job market by producing graduates with demonstrably relevant skills in the ICT sector.

The ambitions at George Mason University were more modest and localized than at Linz or Middlesex. The Web Accessibility and Design class was not the focus of the Instructional Technology program. It was merely one class; an important class, but just one class among many in the core requirements. None of the full time faculty in the Instructional Design and Development Concentration centered their careers on accessibility issues, so the class was not publicized at conferences or in scholarly papers. Though Dr. Behrmann is a full time faculty member who is very much focused on disability issues, he is more closely associated with the Assistive Technology concentration, and his professional scholarly output has aligned with disability issues not specific to web accessibility.

It would be a stretch to say that the Web Accessibility and Design class has raised the academic or professional profile of the field of accessibility as a discipline unto itself. It would be more appropriate to say that the class has raised the profile of web accessibility within the instructional technology field. As the Mason graduates have entered the workforce, they have done so after having spent a full semester learning why web accessibility is a concern, how to evaluate web sites for accessibility problems, and how to design for accessibility. That one semester is not enough to turn the students into web accessibility experts, but it should be enough to make them aware of the issues and give them enough information to be able to work effectively within teams that are developing accessible instructional materials, even if they themselves are not the designated accessibility experts. Anecdotally, some of these students have reported that they have in fact been designated as the accessibility experts, and they had to seek out additional resources to fill in the gaps in their knowledge beyond what the Web Accessibility and Design class taught. It is impossible to say how many of them actually use their accessibility knowledge on the job though.

### Theme 1.5: Increasing Employment Opportunities for People with Disabilities

Several of the papers written by the University of Linz team members about the Barrier-free Web Design program and the *web_access* initiative mentioned the value of the accessibility curriculum in providing a career path for students with disabilities (Hengstberger et al., 2008; Miesenberger, 2006; Miesenberger et al., 2010; Miesenberger & Ortner, 2006; Ortner et al., 2004; Ortner & Miesenberger, 2005). These are not merely obligatory platitudes. The Institute of Integrated Studies, where the Linz team members work at the university, is deeply involved in assisting students with disabilities throughout their educational experience as they prepare to enter college, during their college years, and as they enter into the work force. They provide comprehensive academic services and access to assistive technologies, as well as counseling services. The team is committed to the well-being of students with disabilities, and recognizes the valuable role that accessibility experts with disabilities can play in technology industry.

Dr. Springett of Middlesex University was emphatic in his insistence that individuals with disabilities were “immediately, in one sense, experts, because they’re fantastically knowledgeable about coping with the world through their own experience. So they're an absolute mine of information." He reflected on the students with disabilities enrolled in the Digital Inclusion course with respect and admiration for the things they had accomplished in their lives and for the powerful insights that these students were able to share with their fellow students and instructors. He clearly saw a unique role that individuals with disabilities could fulfill as experts in the field of digital inclusion.

The instructional design and development concentration of the Instructional Technology program at George Mason does not target students with disabilities in the promotion of its academic programs in the same way that the programs at Linz and Middlesex do, but the close association with the Assistive Technology track provides some crossover of purposes, and students from the two tracks often take classes together. During my time as the instructor of the Web Accessibility and Design class, I taught several students with different types of disabilities. To the best of my knowledge, all of these students were enrolled in the Assistive Technology concentration, which actively recruits students with disabilities. Like Dr. Springett, Dr. Behrmann and other faculty in the Assistive Technology track recognize the valuable built-in expertise of people with disabilities when it comes to using and making accessible technologies. In some careers, a disability can be perceived as a liability, but in fields related to assistive technologies, accessibility, and digital inclusion, having a disability can be a tremendous strength, giving a person instant credibility on the topic. The role of the academic problem, then is to build upon this innate expertise and credibility by adding the polish of academic discipline.

## Topic 2: The Curriculum Design Process, from Idea to Implementation

### Overview

Creating a new curriculum takes time, planning, and the involvement of multiple individuals. This section of the dissertation explores how and why each of the three sites in this study decided to create curricula based on accessibility and design-for-all and what they had to do to implement the curricula. The three programs have had some success in achieving their goals of spreading the word about accessibility and design-for-all, so they serve as effective examples of how to accomplish this goal. They each also faced unique challenges and, in some cases, setbacks, which can provide a dose of realistic thinking to faculty at other institutions that may be considering implementing a similar curriculum.

### Theme 2.1: Synergy with Existing Disability Programs within the Institution

The curriculum in the three cases examined here did not appear suddenly or unexpectedly. The curricula were conceived, planned, and enacted by people already active in disability-related fields. These people were employed in disability-related jobs in academic programs with a history of promoting the interests of people with disabilities. This was fertile ground for academic projects that benefit people with disabilities, and the individuals cultivated their new ideas in a nurturing environment that would allow their ideas to grow and mature. This is not to say there were no difficulties, because certainly there were and continue to be difficulties, but it seems unlikely that the curricula could have suddenly emerged from environments without some history of supporting the interests of people with disabilities.

The Institute Integriert Studieren (Institute of Integrated Studies) at the University of Linz, where Dr. Miesenberger and Mr. Batusic work, and where Ms. Hengtsberger worked until recently, has been involved in disability research and services since 1991, and is well-respected around the world, despite their relatively small size (Institute Integriert Studieren, n.d.). The center provides comprehensive direct services to university students with disabilities at the University of Linz and five partner universities, leading the way in Austria for making a university education an obtainable dream for people with disabilities. The people at the center have planned organized and coordinated international conferences such as ICCHP, the International Conference on Computers Helping People with Special Needs, which is now in its thirteenth year, and AAATE, the Association for the Advancement of Assistive Technology in Europe, which is in its 12th year.

Dr. Miesenberger and his team were able to leverage the resources and reputation of the Institute Integriert Studieren as they embarked on their foray into curriculum development. Their job descriptions already required them to think about disability issues on an ongoing basis, so their curriculum activities were a response to needs that they had become aware of through the natural result of their professional responsibilities.

The Digital Inclusion master's degree came from a team of people with equally distinguished careers in disability-related studies. Ms. Whitney is the head of the Design for All Research Group in the School of Computing Science at Middlesex University. This research group is the UK contact center for the European Design for All e-Accessibility Network (EDeAN). The work that Ms. Whitney and Ms. Keith have done with the Design for All Research Group has allowed them to collaborate with professionals in disability-related fields and human-computer interaction. Their work with EDeAN on design-for-all curriculum topics led to the eventual creation of the Digital Inclusion master's degree. It was their way of putting their own recommendations into action at their own institution.

The situation is similar at George Mason University. The instructional technology program has been closely affiliated with the Special Education program and the Assistive Technology concentration for many years. Some faculty, such as Dr. Behrmann, have been called upon to teach classes in both the Instructional Design and Development side of the curriculum and the Special Education/Assistive Technology side. This crossover of faculty and the relatively close association of the programs has facilitated interdisciplinary dialog within the university and has provided opportunities for them to collaborate on many projects. Dr. Behrmann is also the Director of the Helen A. Kellar Institute for Human disAbilities (KIHd), which was chartered at Mason in 1988. The KIHd has secured close to $9 million in funding over those years on a wide variety of projects in its five focus areas: (a) research and development, (b) technical assistance, (c) model program development, (d) training at the graduate and undergraduate levels, and (e) policy analysis related to local, state, regional, and national needs. Part of that funding has been associated with projects for the Instructional Technology immersion students. These, and other, disability-related projects exposed a need for training students in web accessibility techniques, and this was one of the factors leading to the creation of the Web Accessibility and Design class. The instructional technology faculty recognized that the students working on disability-related projects needed that skill set, and eventually decided to make the class part of the required core of the curriculum.

These three cases point to the synergy between the universities and the disability-related programs at those universities. The people were able to leverage the existing organizational structures, the reputations and resources of the disability-related organizations, and the relationships with the larger community of disability scholars to create curricula to teach accessibility and digital inclusion. It would probably be one step too far to infer that the curricula could not have emerged in the absence of these types of synergetic structural relationships, but they certainly helped.

### Theme 2.2: Championing the Cause

Yes, there was a synergistic confluence of organizations and resources in the three cases in this study, but individual people still had to notice a challenge, envision a way to solve it, make decisions, and do all of the hard work to accomplish the vision. No matter how much dry tinder one has, it takes a spark to start a fire. Several of the individuals whom I interviewed in this case study were the spark that started the fire to create curricula about accessibility and digital inclusion. If key individuals at each of the institutions had not championed the cause of accessibility and design-for-all, nothing would have happened. Nothing had reached a tipping point, and no one was putting pressure on the faculty to do anything. The laws and policies did not mean anything at the curriculum level. There were no laws requiring technology programs to teach about accessibility. (There were laws requiring universities to accommodate students with disabilities, but that is another issue entirely.) It was a matter of these key individuals deciding it was important and then doing something about it.

The point in discussing the role of these key individuals in creating the curriculum is not to praise them, though they certainly merit praise. The point is to illustrate that people drive the process of curriculum change. Changes do not happen spontaneously or in the absence of purposeful or coordinated effort. Someone has to decide to make it a priority, and follow through with that decision until they succeed in changing the curriculum. At the University of Linz and at Middlesex University, it took many years and a considerable investment of time and resources to create brand new curricula and to essentially create a new academic specialization. These efforts were met with mixed success, especially in the case of the multiple attempts at the University of Linz, but the people involved did not lose sight of the ultimate goal. As a result of the efforts of the people who championed the cause at the three institutions, there is a new master's degree at the University of Linz in web sciences with web accessibility taught systematically throughout the curriculum, a master's degree in instructional technology at George Mason University that requires all students to learn web accessibility, and a new master's degree at Middlesex University solely focused on digital inclusion. The faculty at Middlesex and Linz feel that they have only begun to achieve their full vision, so it will be interesting to trace their progress over the years. With the setbacks that both locations have experienced, most notably the cancellation of programs they worked so hard on, it will be understandable if their enthusiasm for championing their causes wanes as they face the hard realities of the way their programs are received.

Dr. Miesenberger was the main champion of the cause at the University of Linz, with the support and collaboration of his colleagues, including Mr. Batusic, Ms. Hengtsberger, and others in the Institute Integriert Studieren. That Dr. Miesenberger would champion this cause comes as no surprise to those who know him and work with him. He has demonstrated a strong commitment to disability issues throughout his career, and is widely regarded as an important academic scholar in the field, and a tireless advocate for disability rights. He has spearheaded three separate curriculum development efforts in web accessibility, plus a separate curriculum in assistive technology, which is not a part of this study. He created and currently directs multiple international conferences on disability issues and edits the conference proceedings.

At Middlesex University, Ms. Whitney and Ms. Keith were the main creators and champions of the Digital Inclusion curriculum. Dr. Springett is a leader and respected scholar in his area of specialization, but was not involved much in the initial stages of the curriculum planning and development. Ms. Keith contributed her strengths as a researcher to investigate the existing design-for-all curricula among European EDeAN partners, and Ms. Whitney led the charge through the negotiations with the administrative bureaucracy at the university to get the curriculum designed and approved. Both Ms. Whitney and Ms. Keith have become leaders within EDeAN on the topic of design-for-all within the curriculum. They created curriculum guidelines for teaching design-for-all at the master's level and undergraduate level, and have promoted their ideas through conference papers and EDeAN dissemination activities. They promote the Digital Inclusion master's degree is an example of how to implement the curriculum, and have engaged in discussions with other institutions about ways to replicate the Middlesex curriculum or partner with Middlesex to offer joint programs. As they created the program at Middlesex, they enlisted the expertise of Dr. Springett to round out the course content to include a module on usability, human-computer-interaction, and user testing.

Ms. Neuber provided the initial spark at George Mason University. She recognized the need to address web accessibility, so she took the initiative to hone her own HTML skills, then designed and taught a class on web accessibility. Prior to teaching the class, she brought in outside consultants from WebAIM to learn more about web accessibility herself, and to give the opportunity to web developers at Mason to learn more as well. Dr. Behrmann played an important supporting role by getting behind Ms. Neuber's efforts and making it a priority within the Assistive Technology curriculum. When the Instructional Technology faculty decided to redesign the curriculum, Dr. Behrmann helped guide the decision to make the Web Accessibility and Design class a core part of the curriculum. He is quick to point out that he did not have to pressure people to recognize the importance of web accessibility. "I don't think anybody ever felt pushed or pressured into saying this needs to be a part of the program." He said. "It just became a part of the program. And then when we re-did the program and finalized it, it was decided [that the Web Accessibility and Design class] needs to be part of it. So I never felt like there was pushback." Ms. Neuber gave credit to Dr. Behrmann for pushing accessibility during the curriculum redesign discussions, but likewise praised the Instructional Technology faculty as a whole for open-mindedness and willingness to accept accessibility as an important topic. The pioneering work by Ms. Neuber and Dr. Behrmann cleared the path for those would teach the class later.

I was the first instructor to teach the Web Accessibility and Design class as soon as it became a core part of the curriculum, and I taught it more semesters than anyone else, but I can take no credit for influencing the curriculum decisions of the Instructional Technology faculty. They made those decisions entirely without me. I just happened to arrive at an opportune moment to take advantage of the decisions they had already made. My contributions were in the instructional design decisions for the class. In hindsight, I realize that I could have taken the initiative to extend the influence of the class to other academic departments, and to promote the class as a model of how it is possible to address accessibility in curricula not specific to disability issues, but I did not take that initiative during the time I was teaching the class.

By the time Ms. Zirkle began teaching the class, it was already a well-established part of the curriculum, so she did not have to sell the idea to anybody. She could just step in and teach. Ideally, this is the type of scenario that the champions of the cause would like to see everywhere. They would like all technology programs to integrate the topic so that teaching it becomes commonplace and routine, and so that the departure of one instructor does not mean the end of accessibility and design-for-all in the curriculum. Having a pool of knowledgeable professionals to choose from as instructors would be a byproduct of the infusion of accessibility and design-for-all into the general technology curriculum.

### Theme 2.3: Leveraging External Professional Relationships and Networks

All of the programs represented in this study benefitted from efforts of the faculty to leverage professional relationships and networks outside of their respective universities. In the Linz and Middlesex cases, the faculty nurtured those relationships with the express purpose of invoking support from them to create a curriculum. In the Mason case, the external relationships eventually led to a need for a curriculum, even though that was not the initial purpose for fostering the relationships.

The faculty and staff in the Institute Integriert Studieren developed the first web accessibility curriculum at the University of Linz, the Barrier-free Web Design program, in-house, without much direct involvement with outside organizations. When this program failed to attract enough students in Austria, they decided to reach out to partners across Europe and form the *web_access* initiative, in the hope that they could tap into a larger audience and build on the strengths of the respective partners. They created a harmonized and standardized European curriculum model, hoping several universities would adopt it. They were able to achieve moderate success with this effort—in particular with the integration of the materials into the Web Sciences degree at the University of Linz and at the University of Pannonia in Hungary, but other universities were either unable or reluctant to adopt the curriculum, so this effort fell short of its original ambitious goals too.

Even with all of the professional relationships that Dr. Miesenberger has forged during his productive career, he was not able to convert those relationships into sufficient momentum to match his expansive vision. In his typical congenial and self-deprecating fashion, Dr. Miesenberger reflected on some of his past efforts that did not go as well as he intended, lamenting, “Let’s say I’m very bad in management!” He has learned that it takes more than a good idea, or a good cause, or even a good consortium of partners to enact changes in the curriculum. He still asserts that the only way that the web accessibility curriculum ultimately can be successful is with a strong international coalition of committed professionals, but he now considers this a necessary but insufficient condition.

Having failed to gain the buy-in and cooperation that he needed with the *web_access* initiative, he returned to more of an in-house model with his third attempt to create a web accessibility curriculum. Unlike the previous two attempts, in this third attempt—the web sciences master's degree—Dr. Miesenberger was not the main one leading the curriculum design process, and the main topic was not web accessibility. It was a collaborative effort on the part of the computer science department faculty members, and the curriculum content spanned a wide range of topics, including web engineering, web art and design, web and business, and web and law. Dr. Miesenberger's main role within the design of the Web Sciences curriculum was to ensure that web accessibility is addressed at some level for all of the students. He incorporated some of the content from his own *web_access* curriculum, making the Web Sciences degree a showcase example of how the *web_access* content could be integrated into the ICT curriculum. The web-accessibility component is much more limited in scope than it was in the Barrier-free Web Design curriculum, but it reaches more students.

Even though the web accessibility portion of the web sciences degree was created without direct involvement from a network of outside professionals, the materials were adapted from the *web_access* materials, which *was* created by a network of outside professionals, so it is fair to say that the web sciences curriculum benefitted from professional relationships that Dr. Miesenber and his colleagues had cultivated.

Dr. Miesenberger has said he will eventually reach out to other institutions again in an attempt to create an international master's degree in accessible web design, because he still believes that there is a role for web accessibility experts and specialists in the job market. From the enrollment problems with the Barrier-free Web Design program, he already knows that the market is too small in Austria to sustain a local master's degree, but an international degree would expand the potential market for students and graduates of the program. When he does reach out, one of the most logical points of contact will be the people and organizations associated with EDeAN.

Both the University of Linz and Middlesex University are members of EDeAN. Ms. Whitney and Ms. Keith, who played a prominent role in developing the international curriculum guidelines for design-for-all and accessibility published by EDeAN, benefitted from the work done at the University of Linz. According to Dr. Miesenberger, the Institute of Integrated Studies was "involved throughout" the process of creating the EDeAN curriculum.

"They [Ms. Whitney and Ms. Keith] used part of what we had available from [the Barrier-free Web Design and *web_access* curricula]…. Of course they oriented it much more toward design-for-all, and broader issues, but web accessibility is part of it." Now, with the creation of the Digital Inclusion degree and the publication of the EDeAN curriculum guidelines, the University of Linz is benefitting from the work done at Middlesex University. Faculty at the two universities have collaborated on some scholarly publications about the curriculum (e.g., Whitney, Keith, et al., 2011) and are very familiar with each other's' work.

In the interview, Ms. Whitney credited several organizations with the original inspiration to start the Digital Inclusion master's degree.

> The idea for more training, for the masters, came from EDeAN, and also from a meeting instigated by the European e-inclusion unit, an organization which now called Digital Europe, but which used to be called EICTA—the European ICT organization. That's the industry association. And also with EDF (The European Disability Forum), and the e-inclusion unit….

The digital inclusion degree was a way to act on what these groups had been discussing for so long: the need to provide high-quality training in a systematic way.

The decision to require a course in web accessibility and design at George Mason University came about because of external relationships as well, but of a different kind. The external relationships that drove the curriculum process at Middlesex University and the University of Linz were mostly peer relationships with other academics and educationally oriented organizations. The relationships that influenced the decisions at Mason were the industry and government partnerships and grants that brought in funding. This gave the curriculum design process a whole different dynamic.

The Web Accessibility and Design class became a part of the curriculum out of a need to meet the expectations of the organizations that were providing funding to the Instructional Technology department. Contracts with state and federal government for the immersion program required the students to produce instructional materials that would be accessible to learners with disabilities, so the Instructional Technology department had to train their students in accessibility to meet the immediate need. By way of contrast, the

European programs were created more out of a sense of idealism and wanting to do the right thing. They had the idea and then had to go out and seek funding and students. At Mason, it was the reverse. They had funding and students already. They just needed to add accessibility to the curriculum to ensure their funders would be happy.

Because of the relationship that Mason had with funders, the addition of accessibility to the curriculum did not require leveraging professional academic relationships. No one consulted with professional academic organizations about the curriculum change, or tried to justify the curriculum change by virtue of academic guidelines, standards, or anything of the sort. The curriculum change occurred because of a practical need, so no justification by persuasion about academic ideals was required. Idealism was not totally absent from the scenario though. Dr. Behrmann's idealistic commitment to disability issues drove him to seek out funding for projects in line with his convictions and professional interests. His selective targeting of funding sources helped bring enough projects requiring accessibility expertise, that by the time the curriculum was being redesigned, he did not have to do much persuading to get the rest of the faculty to accept accessibility as a part of it.

### Theme 2.4: Involving People with Disabilities

If the goal is to make the world a more inclusive place for people with disabilities, it makes sense to include people with disabilities in the effort to achieve that goal. Too often in history, the fate of people with disabilities has been decided by other people without disabilities, perhaps out of an arrogant sense of superiority, well-intentioned but misplaced paternalism, naïve neglect, or some other reason. The disability rights movement has tried to change the balance of power, insisting on being treated as equals in society, and on being able to make decisions regarding their own fate, moving from a position of subordinate dependence to a position of egalitarian independence. This sentiment is embodied in the phrase “nothing about us without us.” In a book by that title (Charlton, 1998), the author recalls;

> I first heard the expression “Nothing About Us Without Us” in South Africa in 1993. Michael Masutha and William Rowland, two leaders of Disabled People of South Africa, separately invoked the slogan, which they had heard used by someone from Eastern Europe at an international disability rights conference. The slogan’s power derives from its location of the source of many types of (disability) oppression and its simultaneous opposition to such oppression in the context of control and voice. (p. 3)

It is fair to ask how well the three cases in this study managed to involve people with disabilities in their disability-related endeavors.

Only one of the ten people that I interviewed, Mr. Batusic, has a disability that affects his ability to use digital technologies. His blindness gives him first-hand knowledge of the challenges faced by people with disabilities, because he is one of them. He wrote some of the content for the Barrier-free Web Design program, and teaches several classes in the computer science department at the University of Linz, including a class about web accessibility. He coauthored conference papers with Dr. Miesenberger, and was the server administrator for the Barrier-free Web Design program and the *web_access* initiative. Interestingly, during my interview with him, he seemed to downplay his own disability, as if to suggest that his involvement with these efforts had little to do with his own disability. He talked about the scripts he wrote, the technical issues in setting up the course management software, and other details of the projects that he worked on, but did not talk about his own disability in any of these contexts. It was only when I asked him directly about his disability that he talked about it. It was not that he was ashamed, by any stretch of the imagination. He simply did not think it was much of an issue.

When I asked him if his blindness allowed him to have a closer relationship with one of the Barrier-free Web Design students who was blind, he replied that the relationship “was nothing special.” When I asked “He or she didn’t come to you with specific questions?” His response was, “Oh, he came with plenty of specific questions, but it was not really bound to his blindness.” Mr. Batusic’s matter-of-fact responses to questions like this showed that, while he acknowledged his disability, he felt more natural defining himself by other things in his life. His disability is a part of him, but it is only a part of him, and it does not constrain his sense of identity.

Even though only one of the individuals I interviewed had a disability relevant to digital technology access, each of the cases has a clear history of involving people with disabilities and working with them (Ms. Neuber’s disability does not affect her ability to use ICT). Some of the faculty members in George Mason University’s Special Education and Assistive Technology programs have disabilities, but, with the exception of Ms. Neuber, who created the first Web Accessibility and Design class, these faculty members are not web-accessibility specialists, so they were not directly involved in the decisions regarding the Web Accessibility and Design class. Even so, the day-to-day presence of these faculty members with disabilities among the rest of the faculty, and the collaborative work among faculty members with and without disabilities has created an environment of mutual respect, and trust that important decisions will take into account the needs of people with disabilities.

The scholarly and promotional literature published by the Institute of Integrated Studies about the programs at the University of Linz included prominent encouragement to potential students with disabilities to enroll, as in these examples.

> The goal of the postgraduate course is not only to teach people about Web Accessibility, but also to design the course itself in a way that people with disabilities are able to attend. To allow such an inclusive education, several considerations had to be taken into account. (Ortner & Miesenberger, 2005)
>
> The main target group for this course are Web designers and Web developers including people with disabilities. (Ortner & Miesenberger, 2005)
>
> Again in particular people with disabilities themselves are invited to participate as they have unique experiences and knowledge in the field and are confronted with increased problems at the labour market. (Miesenberger, 2006)
>
> Among them we would especially like to encourage [people with disabilities (PwD)] to participate because of both being experts for their own needs and enabling their employability. Due to this accessibility of a) the eLearning platform, b) the content and materials but also c) the authoring tools are at focus in the project. PwD themselves should be able to act as independent teachers and learners. (Hengstberger et al., 2008)

The commitment to empowering students with disabilities as both creators and consumers of accessible technology permeates the projects and literature at the University of Linz.

The faculty members at Middlesex University are equally committed to involving people with disabilities, and spoke to me about some of the students that they have had in their program who have disabilities. Dr. Springett, in particular, extolled the virtues of working with people with actual disabilities and not just trying to guess or anticipate their needs without actually involving them in the process. In fact, the module that he taught in the Digital Inclusion program on Inclusive Design and User Experience emphasized the value of seeking input directly from people with disabilities to make sure product designs are not merely accessible but also useful and desirable to the target audience.

**Theme 2.5: Learning from Other Curriculum Models**

As the process of designing an accessibility curriculum at the University of Linz got under way, Ortner and colleagues (2004) recognized the efforts of the Division of Information Technology (DoIT) at the University of Wisconsin-Madison, with their in-house web accessibility workshops and their publicly available "Web Accessibility 101" instructional materials (Do-IT, n.d.). These workshops and materials were not part of a degree-granting curriculum. They also recognized the semester-based classes in accessibility offered occasionally by faculty at the Illinois Center for Information Technology and Web Accessibiltiy (iCITA) at the University of Illinois Urbana-Champaign. In addition, there were a handful of programs that addressed disability issues in human-computer interaction, such as the program at the University of Crete in Greece (Whitney et al., 2011). Still, there were no full-scale academic curricula to serve as a model for what would eventually become the Barrier-free Web Design program at the University of Linz. The web accessibility curriculum at the University of Linz was the first of its kind, and in fact remains the only attempt to create a two-year academic program dedicated only to web accessibility. Though the original intent was to create a master's degree, they had to settle on an academic certificate. So far there has been no successful implementation of a web accessibility master's program anywhere (the program at Middlesex, before it was discontinued, granted a master's degree, but it was not strictly a web accessibility curriculum; it also addressed technologies such as ATMs, mobile devices, etc.). A few years after the design of the Barrier-free Web Design curriculum, the *web_access* began to create a European-wide accessibility curriculum, and there still was no equivalent model to draw on, other than the University of Linz's own Barrier-free Web Design program.

The faculty at George Mason University likewise had no precedent to draw upon when adding a 3-credit course about web accessibility to the core, required curriculum of an instructional technology program. No other instructional technology program required this level of engagement with accessibility principles, even up to the present time. The occasional classes offered at the University of Illinois Urbana-Champaign were typically offered through the computer science department, and were not a required element of any curriculum, either then or now.

The digital inclusion curriculum began several years after the efforts at the University of Linz and at George Mason University, so it had these curricula to draw from, though they were aware only of the efforts at the University of Linz. No one had publicized the class at George Mason, so hardly anyone in the web accessibility field knew it existed. Both the University of Linz and Middlesex University participated in EDeAN, so the faculty members at Middlesex University were able to collaborate with the faculty members at Linz and learn from their experiences with the Barrier-free Web Design program and the *web_access* initiative. Ms. Whitney and Ms. Keith adapted parts of these curricula for their own program and for the curriculum guidelines that they later created for EDeAN. The curriculum elements supplied by the University of Linz were only a small part of the overall curriculum that the faculty created at Middlesex University, because the much broader scope of the Middlesex curriculum. The curriculum created at the University of Linz was highly technical and dedicated to web accessibility for computer scientists and other similar professionals. The Middlesex curriculum was open to students from a wide range of professional and educational backgrounds, including nontechnical ones, and the content of the curriculum extended to all digital technologies, not just the web. There was some overlap between the curriculum at Linz and the curriculum at Middlesex, but it was not an exact match.

As part of their curriculum design process, Ms. Whitney and Ms. Keith conducted a survey of European institutions through their EDeAN partnerships to find out which institutions teach design-for-all. As Ms. Keith explained in the interview:

> We distributed a questionnaire through our partners, with the intention that they either knew the information themselves or they could approach other universities that they knew who were teaching in this area, or that might be teaching in this area. So the idea was to look for courses that might have something where they had elements of design-for-all…. So we [had them look for] things to do with working with users, accessible interaction, accessible content,...web accessibility,...e-learning, e-health, e-government, and what was happening in those sorts of areas. Initially, people were looking for named whole courses, and they tended not to be too successful on that, but what was emerging as we were trying to get them to get some data for us, was that they would know individuals that would maybe go and do a one day teaching in somebody else's course, or maybe a few days, or they do a little bit. So we gradually encouraged them to go and find what we called the hidden gems, because it wasn't something that would come up if you did a local language search in Germany, France, or wherever you happened to be. You actually needed to know people who were researchers in the area, or that they had incorporated that into their teaching.

In addition to identifying the places where accessibility is taught, Ms. Keith wanted to find out the extent to which it is taught, so she could calculate approximate credit hours and try to make equivalent comparisons between programs. This proved difficult because of the different ways that countries count credit hours. Another reason it proved difficult was because in some programs, design-for-all was interwoven throughout the content, making it difficult to count the number of credit hours. Ms. Keith continued:

> At Dundee University, which is now headed by Vicky Hansen, who's previously from IBM, they developed their Human Computer Interaction with an understanding of disabilities and aging integrated throughout their teaching, throughout their course. So when we tried to get them to answer the question "how many hours are you teaching about disability issues?" they found it very hard to answer that sort of question, because it's spread throughout the entire course. Examples are always being included which are relevant to that. For others, like one of our German partners who's in rehabilitation, he has a 10 hour seminar or something when he particularly addresses issues of disability and using computers. And that's specialized at that point. And that's delivered in something that's closer to a master's level, though there are variations. Sometimes they're like a join between a third year undergraduate course and a first year of the masters. In Germany, for instance, they still tend to go straight through in five years, so you end up with a qualification that is closer to a master's.

Ms. Keith continued to name a few programs with a design-for-all component:

> At University, which does a lot of work on usability and computer interaction. So they do a bachelor and master's degree in ergonomics, which is man-machine interaction, and they've got a module in that which is about disability. And they've got some of the leading researchers working there. And the University of York, which is where a lot of the people at City University came from—they moved themselves up to York—they have a masters in information technology, and within that, they do some stuff on accessibility as well. And our friends in Greece in the University of Crete are very active in research in disability issues.

In all, Ms. Keith was able to identify about fifty programs in Europe that addressed design-for-all in some way (Craven & Klaus, 2008; Whitney & Keith, 2008). This may seem like a large number, and in some ways it is, but the depth and breadth of these programs varied widely, with most of them treating the topic rather superficially and briefly, compared to the way that the Digital Inclusion program would need to address it.

Many of the faculty at these institutions had contributed in significant ways to the scholarly literature about design-for-all, but few of them had much to offer in terms of the detailed curriculum content that the Digital Inclusion program required.

Prior to writing this dissertation, I conducted a web search of universities offering classes in accessibility. My search was not as thorough as the search performed by Whitney and Keith, because I did not send out surveys or contact people at the institutions personally. I limited my results to what I could find on university web sites that was readily identifiable as accessibility-related. The results, presented in Appendix B, lend support to the assertions of Dr. Miesenberger and Ms. Whitney that there are no other programs exactly like theirs, and that it is difficult to find serious treatment of accessibility in the curriculum.

Looking toward the future, Whitney, Keith, and Schmidt-Belz (2010) claim that universities in Greece, Malta, Finland, Germany, Czech Republic, and Norway are either currently planning or considering creating curricula using the EDeAN curriculum guidelines as a starting point, and using the Digital Inclusion program as a model. Also, the University of Pannonia in Hungary has used parts of the *web_access* curriculum in one of their programs. The programs of the future will have the benefit of being able to learn from the pioneers that have come before them, including the universities in this study.

### Theme 2.6: Up-Front Development Time and Effort

One theme that surfaced repeatedly in the interviews was how long it takes to change the curriculum: 2 years, on average. It took about 2 years to develop the Barrier-free Web Accessibility curriculum, from the start of the funding until the first students enrolled. It took about 2 years to develop the *web_access* curriculum as well. About 2 years passed between the time that Ms. Neuber decided web accessibility was important until she welcomed the first students into her class. It took another 2 years before the Web Accessibility and Design class would become a part of the required core curriculum in Instructional Technology. It also took about 2 years to develop the digital inclusion curriculum as well. Two years seems to be the magic number.

Even after the curriculum is established, it takes a considerable investment of time to teach a class for the first time. Even though the Web Accessibility and Design class had been around for about 7 years already, when Ms. Zirkle began teaching the Web Accessibility and Design class, she found that "the learning scale [was] just beyond unbelievable" for her as a first-time instructor as she planned the class content, chose instructional materials, and put the class together. It did not take her 2 years, but she was not designing a new curriculum. She was simply taking over the duty of teaching an existing class. She needed to take the time to make the class her own, rather than teach it exactly as I had taught it before.

When I taught the Web Accessibility and Design class the first time, I experienced a similar overwhelming feeling. I was given the task of converting a 2-credit class into a 2-credit class, and was told to make sure students have a good grasp of HTML and Dreamweaver by the time they finish, so they could put together online portfolios of their coursework in portfolios. The requirement to learn Dreamweaver meant that they had to purchase Dreamweaver, which was no small investment. Knowing the cost of the software, I tried to find free resources that I could use as reading materials for the course. I knew I was going to use the WebAIM materials to teach the accessibility component of the class, but I could not find acceptable free online materials to teach Dreamweaver and HTML in a way that would meet the needs of the class. I ended up writing my own materials—enough materials to fill an entire book, it turned out, although I did not know it would be such a consuming project when I first started. This took many weeks and long hours of planning the instructional materials, writing them, creating illustrations, and integrating them into the course management software. It was a lot of work crammed into a short span of time. It turned out to be a good investment of time, because I ended up using those materials, with periodic updates (some of them substantial) for the rest of the time that I taught the class.

One of the reasons why the curriculum development process took so long is that no one could devote himself or herself to the task full time. Everybody had other duties and other job responsibilities to attend to. Another reason is that it usually takes a considerable amount of time to complete the internal review and approval process with university administrators, as will be discussed in the next section. A third consideration, at least for curricula developed in partnership with other institutions, is the amount of time it can take to coordinate efforts between the partners. If it takes two years to implement a curriculum without any partners, it is easy to imagine that adding partners would only compound the delays. Delays and setbacks have become an expected part of the routine in the collaborative work at the University of Linz and Middlesex University, particularly in their work with *web_access* and EDeAN. Whitney and colleagues (2010) listed a number of universities that are considering implementing design-for-all in the curriculum, and then noted how long it has taken to get this point. “While progress is somewhat slow, these results are encouraging in gaining recognition of the many stakeholders: educational institutions, the academics responsible for course delivery, the student population, future employers in major industries and user representative organizations.”

**Theme 2.7: The Internal Review and Approval Process**

All universities have some kind of internal review and approval process in place to evaluate new curricula before they can become a part of the official university course offerings. Adding a single class, as George Mason University did, is much easier than creating a new academic degree or certificate program as the University of Linz and Middlesex University did. The procedures vary between universities and between countries, and there are a lot of variables to take into account.

In Austria, public universities receive funding from the national government to provide free postsecondary education to Austrian citizens. Students do not have to pay for undergraduate or graduate degrees. With such a large investment of capital and resources, the government tries to make sure that it gets some kind of return on its investment. It is willing to fund academic programs that serve the country’s interests and less inclined to fund programs that do not offer a clear career path for students, or which require a large investment of time and resources for a small number of students. If a proposed program fails to demonstrate the new degree program will meet a minimum threshold of interest by students and potential return on investment, the university will not approve it. The university can still offer classes on the subject, and even an academic certificate, but not a degree, and not for free. Students have to pay to enroll in nondegree programs. In a country of free academic degrees, trying to sell students on the idea of paying for a nondegree academic program is difficult.

Dr. Miesenberger (2006) described the process briefly in a paper shortly after the program began:

> The most critical issue was getting approved the course by the university board and the involved bodies (politics, industry, administration) as the course hands over an official and state wide accepted university degree. The course got accepted in spring 2005 after almost 2 years of negotiation.

Ms. Hengstberger provided more details in the interview.

> It's really complicated. You have to prepare a lot of documents. You have to contact the director of the university. You have to present it in the study board of computer science, the study commission, as it's called. They decide if it's important, and they also meet just three times a year, so you have to wait 2 or 3 months for their meeting and their decision. Then you have to go to the senate. The director is the boss of the university, and for the content, it is the senate or the dean. You have to prepare a financial plan, a resources plan, argumentation, a market study of why it's needed, and so on.

Dr. Miesenberger also provided a few more details in the interview.

> If you launch a program [in Austria], this is under the umbrella of the Austrian Republic. And to get it accredited asks for feedback, or providing information about the program, about the impact, about the number of potential students, and things like that. Then the different chambers, and a lot of bodies have to have the possibility to give feedback on it, and then to make a decision. And then it might be an [approved] program...And the biggest barrier still, for getting the [approval], is showing the interest of students.

Unfortunately, the Barrier-free Web Design program fell short of being able to demonstrate sufficient student interest to warrant an academic degree, so the university did not approve it. This was a setback for Dr. Miesenberger and his team. After some debate (and disagreement) among the team members, they decided to offer the program as an academic certificate, and keep the full two-year curriculum as originally planned. The government does not fund certificate programs, however, so students had to pay for the Barrier-free Web Design program. The requirement to pay, combined with the length of the program and the lack of a degree made the program a hard sell to potential students, as well as to the official bodies that need to approve new programs, but it was eventually approved as a nondegree academic program.

The *web_access* materials did not need approval in and of themselves, because the materials were more like curriculum guidelines and ideas, rather than a fully-implemented curriculum. The intent behind the web_access initiative, though, was for the partner institutions to implement some part of the web_access materials into a curriculum at the respective institutions throughout Europe. The Linz team (Hengstberger et al., 2008) wrote in a conference paper that

> the process of [approval] is characterised by different systems...in every partner country. Differences can be recognised regarding the autonomy of universities, the duration of the process of approval, the schedule of terms and the credit systems and module sizes.

The international nature of the *web_access* initiative complicated the project in many ways, because each country and each university had its own rules, processes, and procedures for approving a curriculum. “It was not so easy to get a master’s degree, to approve it at the universities. It was really difficult for each partner,” said Ms. Hengstberger.

In fact, even at the University of Linz, which was the lead partner in the *web_access* initiative, the approval process derailed the original plan of creating a new master's degree. The reviewing bodies raised some of the same objections that they had raised previously with the Barrier-free Web Design program. The hope had been that the involvement of multiple international partners would provide enough clout to push forward through the approval process, but with the breakdown of approval processes across the partners, the reviewing bodies denied a master's degree at Linz once again. The team in Linz had to regroup and figure out what to do next. They decided to use parts of the *web_access* materials in a new web sciences degree program that was being developed. This was a step down from the *web_access* partners had originally envisioned, but it was the best that could be done at the University of Linz.

Aside from the University of Linz, only the partner in Hungary managed to officially implement part of the *web_access* curriculum. There were many reasons for these disappointing results for the *web_access* initiative, but the complexities of the approval process was a contributing factor. All of the interviewees at the University of Linz expressed frustration at the way the *web_access* initiative lost momentum, and at the way that the approval process bogged everything down. The entire duration of the *web_access* project was two years—including development time—and it took about two years to receive approval, which meant that not a single partner had implemented the curriculum by the time the project was officially over. It was only after the funding ended that the programs began at the University of Linz and in Hungary.

The approval process at George Mason University was much easier because the faculty were not trying to create a new degree program. Creating a new degree program would have required approval at the state level (Virginia) and at the university level. Adding a class to the curriculum required the faculty within the program to agree on it, and it required some level of approval from the graduate committee at the university, because they actually overhauled the entire instructional technology curriculum, but this did not involve anything like the level of scrutiny required at the University of Linz to start their new program. At George Mason, the approval process for the Web Accessibility and Design class was mostly a nonissue. They already had an instructional technology degree program in place, and they even already had a class in web design and accessibility in place before adding it to the core curriculum. It was just a matter of converting the original 2-credit class into a 3-credit class, and changing the curriculum documentation to show that the class was now required.

At Middlesex University, the creation of the new Digital Inclusion master's degree required a review and approval process, somewhat like at the University of Linz, but without the extra burden of having to please reviewers at the national level. Unlike in Austria, degree programs at universities in the United Kingdom are not free. Students pay tuition, much like students in the Unites States. Dr. Miesenberger lamented that it was much easier to start new academic programs in the United Kingdom or in the United States than in Austria, and the Middlesex case showed this to be true. The reviews at Middlesex were still rigorous, including peer reviews by outside experts, but they were less onerous than in Austria, and the British system is more willing to grant faculty and departments autonomy than their Austrian counterparts.

One of the levels of approval that the Digital Inclusion program had to pass through was the university's marketing team. Ms. Keith described some of the concerns that the marketing team discussed with her and Ms. Whitney:

> After we set the course up, we had to talk to the marketing people, and of course the question they're asking is, "is there another one like it?" because they want to know whether you're unique, or, quite frankly, a bit odd, for trying to offer a course that nobody else wants! There is a difficult balance when you're setting up a new course. There's a slight comfort level in being able to say, "actually, there's half a dozen around the country, and they're very well subscribed, and if we set up one as well, on a 'me too' basis, we'll attract students as well." But no, we're not really in that situation. It's quite unique. And we hope that other people will have a "me too" situation, either to integrate it more into the mainstream teaching or set up a specialist course. That was part of the aim, or goal at the end of or project: to leave enough information around that other people would consider setting up a program.

After several exchange, and some persuasion, the marketing team granted permission to go ahead with the curriculum. The other committees within the university and the external reviewers also gave their approval. Even with the greater autonomy afforded by the British system, the whole approval process lasted between one and two years, which delayed the start of the program by a year. The approval process at Middlesex took about the same length of time as the approval process at the University of Linz. The main difference is that the Digital Inclusion program was allowed to run as a master's degree. The team at the University of Linz had tried twice to launch master's degrees, and had failed both times.

The cases in this study show that it is substantially easier to receive approval for relatively small changes to the curriculum (i.e., George Mason University) than to create an entirely new curriculum (i.e., the University of Linz, Middlesex University, and the *web_access* partners). Regional differences in the approval process can influence the success rate of attempts to create new curricula, but even regions that allow more autonomy within departments generally require about two years to grant approval.

### Theme 2.8: External Accreditation and Validation

None of the programs in this study created their curriculum to satisfy the demands of external accrediting bodies or associations, nor did they have to meet any externally-applied set of expectations because none existed. The people who created the curricula in this study were pioneers leading the way. They are among the first to incorporate accessibility and inclusive design into the curriculum, so if external accrediting bodies ever require academic programs to incorporate accessibility into the curriculum it will be at least in part due to the efforts of the people in this study.

In the United States, regional accrediting bodies monitor universities and decide whether the universities meet the applicable standards as determined by a periodic peer review process. The Southern Association of Colleges and Schools (SACS) is the regional accrediting body for George Mason University, as a whole. In addition to regional accreditation bodies, there are programmatic accreditation bodies for specific knowledge domains, such as medicine, law, art, music, teacher education, and many other academic disciplines. George Mason's Instructional Technology department is a part of the College of Education and Human Development (CEHD), which receives accreditation from the National Council for Accreditation of Teacher Education (NCATE).

According to Dr. Dabbagh, NCATE had recently reviewed the CEHD, including the Instructional Technology program, and had renewed accreditation for the programs before the redesign of the Instructional Technology curriculum in 2005. When I asked Dr. Dabbagh if the recent accreditation review had anything to do with making the Web Accessibility and Design class a required part of the Instructional Technology curriculum, she replied "accreditation didn't have anything to do with our decision." The topic never came up. There are standards prohibiting discrimination against students with disabilities, but there are no accreditation standards or requirements mentioning the need to teach accessibility in the curriculum.

The alignment of NCATE, with its teacher education emphasis, and the Instructional Technology program, with its emphasis on corporate and government training and instructional product development, was never a great match. In 2011, representatives from NCATE discussed this mismatch with Dr. Dabbagh, as the newly appointed Director of the Division of Learning Technologies, and informed her that the Instructional Technology department would be released from the requirement to pass NCATE accreditation. Dr. Dabbagh does not intend to seek accreditation from any other accrediting body. This recent development gives the Instructional Technology program more independence and autonomy, and it was clear that this pleased Dr. Dabbagh. On the downside, the reduced level of external scrutiny could potentially lead to a sense of complacency within the program. At least for now, complacency is not a concern, in terms of including accessibility in the curriculum, because Dr. Dabbagh, Dr. Behrmann, and other faculty in the Instructional Technology department remain committed to keeping accessibility as a core requirement, even though their peers—instructional technology programs at other universities—do not offer comparable classes. If anything, George Mason's program could be in a position to exert some pressure on their peers to follow the example of Mason's program.

Now that NCATE has forfeited its role as the accrediting body of Mason's Instructional Technology program, are there other organizations that might be a better fit? There are some professional organizations in the instructional technology field, such as the International Board of Standards for Training, Performance, and Instruction (IBSTPI), The Association for Education Communications and Technology (AECT), the International Society for Technology in Education (ISTE), and The Society for Information Technology and Teacher Education (SITE). To varying degrees, these organizations promote their own standards, competencies, or accreditation procedures (e.g., Earle & Persichitte, 2001; Spector et al., 2006), and could fill the accreditation gap at Mason, though, at least for now, Mason's program will remain independent of them all.

The instructors in Mason's program do employ the AECT standards and IBSTPI competencies when designing their own course materials, and when asking students to create portfolios of their coursework. Many of the students create tables of the AECT or IBSTPI standards and competencies so they can indicate which classes addressed which standards and competencies, as a way to show that they are learning all that they should learn as aspiring professional instructional technologists. Dr. Dabbagh indicated in the interview that she does not want to favor one or the other of these lists of standards. She wants students to be aware of them both.

If the AECT standards or IBSTPI competencies are used as the gold standard of what instructional technologists should know and do—especially if they are used for the basis of external accreditation—it is important to consider what they say about accessibility and digital inclusion for people with disabilities. It turns out that, strictly speaking, they say nothing at all about disabilities. The AECT “advanced standards” mention the need to take into account “learner characteristics” during the design process, but the standards to not mention disabilities explicitly (AECT, n.d.). The IBSPI competencies for instructional design also mention the need to “identify and describe target population characteristics” (Spector et al., 2006), but make no mention of disability.

One could argue that these admonitions to take into account learner or target population characteristics are sufficient to cover the topic of accessibility, especially considering that the standards do not elaborate on these admonitions at all, leaving all interpretation up to the reader. By not singling out any particular kind of learner characteristic, the wording is broad enough to include all kinds of learner characteristics. This is true enough. Disability is a unique kind of learner characteristic, though, because it can lead to total exclusion if handled poorly by an instructional designer. If an instructional designer designs content that cannot be read by a screen reader, for example, the learner will be completely unable to use the content, never mind if the learner is a part of the target audience in every other way. Another thing that makes disability a unique kind of learner characteristic is that anybody in almost any category of target audience can have a disability. If the target audience is tenth grade trigonometry students, some of those students have disabilities, and they can be any kind of disability. Furthermore, except in tightly controlled circumstances, the instructional designers may not know ahead of time whether any of the learners have disabilities or not, and may never have access to that kind of knowledge about their learners. Even if the designers know that none of the current learners have disabilities, there still may be the chance that learners who access the content in the future may have disabilities. Beyond this, creating accessible content requires a knowledge base and a technical skill set that takes time to develop, and a certain degree of technical aptitude for working with markup languages and code. Or, if the instructional designer is working with other more technically inclined team members, the instructional designer needs to at least be able to speak intelligently about the issues with the more technical teammates. Knowledge of accessibility topics and techniques is not something that can be resolved by simply stating that instructional designers need to take disabilities into account. Developers need a specialized technical skill set to do so, or they need to work with someone else who has this skill set. To be clear, a person can certainly learn accessibility skills. It is not a matter of accessibility being terribly difficult. Rather, it is a matter of investing the time to learn those skills. Without this investment of time, accessibility efforts are unlikely to have the intended impact of actually making the content as accessible as it could be.

The reason for pointing out the unique nature of disability as a learner characteristic is not to claim that the standards or competencies are wrong, or even that they are incomplete (considering that the terms "learner characteristics" or "target audience characteristics are broad enough to cover every conceivable scenario), but in the context of such vaguely broad language, there is the danger of leaving out accessibility altogether if university programs adopt either the AECT standards or IBSTPI competencies as their criteria for creating an instructional technology curriculum, or the criteria by which they receive accreditation. The simplicity and expansiveness of the language can create an illusion of inclusion, when in fact greater specificity in the language may be the only way to ensure that disabilities are included at all.

In Europe, individual countries typically have their own internal organizations and mechanisms of quality assurance or accreditation, independent of the organizations and mechanisms of other European countries, though there has been a trend over several years toward unification of standards for the sake of cross compatibility (Conraths, 2001). The organizations, standards, and procedures vary from those in the United States, but the main issues are the same. The ideas for the programs at Middlesex University and the University of Linz came from within the universities, not from external accreditation bodies. As in the United States, there are laws prohibiting discrimination against students with disabilities in the UK and in Austria, but, as in the United States, there are no standards in place requiring British or Austrian universities to teach accessibility or digital inclusion.

## Topic 3: Defining the Scope of the Curriculum

### Theme 3.1: Defining the Relevant/Applicable Academic Disciplines

Who should teach about accessibility and design-for-all? Who should learn about it? If it were up to the people interviewed for this study, every ICT academic program would teach *something* about accessibility and design-for-all, even if they do not devote much time to it. According to Ms. Whitney:

> The ultimate aim of EDeAN is that all students have some introduction to design-for-all in their undergraduate course. And this will be a short element. What we're writing at the moment at EDeAN is a book on how to do that, and that will be a European 6 credit course.

Ms. Keith said that she and Ms. Whitney had discussed which academic disciplines ought to teach design-for-all, and they agreed that everyone in ICT ought to learn it. "We would like to see the course integrated into a mainstream course," she said "…so the undergraduates can take it as a part of their mainstream education, and they all go out with this kind of information available to them."

The technical academic programs—such as computer science, computer engineering, web programming, software development, and web sciences—could teach detailed techniques in specific technologies, such as HTML, Flash, JavaScript, video, etc. They could also teach a basic understanding of the disability types (visual, auditory, motor/mobility, and cognitive/intellectual), how people with disabilities use mainstream technologies and assistive technologies, and what the laws and standards are for making accessible technologies.

Academic programs focusing on business and management of technology—business information systems, information systems management, information technologies, information security, enterprise information systems—could get into some of the details of the laws and standards, plus address the basics of disability types and assistive technologies. Programs in law and technology could address a similar set of issues.

Programs in the education sector—such as educational technology and instructional technology—could address the topic from the perspective of learning and instructional theory—addressing disabilities as an important learner characteristic—and/or from the technical perspective of design and development, which would require expertise in specific technologies.

Programs designed to teach students how to provide services directly to people with disabilities—such as special education, assistive technologies, and rehabilitation—could focus on learning the types of disabilities, social and emotional issues, and how to use assistive technologies.

Art and design programs—such as art, design, product design, game and simulation design, human-computer interfaces, usability, and web design—could focus on how people with disabilities interact with technology and how they use assistive technologies. They could also benefit from knowledge of design standards and laws.

The preceding examples are meant to be illustrative but not comprehensive. There are likely other categories of academic degrees that could benefit by adding curricular elements about accessibility and design-for-all. The more people in technology that know about the issues and techniques, the more likely they will be to use those techniques.

### Theme 3.2: Defining the Depth and Breadth of the Curriculum

How much should a curriculum about accessibility or design-for-all teach? Should the accessibility information be integrated throughout the curriculum, or should the program offer one or more classes just about accessibility? Should the curriculum be designed for an entire degree program, for an academic certificate program, for a single class, for a single workshop, or for some other type of program? On the technical side of things, is the goal to create experts who can code accessible web pages, PDF files, videos, and other technologies, or is the goal to give them an overview of the techniques and technologies so they can find or create solutions on their own? On the legal and policy side of things, is the goal to enable the students to draft international industry standards and best practices, or just to interpret the existing documents? These are the types of questions that curriculum developers need to ask as they begin to put their ideas together. The curricula in this study each take different approaches in answer to these questions.

The first web accessibility curriculum at the University of Linz, the Barrier-free Web Design program, was an intensive curriculum designed to create web accessibility experts: people that would know the state-of-the-art coding techniques for making web content accessible. Within the realm of coding and techniques, the curriculum answered the questions of what to teach, and how much of it to teach, in the simplest way possible: teach everything, and to teach it as thoroughly as possible. It was originally conceived as a master’s degree program, but the university administration denied to give it master’s degree status, so it was taught as an academic certificate, without reducing the curriculum scope at all. The program took two years to complete, and was about as comprehensive as it could have been for web developers and students with backgrounds in computer science or similar fields. The program did limit itself in some ways, though, to topics that would be of most relevance to its target audience. For example, while it covered policies and laws in ways that are relevant to coders, it did not investigate the policy or legal perspective in depth from the point of view of one who would be creating or administering policies or writing or enacting laws. The Barrier-free Web Design program was for coders more than for businesspeople or lawyers. The Web Sciences curriculum would later bridge this gap. Similarly, the program’s focus on web accessibility meant that it did not fully address related issues across the full range of social issues—such as rural or aging populations—or the full range of digital technologies—such as software design and mobile devices—in the way that the Digital Inclusion program would later attempt to do.

The materials from the second curriculum at the University of Linz, *web_access*, are general enough that they can be used to guide programs of many different kinds. They were designed to be adapted to the needs of individual countries, programs, and instructors, giving an outline of topics to cover without prescribing exactly how to cover those topics. The *web_access* materials are more of a pattern, or set of curriculum guidelines, for what could or should be taught within web accessibility topics, rather than finished instructional materials that can be inserted into a classroom. The materials can be used in their entirety, or curriculum designers can pick and choose from among the topics and customize them as necessary, whether for a full master’s degree, a single lecture on accessibility, or anything else in between. Because of this flexibility, the *web_access* materials do not answer questions of depth or breadth of the curriculum. The curriculum designers who use the *web_access* materials, though, will have to answer these questions.

The third web accessibility curriculum at the University of Linz, the Web Sciences program, is not all about disability issues or design-for-all. It is a general-purpose curriculum for people interested in web technologies. As such, the depth and breadth of the web accessibility components of the curriculum is necessarily much shallower and narrower than the Barrier-free Web Design curriculum. The students in the program come from different kinds of backgrounds, adding to the complexity of teaching the topic. One group comes from a computer science background, another group comes from a business background, and another group comes from a legal background. The presence of these three different kinds of students means that the instructional materials must be broad enough to cover these three different academic disciplines. Given the limited amount of time in the Web Sciences program that can be dedicated to web accessibility at all, the Linz faculty had to accept that the curriculum could not turn their students into web accessibility experts.

At George Mason University, it was never an option to teach a comprehensive curriculum about web accessibility within the Instructional Technology program. After all, the point of an Instructional Technology program is to teach instructional technology. Web accessibility comes into play when developing instructional technologies, but mainly in discussions of the medium or delivery method. The fact that the Mason faculty members have a full three-credit hour class devoted to Web Design and Accessibility shows that they take the topic seriously. The instructor can cover a fair amount of material in that one class, providing students with a solid foundation to go on and learn more later if they want to.

When I taught the class, I tried to strike a balance between depth and breadth of the instructional materials. I covered HTML accessibility in detail, but only provided a brief overview of accessibility for JavaScript, AJAX, Flash, PDF, Office, Java, or other technologies. The assignments required students to demonstrate proficiency in a range of

HTML accessibility techniques. There were no assignments requiring proficiency in any of the other technologies, though I sometimes allowed extra credit to students who wanted to explore accessibility issues in one of the other technologies. My rationale for teaching one technology—HMTL—in detail was that a certain level of expertise is necessary in order to truly understand what accessibility means, so I gave them expertise in one technology. The rationale for just glossing over the other technologies was more practical than anything else. It would be impossible to teach all of the accessibility techniques for all of the technologies in one semester. The main issues and concepts of HTML accessibility apply to other technologies, so students should be able to transfer some of their knowledge from one technology domain to another, even though the techniques and tools for working with other technologies are often very different. With video and multimedia, the accessibility techniques can sometimes be complex, because the technologies themselves are complex. The instructor would have to teach all about video and multimedia technologies in order to train students in the accessibility techniques for those technologies, and that would be an unrealistic expectation for just one class.

I found that I taught the basics of HTML and CSS coding about half of the time and web accessibility the other half of the time in the class. When I asked Dr. Dabbagh whether she thought a 50:50 ratio like that was appropriate, she responded:

> I've never had people come back and say I wish I had more experience in accessible Web design. Had I had that, I would say they need to have more, but given the situation...right now, and that I haven't heard anything else from my graduates, I would say that what we're doing now is sufficient.

Dr. Dabbagh pointed out that instructional designers usually work in teams. These teams often consist of project managers, instructional designers, subject matter experts, web and/or multimedia developers, and graphic artists. The instructional designer usually does not create the interface, and may not create the media objects in the instructional materials. She explained:

> Instructional designers are not really the developers in the places where they work....They're the folks that look at the learner outcomes and find the appropriate instructional strategies. That's instructional design. Developing is a different story, and many [organizations] have developers on board.

Dr. Behrmann provided a similar analysis.

> For our instructional design folks, it's probably important that they need to know what to do and how to find the resources to make it happen when they need it. Most of the instructional designers aren't going to be doing most of the actual web programming, but they're the ones that are going to be writing the specifications. If they write the specifications for accessibility, the programmers will do it. If they aren't aware of what the requirements are, then they're not putting it in the specifications for their programmers to do it in the first place.

In some ways, this appears to absolve the instructional designers from the responsibility to know all of the detailed techniques for making the content accessible. They need to know enough to know that it is important, and to know how to work with the developers to ensure that the content is accessible in the end, but they may not need to know precisely how to make that happen. At the same time, Dr. Behrmann's comments may underestimate the degree to which some instructional technologists are expected to be the technical experts on the job, especially in smaller teams or when the instructional technologist must work alone on a project. Some employers may assume that a person with a title of "instructional technologist" can do everything that a technology project requires, including computer programming and other aspects of the project in which accessibility expertise is important.

I asked Dr. Dabbagh how much she thought accessibility was discussed in the other classes in the program besides the Web Accessibility and Design class. She thought for a second then said:

> Gosh probably zero! Unfortunately. Well, at least the courses that I teach. I assume that they've already had that in 526 [Web Accessibility and Design]. So they're coming into my advanced instructional design course, and I focus more on theory and pedagogy, and I focus more on constructivist learning environments, and the design of open ended learning environments, and things like that. But some of the students...come up with examples that address accessibility issues because of their own context. They have a context in the workplace or they have a context in the school where they are in contact with accessibility issues, and so they design for that because they want to. But I as an instructor, it doesn't factor into any of my assignments, and I would doubt that it does with any of my colleagues.

Her answer confirmed my own hunch that the Web Accessibility and Design class was kind of an island unto itself in some ways within the Instructional Technology program. The faculty members seem to agree that accessibility is important, but it is not their own area of expertise, so they do not feel qualified or compelled to broach the topic as a part of their own classes, or to require students to meet accessibility requirements when designing instructional materials for class projects or assignments.

It might be more effective to systematically reinforce accessibility by addressing it throughout the instructional technology program, using the web sciences program as a model, but given the circumstances at George Mason, with no other faculty members specializing in disability issues—other than the faculty associated with the Assistive Technology program—the current arrangement seems reasonable. Even though web accessibility is effectively in its own silo, apart from the other classes, the silo effect undoubtedly is not unique to this class or this subject matter. The instructors have their own strengths and areas of expertise, each teaching what they know best, even if no one else in the program addresses those same topics.

The way that accessibility was integrated into the Digital Inclusion program resembled both the Web Sciences program at Linz and the Instructional Technology program at George Mason, but in different ways. The resemblance to the Web Sciences program was in the way that accessibility was addressed throughout the curriculum, even though the purposes of the curriculum extended beyond just web accessibility. The resemblance to the Instructional Technology program was the way in which web accessibility was taught in a single class for one semester, and in the way they chose to focus on the web when addressing digital accessibility, rather than try to build expertise across the full range of digital technologies. The class was called “Accessible Web Design,” rather than “Accessible Digital Design” (or another similar title). They knew they could not teach everything in a single module, so like the Mason faculty, they decided to concentrate on the techniques for the web, and provide only an overview of techniques for other technologies.

Currently there is no academic program anywhere that devotes its entire curriculum to teaching the techniques for accessible design for the web, for any other digital technology. The Barrier-free Web Design program was one of a kind. No one has replicated the scope of that program, and all of the interviewees in this study made the case for their respective programs that they thought the highest priority was to give students an overview of the topic, make them aware of it, and give them enough knowledge that they could go on to learn more later. This raises a question: where will students go to learn more? Mr. Batusic seemed confident that students would be able to find the resources on their own. He did not feel that academia needed an intense program like the Barrier-free Web Design program. Other interviewees were more ambivalent. When I asked Ms. Keith where the detailed accessibility techniques should be taught, she answered:

> I think I puzzle over that one myself. The general principle for when we're teaching computing here is that you don't teach Microsoft products, for instance: Word, PowerPoint, and whatever else. We give students an overall understanding of how computers work, so that no matter what changes may come along in the future, they're not pegged to a particular application, a particular manufacturer, or a particular version that happens to be around at the moment. We should be giving the students the framework for understanding whatever is the next technology that happens to come along. So, working from that basis, if we tell our students at a master's level how to use a particular application today, what's going to happen in 2 years' time when that application is gone and something new has come along? We've trained them to use something in particular, but we haven't educated them in terms of having the transferable skills. I don't know quite where the boundaries lie, but there seems to be, from academic opinion, this difference between *training*, which is to use a particular application, and *education*, which is the broader transferable knowledge. So I'd be worried, that in teaching people to do accessible PDF, that's a training thing and not an education thing.

Both Ms. Keith and Ms. Whitney underscored the difference between "training," which they saw as a nonacademic activity, and "education," which they saw as the responsibility of academic institutions. They wanted their students to be able to become leaders within the field, not merely technicians responding to the leadership of others. Ms. Keith continued:

> The master's level is about high-level problem-solving, and working at the forefront of technology, being able to work across the leading edge of different disciplines, so I think that says we have to be working at more of a theoretical level in order to be a master's qualification. But if someone wants to take an alternative argument, I'm not dogmatic about that.

She conceded that students need to be able to graduate with skills that are immediately useful in the job marketplace. One way to do that is to provide the training in specific technologies and techniques as a part of the degree program, and not rely on students to learn them on their own. Emphasizing academic traits and education over skills training could lead to a disconnection between the theoretical and the practical sides of accessibility, which could skew the perceptions of the students.

Questions of curriculum depth and breadth, and how much of which topics to teach to whom, can get quite complex, and the options are almost innumerable. In many ways, the important point here is not that there are perfect answers to these questions, but that the act of asking the questions is important in and of itself. Different curriculum developers will undoubtedly arrive at different conclusions to fit their circumstances and educational philosophies. Judging by the very small number of academic technology programs that address accessibility, it appears that most technology curriculum developers have not even asked whether they should address the topic, let alone how deeply or how broadly to address it, so any move toward addressing the topic in some way is already an improvement over the status quo.

### Theme 3.3: Creating Specialist Programs vs. Adding Accessibility and Design-for-All to Mainstream Technology Curricula

Is it better to create specialist programs about accessibility and design-for-all, or to integrate those topics into mainstream technology courses? A paper by Whitney and colleagues (2010) expounded on some of the arguments for and against these two approaches.

Over the life of the DfA@eInclusion project, the project partners reported

> concerns over the implications for mainstreaming versus specialist training. The argument for mainstreaming of DfA principles and practices is one of greatly increasing awareness to all ICT and design students and in parallel engaging multidisciplinary awareness in social sciences and humanities of the social issues. The counter-argument for specialist programmes is increased professional recognition of the skills and knowledge needed to identify and solve complex problems. However, the argument against specialization raised by the partners includes the risk factors for student and institution of becoming too specialized, diluting core technical skills and therefore limiting opportunities for employment—in effect the "return on investment" for the student.

Given the strengths and drawbacks of the two approaches, which approach do the interviewees in this study prefer? All of the interviewees expressed a desire to infuse accessibility and design-for-all into mainstream curricula, but examples of both approaches can be found in the programs they created.

The University of Linz first created a disability-focused specialist training program with the Barrier-free Web Design Program. Their second curriculum, *web_access*, was agnostic as to what kind of program it could become. Curriculum developers could implement most or all of the materials in a specialist training program, or they could use only parts of it within a mainstream technology curriculum. Their third curriculum, Web Sciences, is a showcase example of the way accessibility can be integrated into a mainstream curriculum. The same is true of the Instructional Technology program at George Mason University. The Mason faculty never intended the web accessibility component of the Instructional Design program to be any more than a small part of the overall curriculum. The Digital Inclusion program at Middlesex University could still be considered a specialist program, even though it covered a wider variety of situations than the Barrier-free Web Design program did. The Barrier-free program was disability-specific. The Digital Inclusion program addressed other social conditions such as aging and rural populations in addition to disabilities. A close look at each of the programs can help illuminate how the interviewees feel about the question of specialist vs. mainstream curricula.

George Mason University's Instructional Technology program is one example of mainstreaming accessibility education, an approach that results in a much larger number of students who learn about accessibility, even though the depth of the training is shallower compared to programs dedicated to accessibility. All students take one three-credit class on Web Accessibility and Design. This is the only class in the program that addresses the topic of web accessibility, so the depth of the course materials is necessarily shallower than it would otherwise be in a specialized program like Barrier-free Web Design. The faculty could have left the Web Accessibility and Design class where it was originally, as a 2-credit optional course. If this had happened, the course would have continued to attract only a small minority of students (Ms. Neuber said she "felt lucky to get 8 or 10 students" per semester) who were already interested in the topic. Adding the class to the core curriculum increased enrollment to between 15 and 30 students per semester, and increased the frequency to every semester (fall, spring, and summer). It also ensured that all students would be exposed to the topic, whether they were originally interested in it or not. Hundreds of students have since taken the class and have learned the basics of web design and web accessibility. It is impossible to say how many of these students still remember or use this information, but I have had several students tell me over the years about their experiences using their web accessibility knowledge on the job. At least a couple of the students went on to study web accessibility in more depth as a part of their doctoral programs.

Given that instructional technologists are usually not the people doing the actual work to make the content accessible, one might ask whether it is appropriate to make accessibility a part of the required curriculum for instructional technology students. Would it be more appropriate to make the class an optional or elective element in the curriculum? The same question could apply to any other technology-related program in which students may not need to learn the development skills themselves. There may be more than one answer to this question, depending on the circumstances. All of the people I interviewed felt that it ought to be a required part of the curriculum.

One of the primary reasons to require some curriculum element about accessibility or design-for-all to the curriculum of a technology program is to make students aware that the problem even exists. The vast majority of the students that I taught in the Instructional Technology program learned about web accessibility for the first time in my class. If the class had not been a part of the required curriculum, most students would not have learned that their work in instructional technology could adversely affect people with disabilities if they fail to take accessibility into account. Adding accessibility to mainstream curricula increases the number of people who are aware of the issue.

Another reason to require students to learn about accessibility is to give them the practical skills to deal with it effectively. In some programs, the most relevant practical skills would be coding and programming. In other programs, the most relevant practical skills would be program management and leadership. In other programs, the ability to create and interpret policies, laws, and guidelines may be the most relevant practical skill. Whatever set of skills the curriculum designers choose, the purpose in teaching practical skills is to enable students to take action and be useful within the field. Awareness of the problem is important, but it takes skills to get things done.

On the flip side, one could argue against teaching accessibility in mainstream programs by pointing out that many—perhaps most—of the students will not need to apply accessibility principles in their day-to-day jobs, so it is a waste of time and resources to teach all of the students in technology programs about accessibility. When I was teaching the Web Accessibility and Design class, I sometimes wondered how much good I was doing. Many of the students did not have the technical skills or inclinations to become accessibility experts, and the vast majority of them would not have taken the class if it had not been required. Most students were there because they had to be there, not because they wanted to be there. I know that some of the students have gone on to use their accessibility knowledge on the job, but I do not know if they are a small minority, or if they are in any way representative of the entire set of students that have taken the class. During the class, a great many students seemed to become interested in the topic, and seemed to be converted to the idea that accessibility is important, but, outside of the classroom environment, would those same students choose to put in the work to make content accessible? It would be interesting to find out, but I do not have any data to say one way or another, other than anecdotal snapshots from a few students who contacted me later.

Another argument against adding accessibility to mainstream curricula is the problem of curriculum expansion. A program cannot teach every possible concept or technique to its students. The number of courses and credit hours is limited, and not all universities have faculty members that know enough about accessibility to teach it. These are practical concerns that can make it seem difficult to anything to the curriculum, especially if there are no obvious legal or professional consequences for excluding it from the curriculum. I asked Dr. Behrmann if he had talked with other departments at the university about adding accessibility to their curriculum. He responded:

> Oh, yeah, different places. We've got some people over at Human Factors. They really haven't gone very far, but yeah, we have, over many, many years…. [The problem is] curriculum expansion, you know. How do you do it? And the focal points are different. It's possible, but everybody has got their plates pretty full.

These are hard points to argue against, because they are self-evidently true. Curriculum developers must choose between many different possible priorities, which means leaving some things out of the curriculum entirely. Whether accessibility should be one of those things or not is a value judgment. The people interviewed for this study believe that it is important enough to include in the curriculum, and several of them are working hard to make their point to other curriculum developers, but ultimately the other curriculum developers have to make the decision for themselves.

Like George Mason's Instructional Technology program, the Web Sciences program at the University of Linz requires students to take classes about accessibility, even though accessibility is not the main focus of the degree. Accessibility is not relegated to an optional set of classes that most students would likely overlook. Students in that program receive less instruction in web accessibility than the students did in the Barrier-free Web Design program, but more instruction than the Instructional Technology students at George Mason University. The Web Sciences curriculum includes a couple of classes dedicated to web accessibility, plus the topic is integrated throughout the rest of the courses, unlike at George Mason, where no official attempt was ever made to integrate web accessibility into any of the other classes.

About 160 students enrolled in the first group of students in the Web Sciences program, which represents an 800% increase from the approximately 20 students enrolled in the Barrier-free Web Design Program. Not only that, but because of its success in attracting students, the Web Sciences program will likely run for many years to come (even though enrollment has lagged somewhat behind their expectations and goals), whereas the Barrier-free Web Design program ran only once before the university found it difficult to attract sufficient students to keep the program alive. The Digital Inclusion program met the same fate after enrollment declined to the point that the program was unfeasible. The trade-off is that the Web Sciences students will learn much less about web accessibility than the students in the Barrier-free Web Design program. They will not become web accessibility experts unless they supplement their classroom learning with other instructional materials. This trade-off seems worth it though, in light of the number of students entering into the discontinued Barrier-free Web Design program and Digital Inclusion program: zero.

The Web Sciences program will be self-sustaining for the foreseeable future, because of the adequate level of interest demonstrated by students and because of the steady supply of jobs in web development fields. This makes the web accessibility component of the web sciences curriculum essentially self-sustaining as well. The fate of the accessibility component is no longer at constant risk of elimination due to low enrollment. Having faculty members from the Institut Integriert Studieren in the Web Science program also ensures that the curriculum will likely withstand any possible future attempts to excise the accessibility component from the curriculum. The naturalness of the fit between web sciences and web accessibility is another safeguard for the longevity and sustainability of the web accessibility component of the curriculum. It makes sense to link the two.

At Middlesex University, the main curriculum for design-for-all was found in the Digital Inclusion program, but there are a few examples of design-for-all being integrated into the mainstream curriculum. For instance, Ms. Whitney teaches a class on input/output devices to undergraduate students in which she includes some principles of accessibility, assistive technologies, and design-for-all. Throughout the interview, Ms. Whitney repeatedly turned to the idea that the main tactic for spreading accessibility needs to be to “get smaller elements of design-for-all into the mainstream courses, so that more people take it on.” She viewed this tactic as a way to prime the pump. She believes that exposing more people to design-for-all will spark the interest of more students who otherwise would not have known about design-for-all. Ms. Hengstberger used similar logic:

> There’s more demand at the moment to include [accessibility as a small part of broader programs] like Computer Science and so on, or this Web Sciences master, because they know how to do it, and if they need to know more, or want to know more, and get specialized, they can do more, but they know the basics.

Mr. Batusic shared this view, emphasizing that awareness can inspire a developer to become an expert.

> The most important thing is to get awareness of problems, that there people that have problems with barriers in the techniques and the approach to web and so on. I'm sure that all web developers, web specialists, and so on, should be aware of this problem. If you have in your head the vision of this problem, then it's not really difficult for you as an expert in programming or an expert in markup languages to implement the correct techniques. The problem is awareness. That's problem number one.

Mr. Batusic went so far as to say that he did not even like the idea of a specialist degree. He did not want one at all. I asked him how the web accessibility experts would become experts. Where would they learn the expertise? He responded:

> You know, if you study informatics, if you study computer science, then you are also not experts for all parts of computer science…. So even after your degree, you have to study specific things that you need in your life for yourself. It's no problem. If you are an expert in web sciences, a big part of this, a nice part of it, includes the accessibility stuff, so it wouldn't be a problem for you in the end.

He thought that a whole master's degree in web accessibility would be overkill and too specialized. As long as students were aware of the basics, they had the responsibility and the capacity to look up the details on their own.

Ms. Keith agreed with Mr. Batusic's position that teaching accessibility and design-for-all in the general curriculum is a better approach than creating specialized degrees. In the interview, she said:

> We would like to see the course integrated into a mainstream course, rather than a specialized unit, so the undergraduates can take it as a part of their mainstream education, and they all go out with this kind of information available to them, and that becomes more economically viable.

Taken literally, it would seem that her preference at the time of the interview would have been to discontinue the fledgling Inclusive Design program so they could instead integrate parts of the curriculum into mainstream technology programs. Within less than a year, the Digital Inclusion program had been discontinued anyway, whether she truly sought that fate or not. Even at the time of the interview, Ms. Whitney and Ms. Keith, in association with EDeAN, were preparing curriculum guidelines for design-for-all modules that could be integrated into existing undergraduate programs. They will have an opportunity soon enough to put their ideas into practice in the general curriculum.

When I asked Ms. Whitney whether she thought specialist programs or general programs that teach a small amount of design-for-all would be more effective, her response, as Ms. Keith later said, was "more diplomatic." Ms. Whitney said:

> We need both. That's why we're working on the module that can be included in undergraduate courses [for EDeAN], because we need the future ICT professionals to understand accessibility, and to understand the wide range of end users for their products. I believe we also, as well as that, need the experts, the drivers, the people who will be responsible, because we will need people leading, especially in government departments and in large organizations, and also in some of the smaller organizations. You will need somebody who knows the subject really in detail. And that's why we've got a master's here. It's not going to work unless we have both.

Ms. Whitney's viewpoint is more in line with Dr. Miesenberger's. They both want to see accessibility and design-for-all integrated throughout all technology curricula—just like Ms. Hengstberger, Mr. Batusic, and Ms. Keith do—but they also feel that the field as a whole will benefit from the kind of professionalization that can only come from specialized academic programs. Dr. Behrmann likewise felt that "there is a place for" specialized programs, but emphasized that such programs must tap into reliable funding sources to make them viable.

The cases in this study show that there is more than one way to answer the question of whether to create specialist programs or to add accessibility and design-for-all to mainstream technology curricula. Most of the interviewees like the idea of having some of both approaches, and yet all of them agree that the most effective approach for making the biggest impact is to target the mainstream technology curricula. They feel that the curriculum within “ICT academic and industrial courses needs to transform from a specialist element taught by committed experts for a limited number of highly motivated students, to become an essential part of all ICT courses” (Whitney et al., 2010). The pool of students interested in specialist programs is much smaller than the pool of students interested in technology in general. The thinking is that the more students know about accessibility issues and have at least basic skills to cope with them, the greater the chance that these students, once they become working professionals, will make use of this knowledge and actually make technology more accessible.

**Theme 3.4: Defining the Type of Credential to Offer**

As the discussion in the previous section indicates, all of the interviewees feel that accessibility and design-for-all should be integrated into the mainstream curriculum, but some of them still hold out hope that specialized training programs of some kind can succeed, even if they are not traditional academic programs leading to a master’s or bachelor’s degree in web accessibility, digital inclusion, or some other similar discipline. Mr. Batusic was emphatic in emphasizing that the 2-year Barrier-free Web Design academic certificate program was too long. Perhaps an accelerated certificate program could take its place, or even an accelerated full-time master’s or bachelor’s degree. Another option would be to offer intensive training events or workshops. These workshops could be part of an academic program, but they could also be stand-alone training events. Alternatively, on-demand training and consultation could be offered on an as-needed basis. Examples of all of these alternative approaches can be found throughout the world, and, in fact, are more common than academic programs. Maybe these other approaches are easier to start up, or require fewer bureaucratic negotiations, or maybe they are more popular and attract learners more easily than the long, drawn out programs do.

Mr. Batusic recommended limiting the length of programs like the Barrier-free Web Design program to one or two semesters at the most. The instructors would not be able to teach as much during that amount of time, but with a smaller time commitment—and a smaller economic commitment—the program may be able to attract more students, which means that the program can stay in business. If given the choice between teaching the students less or going out of business, Mr. Batusic would choose to teach students less. The one or two semesters could be added to an existing academic program, such as computer science, or web sciences, or software engineering, or other similar mainstream degrees. Students could be given an academic certificate upon completion, or their diploma could state that they have an endorsement in web accessibility, or something to that effect. The information could also be taught as a stand-alone certificate or endorsement, not affiliated with any particular degree, similar in status to the academic certificate offered by the Barrier-free Web Design program, but with a smaller investment of time.

Ms. Keith suggested something similar. Instead of offering a full master's degree like the Digital Inclusion program, a university could configure the curriculum more as a training than as a degree. She suggested it could be “a 12 week or 24 week course,” which coincides with Mr. Batusic’s recommended one or two semesters.

> [Students could] get a certificate or a diploma to say [they’ve] completed this course, which is then more appropriate for people in the workplace, which maybe is more viable. We’ve spoken to some people who are interested in the course who have already got a masters, so they don’t want to go through the masters experience, but they would be interested in the knowledge sharing, of what we’re doing, and getting professional recognition; the fact that there are specialists in that area, which they haven’t got currently.

Ms. Keith’s observation that some students are disinterested in a master’s degree shows a different side of the situation from the Barrier-free Web Design students who were disappointed that the program did *not* offer a master’s degree. Some students will want a degree. Others will not. It may be difficult to please both kinds of students in a single academic program. With shorter, nonacademic programs, this would be less of an issue. When I asked Dr. Miesenberger about the idea of creating a nonacademic program, he responded:

> That’s where I think the demand is increasing. The one spin-off association which we have offers a lot of courses in web accessibility for developers, for companies. This might be half a day or a day, or a week. A group comes, asks for a course, and we offer the course. We tailor the course for them based on the materials we have. A lot of things are going on in that direction, but these are very specific programs, so, for example, a group of developers of a bigger company comes in and asks for a course of 2 or 3 or 4 days on Silverlight accessibility [or some other technology]. Then we have to sit down and apply all of the knowledge we have to this programming environment and implement it. Or another company with whom we cooperate has a system for e-government. They have their own system, their own library, development framework, and they ask for implementing accessibility. We prepare, and then we teach their staff. It is very targeted and tailored...They do not want to become experts in web accessibility. They have a certain programming environment. Accessibility is a core issue, and they ask for this very specific knowledge. And they might change from one programming environment to the next, and they might knock on the door again and say, “we need accessibility implemented here.” This very often leads them into consulting or even in project cooperation, which we do for several companies already. They

> design their new web development, send us the templates, we develop accessible templates for them, send them back, and then we do teaching, one or two weeks, telling the experts how the templates have been designed so they can be re-used, and how to bring accessibility into their whole web presentation. So it's a different model.

I asked Dr. Miesenberger if he thought the business consulting and training approach was a better model than the academic model for providing training in highly technical skills. He responded without hesitation

> At the moment I would have to say that from what we learned, this very practical-oriented business model of consulting is for sure the better one. Business and day-to-day practice asks at the point of solving a certain problem. Full stop.

He then commented on the role of academic programs, saying that he felt it was probably most effective to make as many people aware of the problem as possible by integrating accessibility into mainstream curricula, even if they do not become experts, because when the need expertise down the road, they will at least know that they lack the expertise. At that point, they can reach out to professional consultants and trainers who can fill in the gaps and either do the work for them or train them in the specific tasks that they need to accomplish at that moment, without going into all of the academic or technical details that are not immediately relevant.

Dr. Miesenberger would not have made these same statements in the years that he was preparing or administering the Barrier-free Web Design program or the *web_access* initiative. The disappointing results of those efforts have caused him to shift his priorities and to see the value in meeting industry needs at the actual point of need, rather than put too much emphasis on academic purity. Teaching accessibility at the university level within mainstream programs is still an important way to ensure that the rising generation of technology professionals knows enough about accessibility to be able to seek help when necessary. As it is now, a lack of knowledge about accessibility and design-for-all is one of the main obstacles preventing companies from implementing design-for-all principles in their products, according to a survey by Whitney and colleagues (2010). It will likely take a combination of academic curricular changes and on-the-job training and consulting within businesses to overcome the knowledge deficit in the professional workplace.

Ms. Whitney mentioned a specific kind of on-the-job training that the EDeAN partners identified as a key area for curriculum development: training the people who work in direct sales and support of technological devices to be able to help customers with disabilities, and not merely shrug off the customers because of a lack of training.

> If you buy a mobile phone and you're using accessibility features, when you phone the help desk, the person on the other side of the phone...can answer your questions intelligently. Yes, more than "some idea." But at a university, they're not the sort of people that we teach, but that is a missing element. And from the point of view of a person with disabilities, one of the most frustrating things is when they buy something for its specialist features, and that they need, to then get specialist advice about it. They can't just use the general staff.

This kind of training usually happens within companies, sometimes with the help of outside experts. The main role of academia in this type of scenario, as explained by the interviewees in this study, is to raise awareness of disability issues as a part of its main curricula so that the companies that hire the university's graduates have people on staff who recognize the need to provide the training. A secondary role of academia might be to educate the specialists—perhaps in a master's degree or certificate program—who will provide the training.

In the end, it may not matter much how the specialists get their training, or what credential they have to show for it at the end of the training. The specialists could have master's degrees specific to disability issues, or perhaps academic degrees in broader technology fields. They could have academic certificates or endorsements, or they could attend workshops without receiving any kind of official recognition. They could teach themselves using web resources and books, or they could learn on the job. All of these are viable options. There would certainly be advantages to offering in-depth training in specialized master's degrees. For example, students would have the chance to immerse themselves more thoroughly in the subject matter that way. It could also raise the level of professionalism within the field, as faculty members feel pressure to keep up with the latest trends and to publish more research on the subject. These are the advantages that Dr. Miesenberger sought with his initiatives. The nonacademic approaches to accessibility training may not offer these higher-level advantages, but they do offer to plug the gap of accessibility ignorance, and that may be a higher priority in the short term than academic maturity or prestige.

### Theme 3.5 External Collaboration and Joint Degrees

Of all of the interviewees in this study, Dr. Miesenberger has been the most enthusiastic about collaborating with institutions outside of his own university for the creation of a common curriculum or joint degrees. Under his direction, the *web_access* initiative brought together partners from different European countries to create a framework for a web-accessibility curriculum that could be shared among partner institutions, with the intent of laying the groundwork for a joint European master's degree, with elements from each of the partners. Even after these grand goals unraveled, and after it became apparent that he would have to take a different approach of teaching small parts of this curriculum within mainstream technology curricula, he never let go of this goal.

During the interview, he talked about his desire to eventually reach out again to partners across Europe, or perhaps even beyond the European continent, to set up a joint master's degree. He explained:

> [The collaborative, joint-degree model is] supported by the European Commission, the so-called Bologna Process. They support joint master programs which facilitate the exchange of students. You could run a part of the curriculum, let's say, at Middlesex University, part of it at the University of Linz, part of it another partner university in Germany or wherever, and in the end they all accredit the full masters, so they have to agree at all of the universities that the curriculum is at the level that all universities would accredit it as a master.

He felt that the *web_access* initiative was perhaps ahead of its time, which was one of the reasons it failed to achieve some of its objectives. The University of Linz was strongly committed to accessibility, but the *web_access* partner institutions were less experienced in that area at the time, so they had less to contribute without creating new classes and new programs. Dr. Miesenberger continued:

> We had no potential partners at the time giving lectures in web accessibility. We couldn't find them. Now there are universities and colleagues out there that are already giving lectures on accessibility. And if we integrate them, they can say to the university, "our contribution is what I'm already teaching, so there is no additional cost for the university, but we bring it to a higher level, and we can sell it to more students." I think the bits and bytes are there. As I said before, we need individuals who say "yes, let's take the things which are here," and it would be an ideal win-win situation for the partners.

With the way that technology can link people and places, he sees no reason why other institutions from around the world could not join in the collaborative effort or become a part of the joint degree. He named George Mason University as a potential partner, though he has not engaged in talks with anyone at Mason about it. Perhaps the Ontario College of Art and Design could become a partner, with their new program in Inclusive Design. Extending the reach beyond Europe might complicate the picture from a perspective of organizational management, but it could enrich the program, by choosing from among the most qualified and most willing partners from around the world.

Ms. Whitney’s and Ms. Keith’s involvement with EDeAN has attuned them to the possibilities of international collaboration and joint degrees as well. As they help to set European-wide curriculum guidelines, they would like to add more universities to the list of institutions using those guidelines. Like Dr. Miesenberger, Ms. Whitney talked about her desire to collaborate and set up joint degree programs. A Linz-Middlesex partnership of some sort seems like a logical starting point. They are each aware of what the other is doing, and have worked together in EDeAN and other contexts, even co-writing publications. There is no formal agreement in place between the two institutions at this point to create a joint degree, but when they are ready to make the move, they will likely confer with each other on the best path forward.

With so few institutions currently even attempting to create curricula dedicated to accessibility or design-for-all, university administrators may worry that the rarity of the programs is a liability. Those who make the decision within universities to approve or disapprove the creation of a degree program usually feel more comfortable approving a program if they know other similar programs exist. If no similar programs exist, it is logical to ask why not? It is possible that they do not exist because they are not popular, practical, or sustainable. Joining with other universities may help to assuage the concerns of university administrators that a new master's degree in accessibility or design-for-all is too unique or too risky. Sharing the responsibility and the liability can provide a safety buffer for the individual institutions. The risks would be distributed across the network of collaborating partners, and no one university would need to absorb undue liability this way.

The creation of an international joint degree may also make the degree more attractive to potential students. A nonmainstream degree from a small country like Austria may appear riskier to the students than a degree that spans multiple countries and offers an international diploma. An international degree also opens the door wider to a larger pool of potential students. Dr. Miesenberger had learned the hard way that the pool of potential students in Austria is too small to sustain a strong web accessibility master's degree program. A European-wide program, or even a world-wide program, though, could certainly be sustainable at some level.

### Theme 3.6: Internal Collaboration and Interdisciplinary Degrees

Collaborative curriculum initiatives do not require faculty to step beyond the borders of their own campus. Many possibilities exist for collaborating internally between different departments of disciplines in the same institution. Interdisciplinary programs can be difficult to initiate, because of the way that higher education institutions tend to separate academic disciplines into separate vertical organizational structures, as if each discipline could stand completely on its own. This kind of structure may simplify organizational charts, but it obscures the complexities of the world outside of academia, in which people need to routinely reach out to others with different kinds of expertise to solve real world problems.

Of the programs in this study, the Web Sciences degree is the best example of internal collaboration within the same university. The degree itself is interdisciplinary, offering a concentration in computer science, a concentration in business, and a concentration in law. This arrangement brought together faculty from different disciplines and required that they work together to create a curriculum that was meaningful from the three different academic disciplines. The students in the program likewise have to learn to collaborate with each other and to draw on the strengths of the students in the other disciplines. The intention behind this interdisciplinary approach is to replicate the kind of interdisciplinary collaboration that occurs in the professional workplace. Web design, aside from personal or very small-scale projects, requires a coordinated effort among teams of people from different backgrounds and perspectives. The computer programmers, web server administrators, and database administrators have to know how to structure information, how to protect the information from security threats, how to retrieve the information and code it for effective (and accessible!) display in the web interface, and other related tasks. The business leaders and marketers are more interested in the message and sales potential of the web. They leave the coding concerns to the technical people. Those who take a legal and policy perspective concern themselves with risk management, liability, protocols, and policy creation. Others play a role in web site creation. Graphic designers, for example, give the interface its public "look and feel" and visual interest, and writers give users something to read. On a broader scale, hardware and software engineers create the devices and interfaces through which everyone accesses web content. The field of web sciences spans these and other disciplines, so an interdisciplinary program like the one at Linz makes sense.

George Mason's Instructional Technology program is also cross-disciplinary, in that it brings together faculty from corporate training, K12 education, and special education for its three concentrations: instructional design and development, integration of technology in schools, and assistive technology. The faculty members generally teach to students within their own discipline, but there is some crossover, in which instructors teach students from other disciplines. The Accessibility and Design class is one of these crossover classes. Master's degree students in the Instructional Design and Development concentration and in the Assistive Technology concentration, as well as certificate students in e-learning, must take this class as part of the core curriculum. The class is listed as an optional class within the other concentrations and certificates. The class debuted with a dual classification under the Special Education and Instructional Technology headings within the course catalog, and it has maintained this dual listing status throughout its existence.

In principle, the Web Accessibility and Design class, or perhaps a slightly modified version of the class, could become even more inter-disciplinary than it is now. Students in other degree programs, such as computer science, human factors and applied cognition, and information systems, for example, could benefit from knowing about accessibility and design-for-all. Dr. Behrmann indicated that he had approached the faculty in these other departments, but so far the other departments have not added this class to their curriculum, nor have they collaborated with the instructional technology program to teach accessibility concepts within the context of the existing curriculum. The opportunity for collaboration of this type still exists, but no one is actively pursuing it right now.

Ms. Zirkle talked about her desire to see the class taught in other disciplines at George Mason. She commented that adding accessibility to the curriculum of other technology programs

> would not only put Mason at an advantage, but it would also put students at an advantage. Because more and more, you start to see, as students go out into the workplace, if it's going to be instructional design, or if it's going to be web development, or anything within an IT field of any kind, they are now asking questions about accessibility: their knowledge of it, can they code for web accessibility, and so on. And if we're not trying to influence that, then we're not preparing students as well as we could. And that's what I would really like to see change. Now, that's my hopes and dreams, and bigger than life, but eventually I think it could be a goal.

As a relatively new instructor of the course, though, and with her other full time job responsibilities, she has not felt she has had time yet to reach out to other academic departments. When I asked Dr. Dabbagh about the prospect of teaching web accessibility in other disciplines, she felt it would be a good idea, but did not feel she was the right person to try to push forward with that idea. She felt that the responsibility to push forward with an accessibility agenda belonged to the faculty in the Assistive Technology concentration, and the people in the Equity office, such as Ms. Zirkle. George Mason University is in a good position to take advantage of cross-disciplinary collaboration on web accessibility, but nothing will happen until someone decides to make it a priority.

At Middlesex University, the Digital Inclusion master's degree was mostly a stand-alone program, but there was some crossover with the computer science students and other students in the informatics programs, because the Digital Inclusion faculty members also taught classes in other departments. Ms. Whitney has always made a point to teach design-for-all principles in her class on input/output devices, for instance. The Digital Inclusion program was not a collaboration between academic departments though. The subject matter includes content from the same types of disciplines as in Linz's Web Sciences program, but the Digital Inclusion master's degree was a self-contained, rather than cross-departmental, program.

Forming partnerships and collaborative agreements within universities across academic disciplines can sometimes be as difficult or as complicated as collaborations between institutions, depending on the politics within the university, and on the quality of the professional relationships between faculty members. Questions of budget allocation can be sticking points, and faculty members are wary of expanding the curriculum too far beyond its main purpose. Keeping departments separate is often easier from an administrative standpoint, even if it may not be the best decision in terms of the breadth and quality of the curriculum. On the positive side, cross-disciplinary collaborations can enrich the experience for both faculty and students. It can create a more complete educational experience that more closely resembles the world outside of academia. It can also reduce some duplication of effort if the same classes, or at least variations on the same classes, can serve dual purposes across departments.

## Topic 4: Instructional Materials and Strategies

### Overview

Once the interviewees in this dissertation decided to create a curriculum about accessibility or digital inclusion, they looked to see if they could find existing models of similar curricula from which they could learn. The WAI of the W3C featured some instructional materials, slide presentations, and tutorials on its web site. WebAIM had a rather extensive collection of tutorials online, as well as a CD-ROM that could be licensed for in-house training and workshops. Other organizations and individuals provided training and consulting services, and there were a few universities offering occasional workshops or classes on the subject, but there were no examples of full-featured web accessibility curricula when the team at the University of Linz began to develop the Barrier-free Web Design program. Similarly, no other Instructional Technology program offered classes in web accessibility when Ms. Neuber first conceived of the class, or when the faculty first decided to make the class a required element of the core curriculum. The Digital Inclusion at Middlesex University could turn to the past efforts at the University of Linz for inspiration for part of its curriculum, and it could turn to programs in usability or human-computer interaction for other parts of its curriculum, but there was no other curriculum that brought it all together quite like the Digital Inclusion program anywhere else. The faculty at all of these institutions had to break new academic ground. This section discusses some of the decisions they made in terms of what to teach and how to teach it, and how those types decisions can affect the outcome of the curriculum.

**Theme 4.1: Sparking the Interest and Motivation of the Students**

The interviewees in this study want to convert students to the idea that accessibility and design-for-all are important. Students can learn all the laws and techniques out there, but if they leave the course shrugging their shoulders and believing that it does not really matter, the course has failed to achieve its primary purpose.

The first step is to alert students to existence of the problem. Most people do not think much about disabilities and do not know how people with disabilities use computers. They do not know that digital technology can be accessible to people with disabilities or that the designers of the technologies are the ones who determine how accessible a technology is. It is rather easy, then, to give students a new cognitive experience by simply making them aware of the issues.

One effective way to make students aware of the issues is to show them examples of real people with disabilities using assistive technologies and talking about their own experiences. If people with disabilities are not available to provide a live demonstration in class, a video can often prove equally effective. In my class, I showed videos by WebAIM (e.g., "Keeping Web Accessibility in Mind" and "Experiences of Students with Disabilities" [WebAIM, 2006a, 2006b]) and by DO-IT at the University of Washington (e.g., "World Wide Access: Accessible Web Design [DO-IT, 2009]). In the interview, Ms. Whitney talked about showing a video in her classes to demonstrate assistive technologies in use.

> On the disability side, assistive technology is a really good thing to introduce to first-year students. I teach computer hardware, and when we're discussing input/output devices, I get them to look at both examples of assistive technology,

> and YouTube clips of people using assistive technology, just to stretch their minds, and get them thinking further about different ways...and amongst the clips on YouTube, there's one of a young man who's using a single switch getting a very, very high score on one of the shooty-up games, and that's good, because it starts with the shooty-up game, and then I pause it, and I've got 218 or 219 students, mainly young men, and we discuss that, and a few of them will say that they could have gotten a higher score, and they'll quite often tell me what game it is, and then I play the rest of the clip, and they see that it's someone using a single switch, and so we discuss that. And if you think about computer hardware, and ways of getting information in and out, if you've been through a standard education system, you're probably pretty much limited to what exists, and a computer may be a touchy advice, but really you can use anything, as long as it gets an electrical signal…. By using the shooty-up game, it relates to the students, and it helps widen the returns.

Whitney and Keith (2008) also published a paper about their experiences using video as an instructional tool.

> When asked what had most impact on the students one reported how videos about accessibility and usability were particularly valuable in raising awareness of the issues as well as project work in which the students must develop programming skills necessary to develop accessible and usable software systems. The other reported on the impact of practical experience with web accessibility and the direct hands-on experience of novel HCI methods and techniques addressing users' diversity.

When choosing videos, it is important to choose examples of accessible videos that, at a minimum, have captions. It would be even better if the videos also had transcripts and audio descriptions (narration explaining important nonauditory visual elements in the video). The captions, transcripts, and audio descriptions can be enlightening in and of themselves, even when associated with videos that have nothing to do with disabilities or accessibility. I always made a point to ask the students how many of them had seen captioned videos on the web before, or how common they thought captioned videos on the web were, or if they had ever heard audio descriptions before. It is at this point that most students begin to realize, perhaps for the first time, how unfriendly multimedia can be for deaf and blind viewers.

Bringing assistive technologies into the classroom can be another effective technique. Ms. Neuber recommends bringing the most unusual assistive technologies available as a way to spark interest. One possibility would be to bring a one-handed keyboard, which looks very odd by conventional keyboard standards. The one-handed keyboard that she had access to has a sharply curved interface, somewhat like a baseball catcher's mitt, with keys all over the curved interface.

> [Show people] things...that maybe not a lot of people would use,...but...that capture your attention and [and make people] stop and come over and say, "I want to see what you're doing!" I think that's important. A lot of [accessibility advocates] say, "just show the stuff that a lot of people use," but that's really not it. You have to show the stuff that makes people turn around and go "what the heck is that?!"

The novelty of something like a weirdly-shaped, one-handed keyboard can draw people in, where more common-looking assistive technologies might not.

When I was teaching the class, the most common comment I heard during the first few weeks of each semester was "Wow, I never realized that this problem even existed." The students are surprised both that the there is a problem and that they did not know about it. Alerting students to the existence of the problem is generally quite easy, because most students know so little to begin with. The sudden realization of their own "blind spot" makes many students curious, and they begin to think through what it might mean to access a computer as a blind person, or as a person who cannot use a mouse.

Another tactic is to try to relate to the students' own experiences with friends or relatives with disabilities. As Ms. Neuber stated;

You never know why something catches someone's attention. It might be that

> they know somebody who has a disability and that it has affected them in some personal way…. [You want to get] to the point where they can say, "oh now I get it. I can see why this matters." A lot of times it's someone's personal experience. I think: "my brother losing his vision, or my grandmother." Try to tie it into something that they know."…[Bring] it into a personal experience so it's not, "oh those people with disabilities." [Help them start] to realize that if we don't have [a disability] now, we're probably going to at some point in our life. Sometimes that catches people's attention.

Instructors cannot count on all students having close acquaintances with disabilities, but it would be a lost opportunity to not attempt to make the connection for the students who do have those acquaintances.

Sometimes the most effective technique is to emphasize the technical aspects of creating accessible digital content. In the interview, Ms. Neuber talked about her experiences teaching experienced web designers:

> I thought it was fun, because a lot of these guys are webmasters. They already know HTML. This is just another problem that they need to solve, so you could see some of them light up and be like, "Oh I could fix that! I could make that happen! I can do that!" So it would be like a challenge. I don't believe that their major motivation was helping this person over here with the disability. Their motivation was, "I know how to do this; look at how slick this is." [It was] sort of this new thing that they could add to their arsenal of skills. One guy...took a workshop and he just took off. He just loved the whole thing. He built a [web accessibility] testing tool, and he won an award for it…. It was just neat to see him take off…. He became the Web accessibility specialist in [his] department [at the university]…. It was just a spark for him. I don't know exactly what his motivation was, but a lot of it was, "what can I make work?"

Web accessibility became a technical problem for him to solve, and an opportunity for him to create new software solutions.

Once some light has been shed on this issue, students are often receptive to the idea that this is a serious and important issue. It generally seems self-evident and uncontroversial to most students that those who create web sites and other technologies ought to take accessibility into account. It is usually not until later in the course when they start learning the techniques and find out that some of them are harder than they expected that some of them begin to question whether it is worth it. When this happens, instructors have a second opportunity to try to convert the students to the importance of accessibility.

From my own experiences teaching, I found that most, but not all, students continued to believe that accessibility is important. A few voiced their opinions that accessible design entails too much work, or that accessibility techniques stifle creativity and technology progress, or that people with disabilities are too much of a minority to worry about. When these objections arose, it was tempting for me to want to aggressively defend accessibility or to accuse the student of insensitivity to people with disabilities, but I did not. I figured that reactionary responses such as these probably would have backfired. I did not want the students to feel that their instructor was trying to indoctrinate them against their will, which could have caused them to dig in their heels and merely go through the motions of the class exercises while essentially tuning out the class's purpose and mission. In fact, it is possible that some students just went through the motions, telling me what they thought I wanted to hear, without voicing their true opinions and objections. My position of authority could have colored their interactions, making me think they were more receptive to the message than they actually were. The worst that I could do as an instructor would be to invoke someone's ire to the point that the person becomes an advocate against accessibility. Though a minority, anti-accessibility advocates always press their case, often quite passionately, every time a new accessibility policy or law is proposed. Adding to or emboldening their ranks could be counterproductive, to say the least.

The risks of over-selling the case for accessibility are real, but so are the risks of under-selling it. A lackluster approach to the topic by the instructors gives students an excuse to disregard the message and turn their attention elsewhere. All of the instructors that I interviewed were passionate about the topic, so they taught with a clear sense of purpose, doing their best to engage the students through various methods and tactics. The instructors wanted to inspire a passion for accessibility within their students, and they understood that the best way to accomplish that goal would be to model that passion as instructors.

### Theme 4.2: Curriculum Topics and Assessment Methods

What topics should a curriculum in accessibility or design-for-all include? This is the question that the *web_access* initiative sought to answer, with the publication of a common set of curriculum guidelines and topics among partner institutions. After the dissolution of *web_access*, the partners in the EDeAN have since picked up where *web_access* left off, publishing additional documents to attempt to harmonized the curriculum for accessibility and design-for-all programs. Neither the *web_access* materials nor the EDeAN guidelines try to specify exactly what should be taught or how it should be taught, but they do offer suggestions and try to simplify the process for curriculum designers. Depending on the focus of a program, the curriculum could include all or just a few of the topics listed in the *web_access* or EDeAN guidelines.

The curriculum guideline documents published so far by EDeAN give an idea of the types of things the curriculum can focus on. The have published master's-level curriculum guidelines with modules on (a) fundamentals of design-for-all, (b) assistive technologies, (c) regulations, legislation, and standards, (d) web accessibility, (e) interaction design and user experience, (f) master's level research project, and (g) accessibility in games. They are currently in the process of creating a second set of guidelines for undergraduate education. The EDeAN curriculum guidelines took some cues from the *web_access* initiative, as evidenced by the significant overlap in the main themes for the modules. The *web_access* modules are: (a) fundamentals of web accessibility, (b) assistive technology, (c) guidelines and legal requirements, (d) accessible content creation, (e) design and usability, and (f) project development. The themes are identical, with the exception of the EDeAN module on the accessibility of games. The *web_access* curriculum contained more detail on each of the topics than the EDeAN guidelines, but neither one is a stand-alone instructional product that instructors can just choose and use. Instead, they provide recommended lists of topics, learning outcomes, instructional and assessment strategies, and lists of resources instructors can use in the classroom. They provide lists of prerequisites for the modules, to help curriculum designers create programs that manage the sequence of learning in ways that benefit the learners. They also try to standardize the modules within international specifications of credit hours, so that modules taken in one country can be recognized and transferred to other countries.

The instructional goals and materials for the Web Accessibility and Design Class at George Mason share many of the same themes as the *web_access* and EDeAN materials. Even though the three instructors (Ms. Neuber, myself, and Ms. Zirkle) each taught the class in slightly different ways, they all taught (a) the fundamentals of accessibility, (b) fundamentals of assistive technology (Ms. Neuber emphasized this more than the other instructors), (c) guidelines and legal requirements, (d) coding HTML for accessibility, and (e) creating a final web design project. The Web Accessibility and Design class does not teach accessibility for games, and does not go into much detail about the usability side of things, but the other components closely parallel the components in the *web_access* and EDeAN materials.

The remarkable level of agreement between the materials of the three different cases in this study shows a convergence of thinking among specialists in accessibility and design-for-all. This is encouraging because it means that the field has matured at least to the point where the professionals have a reasonability consistent idea of what it means to be a professional in the field. One of the main benefits of publishing the web_access and EDeAN guidelines is that it provides a kind of road map for other instructors and curriculum developers as they consider creating a curriculum at their own institution. It lowers the threshold of initial investment of time and research into industry best practices, expediting the curriculum development process and for instructors and curriculum designers who may not consider themselves to be foremost experts in the field.

Even with this high level of convergence and agreement among experts, there is plenty of room for interpretation and variation within the curriculum guidelines that they have identified. The Web Accessibility and Design class is a good illustration of different interpretations of the same basic instructional goals. The three instructors of the Web Accessibility and Design class have had different teaching styles and emphasize things differently, drawing on their own experiences and strengths. The three instructors of the Web Accessibility and Design class at Mason have each put their own stamp of personality into the class. Ms. Neuber emphasized assistive technologies because that is one of the things she knows the most about. I placed less of an emphasis on assistive technologies and more of an emphasis on standards-based HTML and coding for accessibility, because that is something I was used to teaching, from my days with WebAIM. Ms. Zirkle is especially interested in having the students evaluate web sites for accessibility problems, because that is what she does on a regular basis in her full time employment at the university. Even with these differences in emphasis, the contents of the course have remained remarkably consistent.

In a nutshell all three instructors at Mason started by raising awareness about disabilities, showing the impact of the web on the lives of people with disabilities, and showing the way in which inaccessible web sites harm people with disabilities. The course at Mason teaches about different types of disabilities—visual, auditory, motor/mobility, cognitive/intellectual, and seizure disorders—and the assistive technologies used by people with each of those types of disabilities. It gives them an overview of the laws—Section 508, Section 504, and the Americans with Disabilities Act—and standards—W3C Web Accessibility Guidelines—related to web accessibility. The course teaches basic HTML skills and how to put together a small web site. It teaches accessibility HTML techniques for images, tables, links, forms, headings, and so on. It introduces students to accessibility for PDF, PowerPoint, Word, Flash, video, and multimedia, but does not go into much depth on those topics.

The curricula at the University of Linz—Barrier-free Web Design, *web_access*, and Web Sciences—all contain a strong dose of coding techniques. The programs attract people with strong computer science, or other technical, backgrounds. The programs at Linz have placed more of an emphasis on the technical side of accessibility than the programs at Middlesex and at George Mason. The web sciences curriculum keeps the technical emphasis, and adds components for business and legal students. Looking to the future, Dr. Miesenberger still would like to create a technically-oriented master's degree program. Computer science is his background, so that is the perspective that he feels most comfortable leading as a curriculum creator.

The faculty of a curriculum with a heavy technical emphasis, like the kind of program Dr. Miesenbeger envisions, will need to be continually update the techniques to keep up with the advances in technology. A curriculum about web accessibility in today's technology sector could address technologies such as HTML, XHTML, XML, CSS, JavaScript, AJAX, WAI-ARIA, PDF, Office, Flash, Quicktime, and video captioning, among others. In a few years, some of these technologies likely will be outdated, and new ones will have come to take their place. Students will need some practical skills in the current technologies. They will also need generalized skills in accessibility that they can transfer from one technology to another. Students have to know that overarching principles as well as the technology-specific techniques.

The Digital Inclusion program set itself apart from the programs at George Mason and at Linz by encompassing all digital technologies, not just the web. The curriculum covered interactive digital devices of all kinds, which means that students cannot get by in the course by learning only about web accessibility. Web accessibility fits under the umbrella of digital inclusion, but digital inclusion is more than just web accessibility. They studied issues like DVD players, ATMs, televisions, phones, mobile devices, office machines, and so on. This breadth of the course material necessitated a shallower treatment of it, so the web accessibility module, for instance, was not as intensive on the technical side as the corresponding materials at George Mason or at Linz.

The Digital Inclusion program covered more than just people with disabilities. It addressed aging populations, rural populations, economically-disadvantaged populations, and other groups that are excluded from full participation in digital society for one reason or another. In the interview, Ms. Keith talked about why she thought it was important to address all of these kinds of digitally-excluded groups in the Digital Inclusion program.

> [With aging], you get multiple minor impairments. You get a bit of deafness, a bit of vision impairment, a bit of restrictive movement, or something like that. So that's quite useful as a way of bringing the different types of disability together. It's something that the students can recognize easily as well, because they've maybe got parents or grandparents or something like that to relate to. And then with disabilities, people are blind, and use screen readers, which is the obvious challenge of accessibility, or at least that's one of the first things that comes to mind. The examples for people being socially deprived in some way: low income, low education, remote rural areas, there's a question of context, and when does that apply and start to become a problem? One I know from my own research, is when I'm working in a low income area, is that people make much use of shared machines, whereas more affluent people have got personal access machines. That starts to become important in any security or confidentiality issues. Plus I'm aware of research by my colleague who sits beside me in low literacy and how people search for information on the web. And that's quite a big challenge. We do make a big assumption that people are reasonably literate in whatever your national language happens to be, and that's not always true. We have massive immigration in this country, and a lot of people who are not speaking English as a

> first language. My colleague this morning just reminded me that one of the boroughs that we looked at before has 47 different languages spoken with that borough. If you're disseminating information to that group of people, they have a basic understanding of English, but not a very high level of understanding of English. And you start asking for government forms and things, that becomes a problem.

Digital inclusion, then, means making sure that the advantages of the information age in which we live do not turn into disadvantages for certain kinds of people who may already be at some kind of sociological or political disadvantage.

The Digital Inclusion program also set itself apart by placing a heavier emphasis on usability and user testing of digital designs. Dr. Springett tried to make it clear to me during the interview that accessibility is only one type of concern with digitally-excluded populations. It is not enough to make something available or accessible, it has to also be usable, desirable, and its design must fit the needs and wants of the users. The attention he paid to the personal, affective side of the user experience gave the Digital Inclusion program an extra layer of meaning in what could otherwise be a more impersonal, technical list of accessibility techniques and rules.

The question of what to teach will probably be answered at least in part by the interests and expertise of the curriculum developers. The programs at the University of Linz have emphasized coding and technical proficiency with accessibility techniques because those are the things that interest Dr. Miesenberger, and he is skilled in those techniques himself. The Web Accessibility and Design class has passed through three different instructors, and the instructors emphasized the topics that interested them most, even though the syllabi for the classes looked very similar for all three instructors.

Closely related to the question of what to teach are the questions of what and how to evaluate the learning of the students. As a general principle, it usually makes sense to assess the learning of the students on the topics that the instructor feels are the most important ones to learn. As with instructional styles, every instructor assesses the students in a slightly different way than the other. There are some commonalities worth discussing though.

Ms. Keith described the three main assignments in the web accessibility module that she teaches.

> [The first assignment is an] evaluation assignment [in which] they will use various automated tools, and do a user trial as well. In the second [assignment], they do a planning and commissioning exercise, and in the third [assignment]...I would like them to focus more on the cognitive side, and content side of understanding information on the web site: how you manage a search engine, how you can lead people to information, how you can present information in ways that makes it easier to understand. I want them to pick a particular issue, and plan a design to the best of their abilities. If they are web competent, they could do web pages, as an example. If they can't do that, they can do something which would allow a trial to take place, which you can even do in something like PowerPoint, you can show what ideally you want your layout to be, what your text is going to be like, what's going to happen on the next page, how you get from one page to another, so you've done some design activity. And you can do some data gathering around that, to show how you can make an improvement. They would then have to specify how that's going to be taken through at the technical level, with some analysis built in as well, because everything at the master's level has to have an analysis side.

Of note is the way that she allowed students of different levels of web design expertise to choose projects that coincided with their level of expertise. The Digital Inclusion program drew on students from many different kinds of backgrounds, and many of the students had no prior web design experience. Rather than penalize them for their lack of experience, she let them work within their own strengths. She encouraged students to engage in projects that are relevant to their jobs and professional goals.

All of the cases in this study teach web accessibility, and all of them include a web design project as part of the assessment. In the Web Accessibility and Design class, this project is the final assignment, and is treated as the culmination of everything the student learned previously. When I taught the class, I used the final project as a way to test students' HTML skills, knowledge of accessibility techniques, and use of CSS for layout and styling. I gave students a checklist of HTML elements to include (images, tables, lists, headings, etc.), techniques to use (e.g., use CSS for layout, make sure the navigation menu shows users which page they are currently on), and evaluations to perform (the website must pass an XHTML 1.0 strict evaluator and the WAVE accessibility evaluation tool) make sure the web site is accessible. Previous lessons in the class taught them how to do all of these things, so the task was to put that knowledge to work in a real life situation.

Assessments can also be used as a teaching tool, not just a final test. When I was teaching the Web Accessibility and Design class, I usually let students re-submit assignments for a better grade. If the students did not achieve an "A," I gave them feedback as to what some of the problems were—without giving them the answers or doing their work for them—and told them that they could resubmit the assignment for full credit. I never told my students that this was my policy. I did not write it in the syllabus or announce it to the class. Students only found out if I sent them an email telling them that they had an opportunity to resubmit the assignment, and even then I did not let them know that I would allow them another opportunity on subsequent assignments. If students made all of the necessary corrections on the second try, I gave them full credit. If their assignment still fell short of an "A," I still sometimes gave them an extra opportunity to get it right, though I did not always give them full credit. I was more willing to give full credit if I could tell the students were honestly doing their best.

This approach was harder for me, as the instructor, than it would have been if I did not give the students extra opportunities, because it gave me more work, and it meant that I had to help the students achieve an "A," and not merely lay the responsibility on their shoulders for all of the learning. I had an incentive to teach it as thoroughly as possible the first time around so that I would not have to regrade assignments. Students who were told to resubmit the assignment generally corrected everything on the second try. I believe this high success rate was due in part to my explanations of what they had done wrong, but also to their realization that I actually cared whether or not they learned the subject matter, and that I expected "A" work out of them.

During the semesters when I included a test, I told the students out the outset that they had as much time as they needed to finish the test, they could consult any materials in books or on the web, and they could take the test as many times as necessary to get an "A," but they had to get an "A" to pass the test. A score of "A-" or lower would result in zero points for the test. I made sure that the test questions were challenging, but not in a tricky or deceiving way, or at least I tried not to make the questions deceiving. I wanted them to research the answers to questions that may not have obvious answers, because knowing how and where to find the answers is probably a more important skill than actually knowing the answers. Long after the course is over, they may not remember specific facts or skills, but if they remember where to find the answers, or at least remember that answers are available, I would still consider the course a success. All of the students over the many semesters that I taught the course were able to achieve an “A” on the test eventually, even if it took multiple tries.

The exact methods that an instructor uses to teach a class are not particularly important from the perspective of curriculum design (though the teaching methods may indeed be important from the perspective of pedagogy). In any case, curriculum designers cannot control every classroom interaction, even if they wanted to. Instructors will always have some level of autonomy within the classroom.

Autonomy is a good thing, but the faculty at the University of Linz and at Middlesex University have expended a great deal of effort to encourage instructors to create courses that follow some basic curriculum guidelines, so that courses taught at one institution can be recognized and quantified for credit at other institutions if necessary. The more compatible the courses and modules are with each other, the easier it will be to track credentials and ensure that students receive an adequate educational experience relative to students elsewhere. This kind of systematic coordination should also help to move the technology sector closer to the goal of having all technology professionals know at least something about accessibility and design-for-all, so they can either do the work themselves or so they know where to find people who can do the work for them.

**Theme 4.3: Accommodating Different Levels of Technical Skills Among Students**

One of the challenges that all of the programs face is the challenge of teaching students of different levels of technical skills within the same classes. When I asked Ms.

Keith how she managed to teach her web accessibility module in a way that kept the technically skilled students engaged without alienating the technical neophytes, she responded:

> Well, that's the interesting challenge I'm dealing with right at this moment in time! ...We deliberately encourage students who are from different backgrounds, so there are one or two from web accessibility or web design [backgrounds who] build their own accessible websites. We've got somebody who teaches people who are socially disadvantaged, who, as far as I know, doesn't have much understanding of what goes on underneath. We've got to find an approach that allows for that mixed ability. And we wanted that mixed ability, because web design is complex, so we need to come into it from all sorts of directions. I'm trying to set the assignment so it can be completed at a master's level, but they can play to their strengths within those assignments. I'm not asking them to design a fully accessible web site. They've only got 12 weeks, and they're only part time, so that would be impossible. So I'm aiming more for competence at the level of management and commissioning [web sites], so they'll have a deep enough understanding of the major issues, and where the barriers are to accessibility. They'll understand enough that they can plan and commission a web site and be confident that they know what the accessibility issues are that should be covered, that are defined by the web content accessibility guidelines, obviously, but also other materials that support issues that are not covered in there.

Ms. Keith was in the process of creating the content for the web accessibility module when I spoke to her, so she had not settled on exactly how she was going to manage the different skill levels, but she did have some ideas that she shared with me.

> They're only in class, so to speak, for only one week [per semester], and the rest of what they do is on distance learning. I should explain that the pattern is that they're here for one week full time, and then over the next 11 weeks, they have 3 assignments to complete. Now, what I'm doing with the one week when they're in, is that, one of the technicians that we have here, who does some teaching, will give them an introduction to HTML, and also to the practicalities of things, like how to upload the website onto the university's servers, because, even if they're only doing just a little bit of code, they need to be able to do that so they can see it, and so I can see what happens. It's not enough to have them write a little bit of code and have a look for themselves using their browser. So they will get just a morning of that, so they'll get at least the "hello world," or whatever it is: their first experience of using HTML. In three hours at the most, they're not going to get very far. But what I am focusing on is starting with an evaluation process, so

> they get the experience of looking at some web sites which have been well-designed, so they can have a look at them, and be able to compare with some sites which have known problems, so they kind of leapfrog past the beginner's side, which is quite hard. I think you can go through quite a lot of weeks of training from a cold start to be competent enough even to do a 4 or 10 page web site. I think there are still a lot of steps that you really can't cope with, like getting into the CSS for instance. Because you need to have gotten your HTML sorted out, then you need to get to the CSS.

Ms. Keith acknowledged the importance of CSS and the other aspects of web accessibility that she would not teach as a part of the class, but decided that those other areas would complicate the class too much for students who were experiencing HTML code for the first time. For her, it was perhaps more important that students learn how to manage accessible web design than that they learn how to become accessible web design experts themselves. Students need to know enough about web accessibility to work with designers and developers, and to be able to speak intelligently with them, even if they do not become designers or developers themselves.

Ms. Zirkle and Ms. Neuber took a similar approach when teaching the Web Accessibility and Design class at George Mason University. They did not try to create HTML experts out of their students. They took into account the different technical backgrounds of the students and took a wide view of the purposes of the class. Their students still had to learn the basics of HTML, but not the details to the point that the class would fit in a computer science curriculum, for example.

When I taught the class, my approach was much more technical than that of the other instructors discussed so far, even though I knew that many of the students had never coded a web page before. I made the decision as the instructor that I was going to teach everyone HTML at quite a technical level, starting from the beginning, assuming they have zero knowledge. I taught them XHTML 1.0 strict, and made them stick to it when they turned in their assignments. In fact, I required students to validate their code using an online HTML validator before turning in their assignments. I also taught them the basics of CSS, and required their final assignment to use CSS for layout as well as for design. On top of all of this, I taught accessibility techniques. I made the choice that I was going to treat all students as if they were going to go on to become web accessibility experts, even though I knew that the majority of them—or perhaps even all of them—would not do that.

This was a tall order for some of the students, and for them it became quite a demanding class. I knew that some of the students would probably never design another web page in their life after that. I also knew that web design would be an important part of the job descriptions of other students in the class. I did not want to sell the latter group of students short. By setting the technical bar high, and by designing the instructional materials in a way that assumed no previous knowledge of the topic, I felt I was able to keep all of the students engaged at some level. Everything would be new for the less experienced students, and there was enough new information to keep the advanced students from coasting or feeling complacent. This approach meant that I had to spend additional time with the less experienced students, which was easier to do with the classroom-based students than with the online students. In fact, students in the online classes seemed much less likely to ask for help overall than the classroom-based students. Even so, the vast majority of the students performed well in the classes. There did not seem to be any significant difference in final grades between students who had prior

HTML knowledge and students who did not. Students without prior knowledge probably had to work harder, but most rose to the challenge. Over the several years that I taught the class, nearly all of the students who did not receive good final grades stopped turning in assignments entirely after the first or second assignment. It is possible that these students decided the class was too demanding. It is difficult to say, because the students stopped communicating with me.

The Web Sciences program at the University of Linz is an interesting mix of students with computer science backgrounds alongside students with business backgrounds or legal backgrounds. The members of the faculty in the Web Science program have to balance the needs and the different career trajectories of the different groups of students. The program handles these differences in a couple of different ways. First of all, it offers a few specialized classes to the students based on their areas of emphasis. The students with computer science backgrounds take classes that teach WAI-ARIA and other advanced web accessibility techniques, while the students with legal and business backgrounds take classes that cater to their respective areas of specialization. There is still a list of core classes that all students in the Web Sciences program must take, regardless of their backgrounds or career trajectories, but the specialized classes help to build expertise in the areas of specialization. Secondly, the program requires students to collaborate on web development projects in which each student contributes his or her own areas of expertise. The business students concentrate on planning and managing the project. The legal students work on legal aspects of the project, and the computer science students create the code for the web site. This kind of group project forces students to work closely with each other while still respecting their individual strengths and specializations. Not everyone in the program needs to know HTML coding techniques to the same level as the computer science students, but they all know enough to be able to collaborate and function as interdependent teams.

## Topic 5: Instructional Format and Media Choices

### Overview

All of the program leaders in the three cases in this dissertation decided to take a blended learning approach, teaching some content in person and the rest on the internet. The Digital Inclusion program at Middlesex University hosted the students on campus during the first week of each semester, then conducted the rest of the educational experience over the internet. The Barrier-free Web Design program at the University of Linz took a similar approach, meeting with students for two days at the beginning of each semester, then moving to online learning for the rest of the semester. The *web_access* materials created at the University of Linz and their partner institutions did not specify how the curriculum should be taught—pedagogical decisions of that nature were left up to the institutions that taught the curriculum—but all of the materials were produced in an online format, making it possible to use an online-only or blended-learning approach. Much of the instructional interaction for the web sciences master's degree—which is the University of Linz's implementation of parts of the *web_access* curriculum—occurs online or in blended learning environments. In fact, the university strongly encourages faculty to place as much of the content online as possible, leaving the decision ultimately up to the individual instructors. Some sections of the Instructional Technology program at George Mason University were taught face-to-face in the past. Other sections were taught online. Students had to choose one or the other approach. Students with limited technical experience were encouraged to take the face-to-face section of the class, but they were allowed to take the online class if they wanted to, or if their schedule conflicted with the face-to-face class. The instructional materials for both sections of the class were online, though—all assignments, all reading materials, all assessments, and discussion groups—so even the face-to-face class had a strong online component. In recent years, the face-to-face option was removed, leaving only the online option.

### Theme 5.1: The Nature of Online or Blended Learning Environments

In many ways, it makes intuitive sense to expect that classes about web accessibility or digital inclusion should be well suited to online instruction. The whole purpose of the programs is to make digital content more accessible and inclusive, so why not teach the course using digital technologies? None of the interviewees claimed that any one kind of approach was better than another from a pedagogical perspective. Whether a course is taught in person, online, or in a blended approach is probably immaterial to the quality of experience for students and instructors in the sense that it is possible to create highly engaging and effective educational experiences in almost any format and any medium for almost any environment. By the same token, it is possible to create insipid or ineffective educational experiences in any format, medium, or environment. No one approach stands out as a clearly superior educational strategy.

The reasons given by the interviewees for teaching the classes online were more strategic and practical than pedagogical. The target audience for Middesex's Digital Inclusion program was working professionals who had little time to spend in classrooms, and some of them lived too far from campus to be able to commute regularly. Neither the Web Sciences program at the University of Linz nor the Instructional Technology program at Mason target working professionals in quite the same way as the Digital Inclusion program did, but all of them are seeking to broaden their appeal to students outside of their geographic boundaries. This last motivation was the one most frequently cited as the main reason for offering the course materials online. All of the interviewees wanted to attract and enroll as many students as possible. Some of this motivation was rooted in the desire to spread the knowledge of accessibility and digital inclusion as far and as wide as possible, and some of the motivation came from the economic realities of academic life: academic programs can run only if they have students, and programs with more students bring in more revenue to allow the program to continue operating. Programs with too few students, such as the Barrier-free Web Design program at Linz and the Digital Inclusion Program at Middlesex, face certain extinction.

The people that I interviewed seemed to agree that, generally speaking, creating engaging and effective online materials takes more up-front work than teaching face-to-face. It requires a full development cycle from planning to completion that often involves multiple people with different kinds of expertise. The lengthy development cycle is due, in large part, to the need to create self-contained, stand-alone instructional products. Students often access the instructional materials alone at their computer, with no instructor or classmates nearby to ask for clarification. The materials need to be clear enough on their own that no extra clarification is needed. Designing instructional materials as clear as this can be exceptionally difficult, especially with complex technical subjects. Ideally, face-to-face instructional materials ought to meet the same high standards for stand-alone clarity, but, in practice, they do not have to, because the instructor is physically present to clarify, elaborate, demonstrate, or add to the existing materials if necessary. Experienced instructors can "wing it" in the classroom if they have to, even without putting a lot of forethought into the instructional design of a particular class session. The immediacy of the face-to-face environment gives students and instructors the opportunity to negotiate the educational experience together, improvising as they go. Online environments, unless delivered in a synchronous format, do not offer this kind of immediacy or spur-of-the-moment, "off the cuff" teaching. The materials themselves in online learning bear the burden of anticipating the needs and questions of the students and of providing answers, or at least pathways to those answers. Students and instructors can still interact via email, phone conversations, online discussion boards, or in other technology-mediated ways, but this kind of communication is often less immediate, so the bulk of the responsibility for teaching usually lies with the pre-prepared online instructional materials, and these take time and resources to develop effectively.

The reason that the development of web-based instructional materials often requires a team of people is because of the technical complexity of the tasks. At a minimum, a typical online course requires a web server, with a web server administration person or team, course management software, with a person or team of people to administer it, and written materials, with an instructor to run the course. This set of options may be sufficient for some things, but there are many options beyond this, such as pre-recorded or live audio or video, interactive simulations or game-based learning environments, online tests, chats, blogs, surveys, polls, and many more. Most modern course management software packages come with built-in tools to create these and other kinds of instructional elements, but someone still has to use the tools and design the instructional interaction in the first place. In the case of video, audio, or multimedia, producing instructional materials of this kind can be immensely time consuming and expensive. More likely than not, the instructor will not have the expertise to both teach the class and develop a wide variety of effective instructional materials in multiple media formats.

The curriculum development process for the Barrier-free Web Design program provides an example of the labor-intensiveness of the process. Dr. Miesenberger, Ms. Hengstberger, and Mr. Batusic created the Barrier-free Web Design curriculum over a period of 2 years, with support from other members of the Institute for Integrated Studies and about seven or eight instructors at other universities or in the private sector, according to Ms. Hengstberger, for a total of about thirteen people. Thirteen people is a large number of people, especially considering that, as Ms. Hengstberger pointed out, the Institute of Integrated Studies already had a sizeable collection of materials to draw from.

> We have worked a very long time in this area at the Institute, and we had a lot of resources. We had a lot of literature, and a lot of experts...We also had a lot of projects relating to accessible web design, or disabilities, or assistive technologies, so we already had a lot of materials, and also a lot of practical experience with our

> students, with what they need and their requirements. So of course we had literature, and books, and online resources, but also our experiences and feedback from experts, and feedback from people with disabilities.

Even with about 13 people and preexisting materials, though, it still took 2 years from the start of the project until they taught the first classes. It is true that all of these people had other responsibilities that demanded much of their attention; no one was working on this full time. It is also true that part of this time was spent navigating the bureaucratic processes of trying to get the curriculum approved as a master's degree, and later as a certificate program when the university denied master's degree. Even so, the curriculum development was time intensive, to the extent that they had to eliminate part of their development plan. They had wanted to create videos of instructors teaching, and combine these with interactive PowerPoint presentations. They created some prototypes, and Mr. Batusic even created custom scripts to assist with the integration of the video and captions, but ultimately found the video creation and integration process too demanding, and they were running out of time, so they dropped the idea entirely. "It was really a lot of work. It was not possible in these two years to develop the curriculum, and all the materials, and [integrate the video component], and [implement] the e-learning system.... [The video component] was a really great aim, but we tried it, and it didn't work out," remarked Ms. Hengstberger, because the conversion process took too much time, despite the script that Mr. Batusic had created. The script itself was XML-based and had no visual user interface. This was no problem for Mr. Batusic, since he is technically savvy and blind, so he had no need for a visual user interface anyway, but the interface was problematic for other users, who needed help to run the conversion process.

The videos might have improved the quality of the instruction, but the team felt they had to sacrifice this potential added quality in the name of expediency. In the end, they did manage to produce the PowerPoint presentations, write new instructional materials, and set up the curriculum in the Moodle course management system, but because of time and resource constraints, they had to settle for something less than their more ambitious original goals.

The Web Accessibility and Design class, which I taught at George Mason University, provides another example of the labor-intensiveness of the process. When I first started teaching the class, there was surprisingly little material available to teach standards-based HTML coding techniques in a way that would meet the needs of my class, so I spent months writing the instructional materials myself. I ended up writing what turned out to be a book-length set of tutorials with illustrations. I created the materials in HTML, created a web site for the materials, created some scripts to facilitate navigation between the modules, and integrated these materials with the learning management system. I experimented with teaching in WebCT, Blackboard, Moodle, and even created my own simple learning management system, which I used for a couple of semesters. I could have stayed with one system the whole time, but I found all of them inadequate on several levels, so I switched from one to another periodically when I felt I had run out of patience working around the limitations of whatever system I had been using up to that point. I never did find exactly what I was looking for, but I used Moodle longer than any of the others. A couple of years into my teaching experience, I created screenshot videos with narration, showing how to work with Dreamweaver to create accessible HTML content. Each short video took days to create, edit, transcribe, and caption. I did all of this work by myself, because I had the technical expertise, but instructors who lack these technical skills will need to either collaborate with others to create the instructional materials, or they will need to make do without the materials, perhaps by choosing from among other pre-existing materials that may not align well with the goals of the class. As it was, I put in a great deal of time and effort into developing the course materials

When Ms. Zirkle took over the Web Accessibility and Design class, she found the task of setting up the course daunting as well. The process of designing class has "been really interesting," she said. "It's been a fun ride, but the learning scale [for her as a course designer and instructor] is just beyond unbelievable." She cited difficulties finding accessible online materials, and appropriate texts. She looked at past course syllabi from the semesters when I taught the class, but she was given the latitude to make the course her own, so she did. "I really had the opportunity to take it and mold it the way I wanted," she said. They gave her a general idea of what they wanted the course to accomplish, but told her, that it was up to her to decide how to do it. "That was challenging," she said. She ended up placing less of an emphasis on the mastery of HTML and CSS than I did, choosing to focus on things such as evaluating existing web sites for accessibility. She did not end up writing all of her own content like I did. She chose to use a combination of existing web-based materials plus the book "Interact with Web Standards (E. Anderson et al., 2010). Beyond choosing what materials to use, she invested the time to put the course content into the course management software, including setting up discussion forums and creating a final exam.

Besides the labor intensiveness of the upfront instructional design process, teaching online changes the way that students and instructors interact. In face-to-face settings, instructors have more of an opportunity to gauge student concerns, and to monitor student progress. The feedback process can be immediate. When students have questions, they can ask them, and the instructor can give explanations on the spot, with the added benefit of real-time interaction and dialog. The immediacy of face-to-face instruction is one of its great benefits. This immediacy is lost in online classroom environments, unless the class is taught synchronously, and students are required to log in at the same time. Synchronous instruction of this kind is less common than asynchronous online instruction, in large part because of the technical complexity of trying to make sure that everyone stays connected to the server. Slow internet connections or other technical problems can turn a simple online lecture into a logistical headache.

Online courses do have some advantages over face-to-face courses. Students can access the materials on their own schedule, which can be immensely helpful for working professionals. They do not have to travel to a classroom, which means avoiding the traffic, travel time, and transportation costs. They can also spend more time with the course materials, if necessary. A face-to-face class happens in real time and cannot be repeated, unless it is being recorded. Students watching or listening to instructional media can pause, rewind, and fast forward the media if they need to review parts of it later. This can be helpful to everyone, but especially to students with certain types of learning disabilities or other conditions that require more time to process the information.

Blended learning environments can be the best of both approaches. Having an opportunity for students and instructors to meet can help provide a human context for the course, which can facilitate future online interactions by allowing the individuals to know the person with whom they are interacting. I came to miss the human context of the class when the face-to-face section of the class was discontinued. In an online-only environment, I struggled to feel that I knew who my students were. I saw their assignments and I received emails from them, but sometimes it was hard to get to know the students' personalities that way. I found it difficult to remember the names of the students, because I could not connect those names to faces. In some of the semesters, I asked students to create profiles in the learning management software (Blackboard) with photos so that I could see what they looked like. That helped a little, but it was still not the same as being able to interact with the students in person. A blended learning approach would have helped to overcome some of these things that I found difficult.

### Theme 5.3: Making the Course Content Itself Accessible To Learners With Disabilities

For the most part, the people interviewed for this research did not have significant problems making the course content accessible to people with disabilities, as one might expect from a group of accessibility experts. There were a few interesting exceptions though that are worth discussing.

Ms. Zirkle complained that she had a hard time finding accessible captioned videos and other multimedia content for the Web Accessibility and Design class. As the university's point person for accessibility, she had been used to constantly reminding instructors and web developers of the need to make their course materials accessible. As soon as she was put in charge of her own course, she realized it was not always as easy or straightforward as maybe she had thought.

> It was interesting, because I finally fell on the other side of what I was trying to talk to others about. And I realized how difficult it really is to sometimes find accessible videos, or if I have the idea of this is what I want it to show to meet the objective, and there are five of them out there, I need to find the one that's going to be accessible and use it.

Unlike most other university instructors, though, Ms. Zirkle has the distinct advantage of working in the campus office responsible for making course materials accessible to students with disabilities. "It's convenient that I'm working here in this office," she explained, "because I can just submit the video and say: I need this captioned. But that's the goal that we eventually want to get to for any other faculty. So now I've turned to be the guinea pig in that aspect for this office." Ms. Zirkle now has greater insight into the challenges of creating accessible web content from the perspective of an instructor, and not just as a web accessibility advocate.

When I taught the Web Accessibility and Design course, I was very conscientious about making sure the materials were accessible. I checked and re-checked the materials that I created in HTML format, and I made sure to include only external materials that met accessibility standards, yet I still managed to embarrass myself one semester when I posted some content that I should not have. I wanted to demonstrate some Dreamweaver techniques visually to my online students in a video format, rather than just write about the techniques. I thought the video would enhance the instruction and make it easier to understand, so I create a few screenshot videos of me doing various procedures in

Dreamweaver with my simultaneous voice narration. It took a long time to edit the videos, transcribe them, and synchronize the captions, but I did it and I was quite proud of what I had created. The next semester, I identified another concept that could benefit from a similar screenshot video, so I created it. Unfortunately, I got busy with other responsibilities and did not have the time to edit the video to the same high standards as the previous videos, nor did I have time to transcribe or caption them. I considered not posting the video at all, but in the end I relented and decided to post it in the hope that someone could benefit from it, even knowing that the video itself was an obvious bad example; it was inaccessible to students who were blind or deaf. I did not have blind or deaf students in the class, so I did not fear the direct consequences to students with disabilities, but I did worry that my students would point out my hypocrisy. None of them mentioned it during the semester, but sure enough, after the end of the semester, one of the students left some scathing comments in the anonymous course evaluations about that video. I removed the video from the course and never used it again. Unfortunately, I never created a replacement for that video either. Other things found their way to the top of my priority list instead, as often happens in life.

Over the years that I taught the class, I taught students with several different kinds of disabilities: blindness, deafness, motor disabilities, and even brain injuries and emotional disorders. The students with the sensory and motor disabilities completed the course with no problems whatsoever, and they contributed valuable insight to the class discussions. The student with brain injuries faced significant challenges trying to concentrate, and found the technical nature of the course very demanding. The student was enrolled in the online section of the class, but knowing the problems the student faced, I arranged to meet with the student on multiple occasions for one-on-one instruction. This helped somewhat, but I was not able to help the student master the content. Ultimately, I gave the student a barely passing grade, because I took into account the considerable obstacles the student faced, but the academic quality of the work was low in comparison to peers in the class. I think the student would have faced the same limitations whether in the face-to-face class, so it is difficult to say how I could have changed the class to make it accessible to this student without fundamentally changing the nature of the class itself. The student with emotional disorders could understand the content well enough, but was not always stable enough to face the workload, so sometimes struggled meeting deadlines. I offered leniency in this regard, but the student eventually pulled out of the class. In the case of this student, more empathy and personal attention from me as the instructor might have kept the student enrolled, but it is hard to say. The course itself did not seem to me to be inaccessible to this student, but it is possible that the technicality of the course was intimidating and overwhelming for the student.

Some of the students in the Barrier-free Web Design program also had disabilities of their own. One had motor disabilities and used a wheelchair. Another was legally blind and hard of hearing. “It was really very difficult to communicate with [this student],” according to Mr. Batusic. Another student was deaf, and, in Mr. Batusic’s words “had a very, very hard life.” Most, but not all of the Barrier-free Web Design materials were accessible to the deaf student. A conference paper (Ortner & Miesenberger, 2005) described some of the issues.

> As the course is primarily based on e-learning, most of the contents of the course have to be learned by the participants sitting at home. To make this selfstudy easier for the students, a lecture-like presentation of the content including slides and speech should support them - with the additional possibility to navigate through slides and chapters. The first attempt was using the Synchronized Multimedia Integration Language (SMIL), more precisely the Timed Interactive Multimedia Extensions for HTML (HTML+TIME), which are based on the XHTML+SMIL language profile of the Synchronized Multimedia Integration Language and add timing and media synchronisation support to HTML pages. But there were some problems that came along with using HTML+TIME: the use of streaming media is not supported, and the only supported browser is Microsoft Internet Explorer. In a second attempt, a prototype using Javascript is currently being developed. Using Javascript does not make the application fully accessible according to the Web Content Accessibility Guidelines, but it is assumed that people with disabilities joining the course use modern assistive technologies. Our tests involving experienced blind computer users have shown that they—using their assistive technologies—could deal with Javascript very well.

In the end, after running into multiple technical challenges, the main PowerPoint presentations had audio narration associated with them, but no synchronized text or transcripts. “That was one of the big mistakes of our materials,” Mr. Batusic lamented. “We had written scripts for everything. We also had slides, but we didn’t have transcripts of our speeches, so it was not easy for the student.... [The student] had the complete text-based materials, and the presentations—the slides—but not our voice transcripts. [The student] made it, but it was not easy.” As when I posted a video without a transcript in the Web Accessibility and Design class that I taught, the team at the University of Linz was fully aware of the need for a transcript, and had even planned for it, but they felt that time and resource limitations made it impractical to follow through with the plan to create transcripts for the large collection of audio narrations that they had, so they posted the PowerPoint presentations as they were, without transcripts. The text-based materials covered the same topics, but not in exactly the same way, so the student missed out on some parts of the course, to the regret of everyone involved in the program.[1]

The online parts of the course materials of the cases in this study were presented to learners in an asynchronous format, rather than in real time. This was likely a conscious decision on the part of the instructional designers, because real-time interactions can be challenging to produce in an accessible way. All audio content, such as lectures and conversations, would be inaccessible to deaf participants unless real-time transcription services are provided. Visual content, such as slides, images, and videos will be inaccessible to blind participants unless text or audio descriptions are provided. Some software programs are available to handle these situations. Some even include accessibility features. When used wisely, with proper planning ahead of time, and with a skilled transcriptionist on hand, these kinds of live interactions in virtual real-time settings can be accessible, but they become more of a production event behind the scenes than perhaps most people realize. Putting on a production of this type can be expensive, when the cost of the transcriptionist and the software package are included in the total. For these, and other, reasons, asynchronous online training is much more common than synchronous training.

Even in programs created for accessibility, by accessibility experts, there is the

[1] The process of adding transcripts or synchronized captions is not particularly difficult from a technical standpoint, especially for someone who deals with technical tasks on a daily basis. The process does consume a large amount of time though. One of the largest investments of time is in the first step of listening to the recorded audio and creating a text transcript. This laborious task can be outsourced, at which point it becomes a question of budget constraints more than a question of time. Some people have even found success using voice recognition technology to create the transcripts, but despite the great advances in this area in recent years, voice recognition continues to have its flaws, not just in accuracy, but also in workflow integration. It is often necessary to respeak the audio to obtain a clearer original recording before the software can process it with any acceptable degree of precision.

possibility of running into accessibility barriers, or at least challenges. Some of the challenges experienced at the University of Linz are no longer issues. Browsers are much more cross-compatible now than they were then, and various software authoring tools have come to market to help in the creation of accessible multimedia. There will always be new challenges though, and curriculum creators should prepare themselves to do the work necessary to make the content of their own curriculum accessible, lest they be accused of hypocrisy.

**Theme 5.4: Effect of Media and Delivery Platform Choices on Instructors with Disabilities**

Technologies come and go, and their capabilities are in constant flux, so it would be inadvisable to make a concrete list of recommended technologies and expect that list to be of much use a few years from now, but the cases in this study can still teach a few lessons about technology choices. The learning materials in the cases of this study are generally representative of the common options that are available to instructors at any university teaching any topic. Most of the content across all of the cases was text-based in an HTML format. Other technologies used included video in various formats (QuickTime, Windows Media, Flash, Real Media), PowerPoint, Word documents, print-based books, PDF files, and interactive HTML (JavaScript, AJAX, etc.).

Basically, any technology that can be made accessible is a valid option, but, as a general rule, it is usually easiest to present the course materials in an accessible, open electronic text format—such as HTML or plain text—to begin with. Some proprietary text formats, such as PDF, also can be made accessible, but the procedures for making them accessible are usually more involved and the results can sometimes be problematic for end users, even if they are technically "accessible." Open electronic text formats are a kind of universal lingua franca, from which other formats can be derived. Students who prefer printed pages, for example, can always print hard copies from the electronic source files.

Other formats besides open text formats are still admissible, and can even be the best choice under some circumstances. For example, well-made videos demonstrating procedural content—such as how to use a software program—can increase learning comprehension for a majority of users, and may be particularly beneficial to users with learning disabilities or print disabilities. All of the cases in this study supplemented the text with other media of some sort, and, with a few notable exceptions discussed earlier, all of these were made accessible to students with disabilities. Certainly all of them *could have* been made accessible. The exceptions arose as a result of time and resource constraints, not technology constraints.

Ms. Zirkle chose to use a printed book as one of her key texts for the Web Accessibility and Design class. Students with print disabilities (blindness, low vision, inability to turn pages, reading disabilities, etc.) will need accommodations in order to make use of it. If a blind student enrolls in the class, for example, Ms. Zirkle will need to call upon her colleagues to convert the book to an electronic version. It takes time to scan and convert the text, which may delay the availability of the text to the student. In addition, the book's many diagrams and illustrations could cause problems if the people doing the conversion do not give them adequate textual descriptions. The more technical the content of the book, the less likely the people doing the conversion will be familiar enough with the content to provide adequate textual descriptions. Not having adequate textual descriptions will make the content more difficult to understand, putting the blind student at a comparative disadvantage.

## Topic 6: Program Sustainability

### Overview

No matter how well-designed a curriculum for accessibility and design-for-all is, it will fail to make much of an impact if the program itself is unsustainable. Universities will not sustain programs that cannot attract students. That is why the Barrier-free Web Design program and the Digital Inclusion program were discontinued. During the interview while the Digital Inclusion program was still active, the faculty talked about their program with cautious optimism, knowing that their program ran the risk of being discontinued if it could not continue to enroll a minimum number of students to justify the cost and time commitment of the faculty. As Dr. Behrmann noted, disability-focused programs are constantly under threat of being discontinued. People who work in the field must always be vigilant about their current and future funding sources, and they must always be on the lookout for ways to promote the programs and keep interest in them alive.

Ms. Whitney reflected on the discontinuance of a disability-related academic program at another institution—Reading University—in Inclusive Environments (i.e., architecture and public spaces) where she used to teach lectures on accessible electronic information.

> That [program] is now ending. It's run for 15 years, something like that. But it's one of the problems in the area. It was run by people who were totally committed to it, and they worked hard at getting students. It ran, and it created lots of people who designed access to all sorts of buildings. But one of those people has retired, and the other is coming up for retirement, and it's reached its end. It would be nice to think it would carry on, but the field we're in...there aren't enough people, are there? There isn't enough money, and that's it. They've run [the program] for 15 years, and they decided: well, that's a reasonable attempt. There are a lot more access consultants now than there used to be, who can look at the built environment for people with a range of different disabilities. In the past, accessibility experts used to come from the perspective of one disability. They could tell you how to make the building wheelchair-accessible, but not necessarily color contrast.

When I asked her where the next generation of accessibility consultants for the built environment was going to come from in the future, she thought for a second, then responded, somewhat despondently:

> Yeah. I don't know. If we had a large amount of money, we could set up a university and run all of these courses, but we don't. I hope somebody else will take it on in the future. It's a very depressing place to end: that we are just tinkering at the edges. Are we tinkering at the edges, or are we actually changing things?

She considered her own question, and responded positively, "I think we're changing things…. But we are in a minority field."

I wanted to analyze this "depressing" thought a little more, so I mentioned the Barrier-free Web Design program as another academic program that had to be discontinued, and asked, "Does that mean there's a certain life expectancy for this type of program? What do you think?" She responded, "It would be nice to think we can create programs that can be taken over and taught by other people. That would be the ultimate aim." At that point we began to talk about ways to ensure the sustainability of academic programs. I asked similar questions of all of the interviewees, and while their responses varied, certain themes surfaced repeatedly. This section of this study will address those themes.

### Theme 6.1: Sustainability Requires Favorable External Influences and Conditions

When I asked Ms. Whitney what it would take to increase the number of students enrolling in the Digital Inclusion program, she suggested several things.

> [It would take] a mixture of a whole load of things, including government recognition of the importance of this, to industry recognition—both carrot and stick—and more pressure on companies that get things wrong, and more praise for those who get things right. So, it comes to legal sanctions, in a lot of ways, [but] it's a combination of different things. I can't tell you ultimately what is going to happen.

The things that Ms. Whitney identified as conditions that could have the greatest impact on the sustainability of a curriculum about accessibility and design-for-all are out of the direct control of curriculum developers. External influences and conditions such as public perceptions about disabilities, the legal landscape of the country, the job market, and the availability of assistive technologies and services are beyond the scope of curriculum development, but it is much easier to create a curriculum that fits within societal expectations than to create one which bucks social trends, or which employers and students feel is necessary. A lot of the battle for the curriculum takes place outside of the classroom in trying to make sure people perceive the curriculum as relevant.

Positive public perceptions about disabilities are both a cause and effect of inclusive and accessible societies. By definition, societies that value inclusiveness and accessibility protect the legal rights of people with disabilities, ensure that people with disabilities have opportunities to work, and develop technologies and services to assist people with disabilities. The reverse is also true. As more people with disabilities enter the job market or participate in society by virtue of assistive technologies and services, the public's perception of people with disabilities can turn more favorable as they see that people with disabilities are a normal part of society. Cinema, television, news outlets, and other media also play a role in how the public perceives and reacts to disabilities (Balter, 1999; Safran, 1998).

A factor closely related to public perception that can come into play is a region's economy. In 2000, I wrote a proposal to give a presentation on web accessibility at a conference on web technologies in South America. The proposal was rejected, on the grounds that South America had more pressing issues to deal with than worrying about whether people with disabilities could use the internet or not. The person who wrote the rejection email talked about the need to focus on infrastructure and accessibility for the general public before it could devote the time or money to the needs of people with disabilities. Undoubtedly this person's comments contained a great deal of truth. They also demonstrated the way in which economic factors can influence opinions on the importance of disability issues. It would have been difficult to introduce a curriculum on web accessibility in South America at this time, because it did not match well with the priorities of the people working in the technology industry. It might be similarly difficult to introduce an accessibility curriculum in any developing country or in any region undergoing economic stress.

Dr. Behrmann addressed economic concerns in my interview with him when I asked him how he thought the prospects for employment in the accessibility field would roll out over time. He responded:

> Well, I think it's in terrible jeopardy right now with the economy. Things that are the right things to do are the first things that get tossed under the bus when the economy is down. If we take system-wide 10% or 15% rescissions or cuts in the budget, who do you think is going to get cut first? I think that all of these programs that cost a lot for a few people are going to be the ones that hurt the most, even if they have a basis in civil rights, and it's morally the right thing to do, I think that they're going to hurt. So until we get an economic rebound, I think we'll be lucky just to stay where we are.

Lest he be accused of sounding too negative, he added, "Overall, in the future, I'm an eternal optimist." His point, though, is that public perceptions and priorities can change with the economic tides. This is an external factor that is completely out of the hands of curriculum developers, but it is something they must take into account when trying to seek approval for their programs or when trying to ensure the sustainability of existing programs.

The legal landscape also sets the tone for the reception of the public to disability-related curricula. Because George Mason University is located in the Washington DC area, many people are familiar with the Section 508 requirement to make federal government web sites accessible to people with disabilities. The federal government employs a large number of people in the area, and many of the companies in the area contract with the federal government, so the requirements are well known. Kristine pointed to Mason's geographical location as one of the primary reasons why it was easy to sell the idea of incorporating the Web Accessibility and Design class into the curriculum.

> We're sitting here on top of the federal government. Graduates need to have [Section 508] knowledge, so it's a bit easier for us. I think than someone who's out in the middle of the country—in Wisconsin or somewhere else—where the

> government jobs are not...as prevalent, [web accessibility isn’t as much] in people’s minds.

Dr. Behrmann and Dr. Dabbagh also talked at length about the way that the Section 508 requirements had shaped the direction of the curriculum. Dr. Behrmann sought and received multiple funding opportunities related to disabilities for the Instructional Technology students, so the students had to meet Section 508 requirements in order to meet the expectations of the funding sources. The continual need to train students in Section 508 techniques made the decision to create a class on Web Accessibility and Design an easy one, and the other faculty, including Dr. Dabbagh, saw it as a logical move.

The work by the WAI of the W3C in creating the WCAG (Chisolm et al., 1999) preceded Section 508 and all other laws about web accessibility. These guidelines, and the other work by the WAI, set the stage for the international attention drawn to web accessibility and for the laws that followed. The WAI has shown that standards organizations and industry groups have the potential to wield substantial influence.

One type of industry group that could wield its influence to change the curriculum is accreditation organizations. So far, they have not taken initiative to add insist that technology programs teach accessibility or design-for-all, and they have not received sufficient pressure from outside the organization (e.g., from industry associations, faculty members, or disability advocacy groups) to make them consider this kind of change. Accreditation organizations could completely change the landscape of technology education almost overnight by adding accessibility and design-for-all to their list of recommended or required curriculum topics. So far this has not happened.

A note of caution is in order with respect to the effect that laws and policies can realistically exert on shaping the curriculum. The mere existence of favorable laws and policies does not guarantee that a curriculum will be successful. The Barrier-free Web Design program and the *web_access* initiative both failed to reach their potential, despite the existence of WCAG 1.0 and civil rights laws for people with disabilities in Austria. Dr. Miesenberger admitted that he made the mistake of assuming that these laws and policies would be sufficient to drive the demand for the curriculum. The Digital Inclusion program similarly proved unsustainable despite the WAI guidelines and laws protecting people with disabilities in the U.K. It would be difficult to imagine a curriculum succeeding without such guidelines and laws, but the guidelines and laws have proven to be insufficient for program sustainability in and of themselves.

To some extent, curriculum developers are at the mercy of external influences and conditions. They are not without the power to influences these conditions though. All of the faculty members whom I interviewed at Middlesex University and at the University of Linz have been active in setting industry standards and in spreading the word about accessibility and design-for-all in scholarly publications and conferences. They are not sitting idly by, waiting for the external circumstances to change. They are shaping them, and they are international leaders in the field.

Some of the faculty members at George Mason University have been involved in efforts to change the external circumstances. Most of my own involvement in external projects, including my participation as a member of the working group for the Web Content Accessibility Guidelines 2.0 (Caldwell et al., 2008), occurred before joining the

Mason faculty. Ms. Zirkle focused mostly on campus-related web accessibility concerns, but also participates in web accessibility-related conferences. Dr. Behrmann and Ms. Neuber are heavily involved in disability issues from multiple angles, but usually do not focus specifically on web accessibility. Dr. Dabbagh directed the Instructional Design and Development concentration of the Instructional Technology program, so, while she is supportive of web accessibility, her focus is on other issues.

In the case of George Mason University, the external influences and conditions—especially Section 508 and the campus's proximity to Washington DC—remain one of the primary justifications for keeping the Web Accessibility and Design class as a part of the curriculum. The external circumstances in Austria and the UK have not quite reached that point yet. Those programs rely more on the convictions of the course leaders and faculty, and in this sense are perhaps more at risk of unsustainability if key faculty members were to leave. This could change once Mandate 376, which is analogous to a European version of Section 508, takes effect in Europe. Mandate 376 could create a logical justification for the curriculum in European programs the same way that Section 508 has at George Mason University. Time will tell.

### Theme 6.2: Sustainability Requires Teaching More People Less

There are two main directions that a curriculum about accessibility and design-for-all can take. One is to create a small, elite group of self-selected specialists in master's level programs, such as the short-lived program at Middlesex University. The other is to expose a large number of students to the basics of accessibility and design-for-all as a relatively small part of a broader curriculum, such as in the Instructional Technology program at George Mason University, which has a seven-year track record of including accessibility in the core curriculum. The curriculum can teach a few people a lot about accessibility, or it can teach a lot of people a few things about accessibility. All of the interviewees tended to believe that the more effective strategy is to teach a lot of people a few things about accessibility. This was true even among the interviewees at Middlesex University, where they had a master's level program for educating specialists, and at the University of Linz, where they had created an academic certificate program for educating specialists, which they tried unsuccessfully to launch as a master's level program. Faculty at both locations were still quite fond of the idea of maintaining master's level programs, but were unanimous in admitting that they thought that the more effective strategy—both for impact and for sustainability—would be to teach large numbers of people, even if it means teaching them only a limited amount of information about accessibility.

The main argument of teaching more students less is one of economies of scale. By teaching more students, more people will know about accessibility and design-for-all, which will increase the overall level of awareness among ICT professionals in the workplace, making it more likely that a greater number of these professionals will apply their knowledge and do the work necessary to make technology more accessible. It is true that these ICT professionals will know less about accessibility and design-for-all than anyone who has completed a master's level specialist training program in the topic, but compared to the current low levels of knowledge among ICT professionals, even a moderate increase of their accessibility and design-for-all knowledge would be a marked improvement. Even if their knowledge is insufficient to do the work themselves, they will at least know that the work needs to be done, so they can seek out specialists to do the work for them, or to consult with them or provide training so they can do the work in the future. In this way, the act of teaching more students less may actually increase the demand for specialist programs that teach fewer students more.

The model of teaching more students less about accessibility and design-for-all is largely untested (the program at Mason is an exception), so there is no way to know if this approach achieves the real end goal of truly increasing the accessibility of digital technologies. It is still a speculative proposition. Other factors undoubtedly come into play, such as the legal situation, the perception of people with disabilities, and other external—and often uncontrollable—factors previously mentioned in section 6.2. That being said, the approach would unquestionably increase awareness of the issue, and the hope is that awareness will be enough to inspire at least some of the ICT professionals to take the next step and follow through with what they learned.

One downside of teaching more students less, especially if it comes at the cost of programs that could teach more to fewer students, is that students who want to specialize in accessibility do not have the option to do so. They can always learn on their own, but there will be no academic degree or qualification to legitimize their learning. I asked Dr. Miesenberger if it worried him that a program that used to teach a lot about accessibility—the Barrier-free Web Design program—is disappearing? He responded:

> Yes, of course that's worrying. We had problems getting students for the long program, no question, and I have to say simply that this is a challenge. We have

> learned that there is simply not a market and a demand at Austrian level. The issue is to bring it at a European level, and to find partners to run it together, and also to share the teaching load, and things like that, and to run it there and provide real opportunities to provide educational opportunities for experts in web accessibility.

He still maintains his belief that a specialized web accessibility program is a good thing, even if it trains only a small number of students per year. When I pressed him to name any academic program in Europe that a student could turn to now to earn a degree in web accessibility, he could think only of the Digital Inclusion program. When I pointed out that their program does not address web accessibility at a level that even begins to approach the technical depth of the Barrier-free Web Design program, he could not hide his discouragement when he responded, “Right. I know.” Neither he nor I meant this as a critique of the Digital Inclusion program. We merely recognized that the Digital Inclusion curriculum was designed with a slightly different purpose in mind.

Sustainability does not require that all programs teach more students less, but judging by the low enrollment rates in the Barrier-free Web Design program and the Digital Inclusion program, curricula that specialize exclusively in accessibility and design-for-all will reach only a tiny market of self-selected students. These students may go on to individually make a large impact on the field, but the chances of making a large impact increase substantially as the number of students exposed to the ideas increases. It would be unrealistic to expect programs to reconfigure their curriculum to teach extensively about accessibility and design-for-all. It is more reasonable to ask them to add lessons, modules, and/or classes to the curriculum. As such, the strategy of teaching more students less has the potential to reach farther and more quickly than a strategy of teaching a few students a lot.

### Theme 6.3: Sustainability Requires Clear Career Paths and Receptive Job Markets

When reflecting on the failure of the Barrier-free Web Design program, Dr. Miesenberger contributed some important observations about the conditions of the job market with respect to the low level of employability of web accessibility experts in their area of expertise.

> The job market for dedicated stand-alone web accessibility experts is rather small. We simply have to take this into account…. Although there is interest in accessible web design on the one hand, people don't really see this as a career track. So they want to have courses which are perhaps related to design, related to web development, in shorter terms, but as a stand-alone program, we cannot demonstrate that there are jobs out there where, with these specialized qualifications, you might get a job…. And the difficulty which we encountered later on is that it's an academic course for academic people who ask at the end that they have a job or an academic career, and that's when we simply have to say "we are not there at the moment in web accessibility." And the others who are interested in practical skills of doing the job of web accessibility, they say, "we need a shorter program. We don't need the theoretical background and things like that." They want to have the facts in half a year or one year, and go to the job market employed, so this is a different course. We sit a bit in between these two interest groups with our academic course. We are oriented toward the group of academic people, but, as we said before, the academic career is not really there...academic, and also job market, which would allow them to say, "Ok, I studied accessible web design as a master in itself."

When I asked him if he had tracked the students who graduated from the Barrier-free Web Design program to see if they had found employment as web accessibility experts, he responded:

> They got jobs in the web design market. There is not a market for accessible web designers; accessibility as a stand-alone job. So they are in bigger design studios, design companies, software development companies, and they try to plug in accessibility there, and in particular they have good job or career possibilities in companies or organizations which are related to web development for the public

> sector, because they ask for the skills. They need the skills. And, out of the 19 graduates we have so far, almost half of them, they are in companies which do services which provide services to the public sector. And several of them work directly for public agencies, for ministries, for local governments, for municipalities, and they are responsible for the web development there, so this is the job area they entered.

The students had been able to find employment, but not necessarily in jobs that required their newly-acquired web accessibility expertise after graduating from the Barrier-free Web Design program. The situation was not entirely bleak, though, because a minority of students was able to find accessibility-related jobs in government or other divisions of the public sector. These kinds of jobs were scarce, however. Finding jobs in the broader web design market proved much easier for the graduates.

Dr. Miesenberger openly acknowledged that he had not fully taken into account the needs of employers when designing the Barrier-free Web Design program. He explained:

> It was my fault. It was our fault. We analyzed the requirements simply from the point of view of web accessibility. From the point of view of the company, or the public sector or whatever, they see the whole picture, and accessibility is [only] one part of it. The issue is to bring this into this holistic picture. When the public sector hires a person, or when they make procurement for the web page, they want to have all of the issues taken into account.

This was a lesson that he applied to the creation of the Web Sciences program. He and his faculty peers designed the Web Sciences program as an interdisciplinary degree, with students specializing in the design, coding, business, or legal aspect of web sciences. These students work together on collaborative projects, to simulate real-world conditions in the workplace. The Web Sciences program still teaches accessibility to all of the students, but it does not teach it to the exclusion of other relevant topics. The program was designed from the ground up to align as closely as possible with industry needs and expectations, rather than merely idealistic scholarly desires and expectations. This close alignment of the academic program with career paths has attracted a large number of students, and shows signs of being a much more sustainable program than the Barrier-free Web Design program.

In the future, Dr. Miesenberger is contemplating creating a European-wide accessibility-focused master's degree, because he thinks that the market at the European level may be enough to sustain the curriculum better than the market at the Austrian level.

> It might be worth it to consider running a European-wide master for experts in web accessibility, really dedicated. This might be a suitable target group we could address and say, "ok, it makes no sense to do it in this small country of Austria, but it might make sense to do one in the German-spoken area, and we might have 20 or 30 students per semester, and there might be a job market for them. They could work with associations of people with disabilities. They could work for the government, or whatever. There they might need a dedicated web accessibility expert, but not 20 graduates in Austria each year. There is simply no job market, and it would be wrong to expect such a job market.

Whether a European-wide program can be sustainable or not remains to be seen, but it will have a better chance than an Austrian-only program, because the market for web accessibility experts across Europe is substantially larger than the market within Austria alone.

The situation was somewhat different with the Instructional Technology program at George Mason University. The demand in the Washington, DC, area for instructional designers with knowledge of Section 508 skills is higher than the demand in Austria for web designers with accessibility skills. Dr. Dabbagh noted that "some of [the job postings on the department email list] say ‘we need an instructional designer who knows 508 accessibility.’” The job market there was reasonably receptive to the idea of creating jobs for accessibility specialists, or at least to the idea of requiring accessibility expertise as part of the hiring requirements. In fact, the reason that the Web Accessibility and Design class was added to the curriculum in the first place was to meet the demand of funding groups that requested that their products comply with accessibility guidelines. The industry demanded it, so the Instructional Technology faculty responded to that demand. The alignment between the academic curriculum and the career path was rather straightforward. This does not mean that all, or even that most, of the jobs for instructional technologists require accessibility expertise. It only means that there were enough jobs requiring it that it made sense to add accessibility to the curriculum.

The more closely a curriculum aligns with the expectations of the job market, the more likely it is that it will be sustainable into the future, because both the students and the employers will recognize the value of the program, and its contribution to the economy. In academia it is sometimes tempting to create programs that appeal on an intellectual and academic level, even if their applicability to the job market is minimal. Those kinds of programs may provide intellectual fulfillment, but if they are to survive, they will need students, and it is much easier to find students for programs that provide clear economic benefits and career paths.

**Theme 6.4: Sustainability Requires Champions of the Cause**

Section 2.2 in this thematic analysis discussed the role that influential individuals played in enacting the curriculum changes in the cases in this study. Without those individuals, nothing would have happened. The circumstances are such that educational institutions are under no obligation to teach about accessibility and design-for-all, so most of them do not teach it. There are no laws requiring changes to the curriculum, no industry standards requiring it, and no critical mass of students demanding it. The external pressures to teach accessibility and design-for-all are so small that they can be ignored with little or no consequence.

Given the lack of momentum toward creating a curriculum that teaches accessibility and design-for-all, the responsibility to change the curriculum rests squarely on the shoulders of the faculty and curriculum planners themselves. They have to make a decision to support the endeavor, and they must do the work to convince others that it is an endeavor worth supporting.

Faculty and university staff outside of disability-related fields are less likely to initiate changes than faculty in disability-related fields, largely because faculty without disability expertise are less likely to feel they are qualified to initiate such changes, and because they are feel it is not their responsibility. Dr. Dabbagh, for example, sympathized with the need to teach accessibility, but felt that the responsibility to advocate for disability issues belonged to the faculty in the Assistive Technology concentration, or to the people who worked in the university's Equity Office, who oversee university-wide disability issues. In her words, she said that "people in the Assistive Technology concentration would need to be experts in leading us, in terms of whether we need to do some more courses on digital inclusion…that would be something that I would think that they need to be pushing." Dr. Dabbagh's apparent abdication of a sense of personal responsibility can be seen negatively, but it can also be seen positively as her recognition that others have more expertise on the topic, so she is willing to accept input from them and to incorporate their suggestions into the curriculum.

In the absence of dramatic changes in the legal landscape, or in the world of professional accreditation organizations, accessibility and design-for-all will not become part of the curriculum without dedicated and prolonged efforts on the part of individuals who champion the cause. It takes this kind of commitment to the issue to get it started, and it will take this kind of commitment to sustain it into the future.

**Theme 6.5: Sustainability Requires Institutional Commitment**

Ms. Neuber talked at about the importance of people to champion the cause, but cautioned that people to champion the cause are not easy to find, and even where they do exist, they need some kind of institutional support in order for their efforts to bear fruit.

> It's always nice to have a champion but you can't always just pull that out of nowhere. You'll get it but you usually get that after you have something in place. They've already said, "okay we need to bring in somebody who can teach our faculty or our IT support people about web accessibility," and once you bring that person in to teach the whole group of people who are going to design the websites then you find a champion here or a champion there who are going to spread the word and it's going to spread from there, but it has to start with the money, and bringing in somebody, and having someone among the higher-ups decide that that's important. And why do they decide that? It's important because it's a problem. I hate to put it that way but that's how everybody works. You have to put out the fire because that's all you have time to do so you almost build a fire in my opinion. It's already there, it's been smoldering for a while, but you make it

bigger so that somebody who has the ability to change things pays attention to it. Her points hearken back to the first point about sustainability, which is that the external influences and conditions play a key role in determining whether a program will succeed. At George Mason, the cumulative effect of the proximity to federal government, Section 508, and the general level of acceptance of disability issues created an environment in which people like Ms. Neuber and Dr. Behrmann were able to champion the cause of accessibility in the curriculum and make changes to the Instructional Technology program.

The role of people to champion the cause was still indisputably important, but their work was made easier by the conducive environment in which they worked. The administration at the campus had been prepared over time to be receptive to pro-disability initiatives, so there was less convincing to do, which made the task of implementing the changes easier and more efficient.

### Theme 6.6: Sustainability Requires Minimizing the Opportunity Cost to Students

All else being equal, people are more likely to choose paths of less resistance than paths of more resistance. The harder it is for a student to learn about accessibility and design-for-all, the less likely the student is to make the effort to learn those things. Curriculum developers should make it as easy as possible for students to find programs and classes about the topic, to enroll in the programs, and to complete those programs. I am not suggesting that the classes themselves need to be designed for the "lowest common denominator" of student ability or that they be watered down. Rather, I am suggesting that the logistical process of entering programs needs to be streamlined so that students are more likely to enroll in classes that teach accessibility and design-for-all.

The case of the Barrier-free Web Design program provides an example of a program that, unfortunately, had a high opportunity cost for students. The program was a full two years long, was expensive for students, and did not offer a master's degree. Long, expensive programs with minimal rewards are recipes for failure, and the Barrier-free Web Design program did indeed fail, after admitting only one group of students. If some or all of these opportunity costs had been reduced or eliminated, the program might have continued longer than it did. The combination of all three of these opportunity costs, though, proved to be more than the program could sustain.

There are a number of ways that the University of Linz could have mitigated the opportunity costs of the Barrier-free Web Design program. Given that the students were not going to earn a master's degree, a shorter program of one year or less could have appealed to a wider range of students. A two-year commitment is a large amount of time to dedicate to a topic, especially without the prospect of an advanced degree. If the university had approved it as a master's degree, students would have had the extra incentive of achieving that level of academic distinction. They could have gone on to earn doctorate degrees from there if they wanted to. As it was, the academic certificate itself meant little to nothing in terms of academic advancement. The knowledge that the students gained was worth something, of course, but knowledge itself may not represent a sufficient incentive, especially when the cost is high. In Austria, master's degrees are free, but academic certificates are not. This means that a cost of anything more than 0 is, relatively speaking, more expensive than a master's degree. The university system has its rules, so the University of Linz could not have offered the certificate for free, but perhaps it could have partnered with an industry association or some other funding source to provide a way for students to complete the program at no cost. It would take extra work to set up that kind of a partnership or funding arrangement, which increases the burden on the curriculum developers, but it reduces the burden on the students, making it more likely that the program would be able to continue.

The Web Sciences master's degree program at the University of Linz presents a contrasting example of low opportunity cost to student, with a consequently higher yield of students who are exposed to web accessibility and design-for-all. The program is still long, like the Barrier-free Web Design program, but it offers a master's degree at the end, which the Barrier-free Web Design program did not. The program is also free to students, by virtue of its master's degree status. By eliminating two out of the three main opportunity costs (lack of a degree and high cost), the Web Sciences program has a much greater chance of succeeding where the Barrier-free Web Design program failed.

The Web Sciences degree lowers the opportunity cost in another important way: it adds accessibility to the curriculum of a mainstream technology program that reaches a much larger pool of potential students. The Barrier-free Web Design program taught less than twenty students. In the first year of enrollment, the Web Sciences program is already teaching about one hundred and sixty students. More students are interested in the Web Sciences degree because it has a wider application in the job market than a specialist degree or certificate in web accessibility. Most students in the Web Sciences program likely did not seek out the accessibility component, and may not have even be aware of the issue of accessibility at all, but they will receive basic accessibility instruction because it has been integrated into the program as a required, core component. The opportunity cost is diminished to the point that the students do not need to think about accessibility at all in order to receive training in it. Accessibility will be taught as a matter of course. Students do not need to seek it; they simply receive it.

A similar situation is in place in the Instructional Technology program at George Mason University. All of the students are required to take the Web Accessibility and Design class, but very few of these students had thought at all about accessibility before taking the class, so most of them do not come with any intrinsic motivations related to the topic. If any of the students in this study have an excuse to not engage with the accessibility curriculum, it is the students at Mason. They may be motivated by instructional technology in general—considering that is the name of the degree program—but in my experience as the instructor, the topic of accessibility seemed to take most students somewhat by surprise. For example, some students admitted that they had never even considered how a blind person might access a computer, let alone how a web developer could make web sites accessible to blind users. The burden of capturing the interest of these uninformed students lies squarely on the shoulders of the instructor. The instructor has a captive audience, and can either create an interest where none existed before, or can squander this chance and miss a rare opportunity to persuade the students to take the issue seriously. As it turns out, the vast majority of the students in the Web Accessibility and Design class perform admirably well, and the students meet the challenges presented to them. Even the less technically-inclined students tended to find a way through the technical materials, which were quite detailed and demanding. They take the new information in stride and many of them express gratitude for having been able to learn about a topic that they had never considered before.

One program with a high opportunity cost for students—the Barrier-free Web Design program—failed where two other programs with low opportunity cost for students have managed to succeed. As with all things, success is easier to achieve if there are fewer obstacles to overcome on the pathway to success. The more that a university can do to remove the obstacles for students, the more likely it is that the university will have success in reaching, enrolling, and retaining students, which means that the program is more likely to be sustainable into the future.

### Theme 6.7: Sustainability Requires Achieving a Tipping Point

There is not one simple formula to ensure that the curriculum will be sustainable into the future. Any one of the themes in this section of the thematic analysis could make or break the sustainability of a given program, but they all contribute in one way or another. Collectively, they achieve the tipping point necessary to move forward and maintain momentum.

The external influences and circumstances set the stage. The tactic of teaching more people less can help raise awareness across the board and prime the pump for an increase in expertise in the field as a whole. The job market makes the program financially viable (or not) for the students, and by extension, for the university. Funding is necessary to start and maintain a successful program, and industry partnerships can be an effective way to simultaneously achieve funding and assist students with their career paths. The program has to align with student and industry needs. Somebody has to champion the cause, because disability issues are often overlooked or sidelined otherwise. The institution has to be on board with its support for the curriculum. Programs must minimize the opportunity cost to students. And programs must market themselves to potential students and industry partners. Together, these items can achieve critical mass and move the curriculum from the drawing board into the classroom.

The Barrier-free Web Design program and the *web_access* initiative had many, but not all, of these elements in place. They achieved initial momentum, but did not reach the tipping point necessary to keep the momentum going and make it sustainable. Dr. Miesenberger wondered if "Perhaps we were some years too early. It might well be that somebody in the next years will take it up and will do it." The timing may have had something to do with it, or it may have simply been a matter of not addressing enough of the important issues necessary to make the program sustainable. Either way, the conversations with the faculty members at the University of Linz, George Mason University, and Middlesex University have helped shed light on the things that they consider to be important elements in sustaining the curriculum into the future.

# CHAPTER VI

## PART III: SITUATING THE ICT CURRICULUM WITHIN THE THEORETICAL CONTEXT OF THE CAPABILITY APPROACH

The last main task of this dissertation is to situate the discussion of the ICT curriculum within the context of the capability approach pioneered by Sen (1979, 1985, 1992, 1993, 1999, 2009) and Nussbaum (2002a, 2002b, 2003, 2006, 2011) in order to provide a theoretical context, a vocabulary, and a logical argument for being concerned with ICT accessibility in the first place, and for teaching accessibility as a part of the ICT curriculum. Strictly speaking, the findings presented in the previous two sections of this dissertation stand on their own, whether or not the reader chooses to view them through the lens of the capability approach. For this reason, I purposely avoided invoking the capability approach in the case study narratives or thematic analysis. My motivation for discussing the applicability of the capability approach to ICT accessibility is to provide clearer insight into my own thought processes and to make a case for not merely reading about ICT accessibility but actually doing something about it.

As discussed in the literature review, the capability approach offers some unique strengths over other approaches to disability. The capability approach integrates disability issues within the broader social disciplines of economic development, social justice, and individual well-being, while emphasizing a holistic perspective of the meaningful opportunities and freedoms available to the individual, taking into account a person's physical limitations (as the biomedical model would) and socio-political environment (as the social model would). The capability approach evaluates justice in terms of opportunities (“capabilities”) rather than outcomes (“functionings”). I begin by reviewing and expanding upon some key elements of the capability approach. From there, I use the capability approach to reframe poverty in terms of “capability deprivation,” rather than a lack of money. This leads to a detailed discussion of why the capability to access ICT is particularly important to people with disabilities, followed by a discussion of how the null curriculum of not teaching ICT accessibility perpetuates disablement. I then discuss the power of the curriculum to create disabilities, with an examination of the indicators within the ICT curriculum that could be used to judge how well it contributes to the capabilities of people with disabilities, followed by a realistic assessment of the limitations of the curricular approach to creating capabilities. Lastly, I take a step back to the original economic development roots of the capability approach to present disability empowerment as an indicator of international human development.

## Key Elements of the Capability Approach

The capability approach is a holistic perspective on economic development and human welfare within societies that emphasizes the social arrangements that maximize the availability of meaningful individual opportunities or freedoms—referred to as “capabilities”—as a way of achieving individual well-being and social justice.

### Development as Freedom

The core of the capability approach is in its insistence that the concept of “development” should be inclusive enough to encompass the things that truly matter to human well-being. “Development can be seen...as a process of expanding the real freedoms that people enjoy. Focusing on human freedoms contrasts with narrower views of development, such as identifying development with the growth of gross national product, or with the rise in personal incomes, or with industrialization, or with technological advance, or with social modernization" (Sen, 1999, p. 3). Freedom is seen "as both (1) the *primary end* and (2) the *principal means* of development" (emphasis in the original) (Sen, 1999, p. 36; see also Sen, 2009, p. 35). Freedom is seen as both the means and the end of development (Sen, 2009, p. 35). Freedom is valuable for the opportunities that it offers (the ends of development), and for the life-enhancing effect of "the process of choice itself" (Sen, 2009, p. 228).

**Capabilities as Meaningful Opportunities**

A capability is a meaningful or "substantive" opportunity or freedom to *do something* that one wishes to do, or to *become something* that one wishes to become (Sen 2009, pp. 231-232, 234). Capabilities reflect the degree to which the circumstances and arrangements of a society allow its members to experience the aspects of life that they "have reason to value" (Sen, 2009, p. 18). Capabilities encompass the full range of human needs and desires, from access to the primary goods necessary for survival to the availability of opportunities for artistic personal expression. As such, capabilities vary in their degree of necessity to sustain human life, but the aggregate of all capabilities—even the discretionary ones—constitute an individual's quality of life. After all, what one person considers discretionary, another person may consider essential. The capability approach allows for this kind of variability by allowing individuals to decide for themselves what they value and treasure (Sen, 2009, p. 227).

## Emphasizing the Opportunities More Than the Outcomes

An individual may choose to take advantage of a given opportunity or to ignore it. "The focus of the capability approach is thus not just on what a person actually ends up doing, but also on what she is in fact able to do, whether or not she chooses to make use of that opportunity," explained Sen (2009, p. 235). The outcome (i.e., what a person actually does or becomes) is mostly irrelevant as long as the individual is presented with a genuine opportunity and is given full freedom to respond to that opportunity. In the literature about the capability approach, the opportunities available to a person are called *capabilities*, and the actual actions or achievements of the person are called *functionings*. "We have reason to be interested not only in the various things we succeed in doing," said (Sen, 2009, p. 18), "but also in the freedoms that we actually have to choose between different kinds of lives." Elsewhere, Sen (1992, p. 41) stated, "Choosing may itself be a valuable part of living, and a life of genuine choice with serious options may be seen to be—for that reason—richer." The emphasis on opportunities underscores the difference "between *doing* something and being *free* to do that thing" (emphasis in original) (Sen, 2009, p. 237). Sen (2009, p. 237) points out the difference between a person who does not eat because of famine or poverty in comparison to a person who voluntarily fasts for religious reasons, but who has access to food. The outcome—going without food—is the same, but the underlying reason for the outcome underscores vastly different scenarios in terms of opportunities.

**Differentiating Opportunities from Commodities**

Traditional approaches to economics use income and commodities as the main axes for comparative assessment. By way of contrast, Sen (2009) explained:

> The capability approach focuses on human life, and not just on some detached objects of convenience, such as incomes or commodities that a person may possess, which are often taken, especially in economic analysis, to be the main criteria of human success. Indeed, it proposes a serious departure from concentrating on the means of living to the actual opportunities of living. This also helps to bring about a change from means-oriented evaluative approaches, most notably focusing on what John Rawls calls 'primary goods', which are all-purpose means such as income and wealth, powers and prerogatives of offices, the social bases of self-respect, and so on. While primary goods are, at best, means to the valued ends of human life, in the Rawlsian formulation of principles of justice they become the central issues in judging distributional equity. This, I have argued, is a mistake, for primary goods are merely means to other things, in particular freedom. (pp. 233-234)

Income and commodities provide opportunities to do things that one values, but the income and commodities are means to the valued ends, not the ends themselves.

**Focus on the Social Factors Affecting Individuals**

The unit of analysis for the capability approach is the individual, but the critical scrutiny is focused on the circumstances created by societies that either empower or disempower individuals to live the lives they want to live. Disadvantageous social conditions can lead to "unfreedoms that leave people with little choice and little opportunity of exercising their reasoned agency" (Sen, 1999, p. xii). "Individual freedom is quintessentially a social product," asserted (Sen, 1999, p. 31), "and there is a two-way relation between (1) social arrangements to expand individual freedoms and (2) the use of individual freedoms not only to improve the respective lives but also to make the social arrangements more appropriate and effective." Social circumstances that restrict the freedoms of their members to engage in activities that they value, or which lack the infrastructure to respond to basic human needs, deprive their members of capabilities. “To counter the problems that we face,” said Sen (1999, p. xii), “we have to see individual freedom as a social commitment.” A central goal of the capability approach is to identify and remove social barriers to individual opportunities. “The success of a society is to be evaluated, in this view, primarily by the substantive freedoms that the members of that society enjoy” (Sen, 1999, p. 18). Though it is possible to talk about the capability of a society, a family, or other group of people, capabilities as understood by the capability approach are experienced at the level of the individual (Sen, 2009, p. 244). The capabilities of a group of people, on average, cannot compensate for the lack of capabilities of an individual within that group. All individuals, including those with potentially serious disadvantages such as cognitive disabilities, are fully human and worthy of social inclusion (see Nussbaum, 2006, p. 99)

**Conversion Factors**

Differences in life circumstances affect the degree to which an opportunity is genuine or not. Internal conversion factors (a person’s age, gender, intelligence, gender, disability, susceptibility to illness, etc.) and external conversion factors (social norms, laws, cultures, the built environment, the natural environment, etc.) may limit the degree to which a person can convert apparent opportunities into actionable capabilities (Sen, 2009, p. 66, 255-256). The ability to convert a given income, for example, into a certain quality of life may be significantly diminished if an individual requires ongoing medical care or has a disability that requires expensive assistive technologies. An individual without these particular needs would have more income available for discretionary purposes, whereas a portion of the income of the other individuals would always be earmarked for medical needs or assistive technologies. Income and other primary goods are among the means to achieving “satisfactory human living,” but they are not the end of good living, because of the inherent heterogeneity in the human population that introduces wide variance in the ability to convert primary goods into quality of life.

**Poverty as Capability Deprivation**

The relationship between disability access and poverty is well documented (Braithwaite & Mont, 2009; Elwan, 1999; Filmer, 2008; Hoogeveen, 2005; Kuklys, 2005; Yeo, 2001; Yeo & Moore, 2003). Usually, though, the literature about poverty interprets the meaning of poverty narrowly in financial terms, as in deficits of “money or material possessions” (Merriam-Webster, 2012). The capability approach interprets poverty more broadly, defining poverty as “capability deprivation” (Sen, 1999, p. 87). Defining poverty as capability deprivation presents a more complex and more complete portrayal of poverty than the mere deficiency of money or resources. Defined this way, poverty becomes a measure of human well-being and human potential within one’s social circumstances, rather than a measure of one’s purchasing power. The capability approach draws attention to the human toll of impoverished opportunities, and shines a light of critical analysis on the social circumstances that cause this kind of impoverishment.

Income deprivation can certainly lead to capability deprivation, but the two types of deprivations are not completely synonymous. A person who chooses a lifestyle of lower income—a monk who takes a “vow of poverty” for the purposes of living a religiously consecrated life, for example—cannot be said to experience capability deprivation in the same way as a worker who was recently laid off and who struggles to find enough paid work to feed a hungry family. Both of these individuals experience low income levels, but the monk's circumstances are the result of rational decisions based on personal values (presumably he had the freedom to choose otherwise), while the laid off worker's circumstances were the result of the external circumstances, and were not at all a result of purposeful choices to suddenly take up a low income lifestyle.

At the other end of the income scale, wealth cannot fully compensate for the absence or insufficiency of certain kinds of capabilities within the social structure (Kuklys, 2005; Nussbaum, 2006; Sen, 1999, 2009). The capability of individuals with disabilities to access ICT is an example of a capability that cannot realistically be purchased with wealth. Even unlimited wealth cannot instantaneously change a badly inaccessible web site into a fully accessible one with the swipe of a credit card, for example, let alone instantaneously convert all of the world's inaccessible web sites and other ICT resources into accessible ones. Given enough time, and assuming that the ICT developers have the skills to complete the accessibility conversion, all of the world's ICT resources could eventually be made accessible, but widespread changes of this scale require transformative approaches to the way that ICT developers approach their own products. Even if an exorbitantly wealthy individual were to fund such an endeavor on a world-wide scale, technologies are redesigned with such frequency that accessibility flaws would likely reappear almost immediately in subsequent versions, unless there was some kind of sustained commitment to accessibility within the ICT sector itself (assuming the impossibility of an ongoing stream of unlimited money from a mythic wealthy benefactor to purchase the loyalty of the ICT sector to accessibility principles). Monetary wealth simply cannot realistically purchase the capability to access ICT. Even the wealthiest person with disabilities experiences poverty (i.e., capability deprivation) when confronted with inaccessible ICT. The lack of direct correlation between income levels and capability levels is the reason that the capability approach resists conflating poverty and income as if they were one and the same thing, because they are not. In the words of Nussbaum (2006), "capabilities are radically nonfungible: lacks in one area cannot be made up simply by giving people a larger amount of another capability" (pp. 166-167).

Sen (2009, pp. 255-256) lists some of the main sources of capability-deprivation and income conversion disparities as (a) "personal heterogeneities...[such as] age, gender, disability, proneness to illness and so on;" (b) "diversities in the physical environment...[such as] climatic circumstances,...temperature ranges, or flooding;" (c) "variations in social climate...[such as] public healthcare and epidemiology, public educational arrangements and the prevalence or absence of crime and violence in the particular location;" and (d) "differences in relational perspectives...[such as the ability] to 'appear in public without shame,' [take] part in the life of the community, and in many contexts, even to fulfill the elementary requirements of self-respect." Any or all of these conditions can conspire to reduce a person's capabilities by reducing the feasibility of achieving outcomes that a person has reason to value. Irrespective of the outcomes that a person actually achieves, the overall set of possible outcomes is reduced, resulting in a condition of fewer choices and fewer opportunities.

## Why the Capability to Access ICT is Particularly Important for People with Disabilities

The capability to access ICT is important because of the prevalence of ICT in today's world, to the point that many kinds of information and communication are available only through digital technologies. In today's digital world, ICT is so prevalent that it is easy for nondisabled individuals—especially those in wealthy countries—to assume that "everyone" has access to phones, televisions, computers, the internet, and other ICT. Without access to ICT, common ways of obtaining information and interacting with others are cut off, causing an impoverishment of opportunity. If, by some magic transformation, all of the ICT around the world could suddenly be made accessible, the capabilities of people with disabilities would increase dramatically. Some of the capabilities would be immediately available, such as the capability to access all web sites and e-books. Others would take some time to emerge, such as the much more subjective capability for people with disabilities to feel fully included and integrated into a world of mixed abilities and disabilities, without having to assume a deficiency-centric lifestyle of constantly working around ICT accessibility barriers. The short-term benefits would consist of accessibility on a technical level: what was previously off limits would be fully available. The long-term benefits would consist of radical societal transformation: the attitudes and expectations of people with and without disabilities would adjust to a new reality in which bodily impairments do not automatically correlate with ICT disablement.

The previously disabling consequences of inaccessibly-designed ICT would disappear, even though the bodily impairments themselves (blindness, deafness, inability to use the hands, etc.) would not. The whole idea of what it means to have a disability would shift in response to the less disabling conditions of the ICT sector. A closer look at some specific ICT-related capabilities can help illustrate why accessible ICT can be so transformative.

### Unique Power of Digital ICT to Create Capabilities

Although not a panacea, digital technologies have the potential to make information and communication much more directly accessible to people with disabilities than analog (nondigital) technologies. Digital content, when it is designed with accessibility in mind, can be manipulated by software programs and presented to the user in the way that most benefits the user. Sighted users can see text and watch videos, for example. Blind users can access the same text via text-to-speech software that reads the text aloud to them (or text-to-Braille software that outputs the text to refreshable Braille devices), and can access the same videos along with their embedded audio descriptions. Deaf users can read the same text and access the same videos, along with the embedded captions (or even sign language interpretation of the video, if it is available). Users who are both deaf and blind could access the same text via text-to-Braille software, and could access the same videos by accessing the embedded transcript via the same text-to-Braille conversion process. A user with motor disabilities may need specialized hardware to navigate the interface, but this would not be a problem if the interface has been designed to be compatible with both keyboard-type devices and mouse-type devices (the actual devices used by a person with a motor disability can vary dramatically depending on the disability, but most of these devices make use of standard types of interactions that emulate a keyboard and/or mouse). A user with low vision could enlarge the text and video and increase (or decrease) the contrast, if necessary. A user with dyslexia could change the font or line-height to be more legible, and perhaps use the same kind of text-to-speech technology that a blind person might use, so that the information can be presented both visually as text and auditorily as speech, to aid in comprehension. In principle, digital content could even be altered by software algorithms to present simplified versions for users with cognitive disabilities, though this is a much more complicated task.

Overall, digital content is uniquely flexible as a way of making content accessible to the widest range of users, including those with disabilities, because it is highly manipulable (when created in ways that do not hinder manipulability). Both the content and the interface can be altered as necessary to accommodate different hardware devices and presentation modalities, which gives digital ICT a unique power to create capabilities that are often cumbersome to achieve through analog technologies.

Prior to the digital ICT revolution, information was transmitted through direct personal interaction (e.g., conversations, speeches, presentations, lectures, etc.) or through nondigital technologies such as text printed on paper, radio broadcasts, or television broadcasts. Analog technologies were revolutionary in their own right, but they presented significant limitations to people with disabilities. Conventional radio broadcasts, for example, are inaccessible in their native format to a person who is deaf. Conventional telephone conversations are similarly inaccessible to a person who is deaf. Printed text is inaccessible to a person who is blind or to someone who cannot pick up the printed materials or turn the pages. Television is at least partially inaccessible to people who either cannot see or cannot hear, and it is completely inaccessible to people who can neither hear nor see.

This is not to say that accessible adaptations for these analog technologies do not exist. To make radio more accessible to the deaf, it is possible to create a printed or digital transcript of a radio broadcast, either before or after the broadcast. To make phones more accessible to the deaf, telecommunication devices for the deaf (TDD) have allowed text-based communication over phone lines between deaf people, and text-to voice relay services have allowed deaf people with TDD to communicate via a human operator acting as an intermediary. More recent innovations include video relay services, which allow a deaf person to communicate via sign language with an intermediary who interprets for the hearing person on the other end of the call. To make printed text more accessible to a blind person, someone else can read the text aloud (either in the presence of the blind person or in a recorded format for later use), or convert it into a digital format to be read by speech synthesizers or refreshable Braille interfaces. To make printed text more accessible to people with motor disabilities, motorized page-turners can make the task of moving through a book easier. To make television more accessible to someone who is deaf, broadcasters can add captions. Making television more accessible to someone who is blind is possible too, by adding voice-over narration (audio descriptions, as they are called) to describe the nonauditory action on the screen. Audio descriptions for the blind are much rarer than captions for the deaf though.

As beneficial as these workarounds to the accessibility barriers of analog technologies are, they are not always convenient, efficient, timely, or readily available. If a radio station does not provide transcripts of its talk-radio programs (most do not), a deaf person would need to plan ahead to have a friend or a professional transcriptionist listen to the broadcast and furnish a transcript. The transcript may or may not arrive in a timely manner, depending on largely the capabilities of the transcriptionist and on the premium that the deaf individual is willing or able to pay for this service. If a person who is deaf needs to make a phone call using a TDD, this usually means the person must be home, because TDD devices, which are essentially small typewriters, are generally quite bulky, and not particularly portable. Calling from places without TDDs, such as public locations, businesses, or the homes of friends, would likely be impossible. (The advent of portable smart phones, with their built-in keyboards and video chat capabilities, has begun to overcome that limitation.) If a person with motor disabilities needs to use a motorized page-turner, it is likely that a person without a motor disability must set up the book and page-turner to begin with, which means that the person with the disability is still dependent on help from others, and may not be able to access the books when help is not present. Captions for television programs work well when they are available, but not all content is captioned. Similar inconveniences and inefficiencies manifest themselves with other workarounds to analog ICT inaccessibility.

Digital ICT is not immune to some of these same inconveniences, inefficiencies, or low levels of availability, but because of the greater flexibility and manipulability of digital ICT by software, digital ICT at least has the potential to overcome many of the accessibility shortcomings of analog ICT. At the most basic level, if digital content is created without accessibility in mind, it is no better than inaccessible analog content. Content designers need to ensure that the text of the content is readable by text-to-speech software, for instance, and interface designers need to ensure that the controls can be used by either a keyboard or a mouse, and not just one or the other. When designers do pay attention to accessibility principles, though, digital content generally provides a greater array of accessibility options to a greater number of disability types than analog technologies. With so much of the world's information and communication technologies now in digital formats, it would be a tremendous waste of the potential advantages of digital technologies to not try to ensure that people with disabilities are able to access them along with the rest of the population.

## Specific Kinds of Capabilities that ICT Can Create

The next few sections present examples of capabilities made possible by ICT, as evidence for the importance of making ICT accessible to people with disabilities. The order of these sections is arbitrary. In any case such a rank order would be, because the relative importance of a capability to any given person depends on what that person values. All of these capabilities are important to someone. This list is not comprehensive. It is meant only to be indicative of the possibilities afforded by ICT.

**1. The capability to inform one's self about current events.** The capability to access news sources and learn about current events in the world is integral to the foundation of many aspects of a person's life. Being informed about current events helps to provide a basis for understanding one's place in the world and makes one aware of the situations and opportunities to engage with society (or not engage, if that is the person's preference; Heilman, Amthor, & Missias, 2010). In fact, the importance of having access to news about current events has been considered so important that "freedom of the press" (which today would include not only printed new media, but television broadcasts, internet news sites, news radio, and other forms of news media) is enshrined in the laws or constitutions of many countries (World Audit, 2012) and in the Universal Declaration of Human Rights ("Everyone has the right to freedom of opinion and expression… through any media regardless of frontiers," Article 19, 1948. In its raw form, information about life, the world, and the events within it may or may not always have an obvious practical use or application, but the accumulated effect of this background knowledge helps form a one's identity and shape one's opinions and perspectives about self and others. On a cognitive and intellectual level, the observation of current events over a sustained period of years can help a person distinguish patterns in human behavior and natural events, giving the person historical data to analyze and from which to draw predictive conclusions. Exposure through news media to conflicts, opposing opinions, debates, and controversies gives a person the opportunity to consider various viewpoints and to align or ally with proponents of one perspective over another, if desired, or to remain apart from them all. Just being aware of current events and viewpoints allows a person to engage in conversation with other people about these things, providing a sense of connectedness to people in the present. Over time, the events and viewpoints build a sense of history within a person, anchoring the person to a time and place within the history of the world.

The extent to which a person chooses to engage with the available news is a personal decision—some people thrive on current events, while others find them disinteresting—but if the news sources are inaccessible to people with disabilities because of the way in which they were designed, the inaccessibility of the sources removes the element of choice: people with disabilities do not access the news because they cannot, not because they choose not to. When this happens, external factors (inaccessible designs) compromise the capability of people with disabilities to benefit from access to current events.

With the introduction of the internet and other electronic media, news has become widely available in digital formats. In fact, print-based news publications have had to adapt to the new digital reality—or face extinction—and have placed increasing amounts of their content online (Grabowicz, n.d.; Stone, Yu-Hsuan, & Mensching, 2010; World Association of Newspapers, 2008). Some news organizations exist only in digital formats. From the perspective of people with disabilities, this is generally good news, at least in principle. The digitization of news media increases its potential accessibility to audiences with disabilities, but only if the digital interface and content are created with accessibility in mind. Otherwise, the digital formats are just as problematic as their analog equivalents.

**2. The capability to receive an education.** The capability to receive an education has been "at the heart of the capabilities approach since its inception," explained Nussbaum (2011):

> Education (in schools, in the family, in programs for both child and adult development run by nongovernmental organizations) forms people's existing capacities into developed *internal capabilities* of many kinds. This formation is valuable in itself and a source of lifelong satisfaction. It is also pivotal to the development and exercise of many other human capabilities: a "fertile functioning" of the highest importance in addressing disadvantage and inequality. People who have received even a basic education have greatly enhanced employment options, chances for political participation, and abilities to interact productively with others in society, on a local, national, and even global level. (p. 152)

An educated person is more fully aware of the possibilities that life has to offer than someone who has received little or no education. This awareness allows a person to imagine many possible outcomes in life. This awareness, coupled with the knowledge and skills that an education ought to provide, creates opportunities that would hardly be possible for less-educated individuals. These opportunities start to manifest themselves at the earliest stages of a person's education, and continue to make an impact throughout a person's life. An education expands a person's spectrum of choices and freedoms, and thus capabilities. The specific knowledge that a person learns during the education process may or may not stay with the person, but the process of learning how to learn can become the foundation for a lifetime of learning and advancement on many personal and public levels.

Educational opportunities are not always distributed evenly among the population. Cultures that limit the education of girls, for example, deprive girls of capabilities, both at the time that they could be receiving an education and at future stages of their lives when they could be benefitting from the acquired knowledge and experiences of the educational experience. Educational systems that exclude students with disabilities, or that fail to adequately educate students with disabilities, likewise deprive these individuals of current and future capabilities.

Inadequate access to educational opportunities for students with disabilities can manifest itself in many forms. In terms of physical access, educational environments not designed for wheelchair access can exclude students from ever attending school. Sometimes wheelchair access is available to some, but not all, areas within the learning environment. If these areas are critical to the teaching activities of the instructor, the student with the disability will lose out on these opportunities. Even if the inaccessible areas of the learning environment are not critical to the teaching experience, the fact that there are inaccessible areas at all teaches the student with the disability that certain parts of the world will always be off limits to people with disabilities. This kind of message is part of the learning experience—the untaught, or null curriculum—whether any instructor ever addresses the topic or not.

Inadequate accessibility of ICT-based educational resources is another problematic area for students with disabilities. In today's schools and universities, more and more learning content is being presented in digital formats, much of it on the internet, but also on television or other broadcast media, and on stand-alone media, such as DVDs. When educational technologies are not designed with accessibility in mind, some students with disabilities will not be able to access them. Instructors may or may not be able to provide adequate alternatives or adaptations, depending on the type of resource and the expertise of the instructor. Alternative accessible formats created ad-hoc will likely lack the polish and professionalism of the original resources, giving students with disabilities an inferior educational experience. Even if a suitable alternative or adaptation is possible, it may not be available immediately, forcing students with disabilities to fall behind their peers as they wait for the accessible version to arrive. Beyond the suitability and timeliness of ad-hoc alternative versions, the fact that ad-hoc versions must be made at all sends a not-so-subtle message to students with disabilities that people with disabilities are not a part of the original planning process; they are afterthoughts to be dealt with on a case-by-case basis because they do not fit the “normal” user profile.

**3. The capability to seek and obtain employment.** People seek and obtain employment for different reasons, though the ability to obtain income is undoubtedly one of the most common reasons for working. In this sense, employment is, at least in part, the means to obtain other things that a person values. Employment has other benefits though too. Careers can be enjoyable in and of themselves. Some people “dream” of becoming teachers, or dentists, or race car drivers, and commit themselves to their chosen career path because of its intrinsic value to them on a personal level. A person’s career can become an integral part of a person’s identity. Employment offers opportunities to form professional relationships with other people outside of one’s immediate family, as colleagues, customers, or clients. Employment offers people a chance to contribute their time and talents to society, to be useful to others. There is dignity in working and not idling away one’s time. Many careers offer opportunities to engage in activities that have the potential to improve the quality of life of other people, either through direct interaction with the beneficiaries, or through the indirect effects of economic activity. Some jobs allow a person to engage in physical activity. Other jobs require intense intellectual involvement, which many people find satisfying. Most jobs at least offer some form of regularity in a person's schedule, helping to add some consistency to life. Whatever the reasons that any given person may have for being employed—even if the only motivation or level of fulfillment comes from the earned income—the capability to seek and obtain employment is a fundamental part of the human experience.

Disabilities can negatively affect a person's employment prospects. By definition, having a disability entails some form of bodily limitation, which necessarily limits the ways that a person can interact with the environment, making some kinds of employment difficult or impossible for people with some kinds of disabilities. Bus drivers must see to be able to drive, so people with blindness or low vision would be ineligible for employment as bus drivers. Dentists and surgeons need the use of their hands to perform procedures, so people without the use of the hands would not be able to perform the daily tasks that these careers would require. It is easy to identify the types of tasks that are difficult for people with disabilities, but in many ways, these activities are the exceptions rather than the rule, especially in today's ICT-rich work environments.

If bus transportation is of interest to a blind person, there are other related career paths that do not involve driving buses. A person could seek a job in the policy sector related to public transportation, perhaps at a research institute, or a lobbying firm, or in transportation logistics, or radio dispatchers, or many other jobs. A person without the use of the hands who is interested in dentistry or surgery could choose a career in the field or medical office management, or public health, or some other position that does not require highly precise manual dexterity.

All of these alternative jobs would require a significant use of ICT on a daily basis, including computers and phones, at a minimum. The blind employee would use a screen reader to access the computer. The software required for the job would need to have been designed with screen reader accessibility in mind. If the required software is not accessible, and if there is no alternative software program, a prospective employer would likely feel justified in denying employment to a blind applicant because the applicant would not be able to fulfill the functions of the job, through no fault of the applicant or of the prospective employer, if indeed there are no viable alternative software programs. Even if there are viable alternative software programs, an employer may have legitimate reasons for standardizing on a particular software brand (for consistency, compatibility, or economy, for example). Beyond the particular software installed on a worker's computer, the job may require the worker to research information on the internet. The level of accessibility of internet resources can vary considerably, rendering some resources completely unusable to a blind employee. Neither the prospective employee nor the employer would be to blame for the inaccessibility of these resources, but if accessing these resources is critical to functioning in the job, the blind person will be unable to perform those functions without assistance. The prospective employer may feel compelled to exclude the blind job applicant from the position based on this fact alone, even if the applicant is otherwise qualified. A job applicant without the use of the hands would be able to access computers and phones through assistive technologies such as speech recognition or keyboards that can be accessed by foot control, or mouth sticks. Similar to the situation with the blind job applicant, if there are job tasks that require the use of the hands, and that are not designed to be accessible to common assistive technologies, the prospective employer will likely disqualify the job applicant without the use of the hands. Unfortunately, the workplace continues to be a place of discrimination and lost opportunities for people with disabilities.

More optimistically, if all of the ICT necessary for employment were designed with accessibility in mind, the modern reliance on ICT in the workplace would become a great enabling factor in the search for employment, rather than a disabling factor. Jobs that used to require vision to read books and papers would be available to blind employees who could read the same type of information on computer screens and mobile devices. Jobs that once required the use of copy machines and the filing of paper resources would be available to employees who could not use their hands, because those same types of resources would be in electronic format, and accessible by assistive technologies. The conversion of ICT systems to electronic formats makes employment possible for people with disabilities in ways that were unachievable before.

**4. The capability to engage in democratic political processes.** The capability approach's aphoristic notion of development as freedom posits that a proper conceptualization of human development consists of cultivating social arrangements that allow and encourage the free exercise of individual agency within the political sphere and elsewhere. Some cast democracy as an issue separate from development—even going so far as to question whether or not democracy is conducive to development (Bhagwati, 2002; Persson & Tabellini, 2006; Rodrik & Wacziarg, 2005). Sen (1999b) argued that "this way of posing the question tends to miss the important understanding that... substantive freedoms...[such as] the liberty of political participation...are among the constituent components of development" (p. 5, emphasis in the original; see also Sen 2009, pp. 346-347). Because of the way "economic performance, social opportunity, political voice and public reasoning are all deeply interrelated" (Sen 2009, p. 350), the very existence of open deliberative processes within public governance is innately valuable unto itself, making it a key indicator of human development within a society, even in the possible absence of a causal relationship between the presence of democratic processes in a particular country and that country's economic development, as measured more narrowly by such conventional metrics as the gross national product (GNP).

The capability approach characterizes democracy as a universal value, though not in the sense that every country or every individual values it to the same degree. "Universal consent is not required for something to be a universal value," explained Sen (1999b). "Rather, the claim of a universal value is that people anywhere may have reason to see it as valuable." Though incomplete, the historical shift in political thought on a global scale—especially in the twentieth century—toward acknowledging the value of democratic deliberation in governance has unlocked the latent potential of the capability of the citizenry to actively engage in the act of determining the destiny of their own polity.

Unlocking latent potential does not always translate into the actual realization of that potential though. Democratic processes can be messy, and are subject to diverse and powerful influences that can be decidedly undemocratic in their origins and affects. Of particular relevance to this dissertation is the question of "minority rights and inclusive priorities," which Sen recognizes as "one of the most difficult issues that democracy has to tackle" (Sen, 2009, p. 352). People with disabilities are a minority population whose needs the majority may find easy to overlook when setting policy agendas. Even when countries introduce legislation to protect the rights of citizens with disabilities, as the United States did with the Americans with Disabilities Act of 1990, the interpretation of those laws in the judicial system can often be "unduly narrow" with "private sector companies frequently [disputing] the threshold issue of disability.... The result, as documented by Professor Ruth Colker in her seminal survey of ADA judicial outcomes, was a statue construed so narrowly on the threshold issue, few cases were able to survive past motion for summary judgment" (C. L. Anderson, 2009), The perception of what constitutes a disability, and to what extent policy should protect the interests of people with disabilities, are matters still very much in dispute.

The problems for citizens with disabilities are compounded when some of the formats for democratic engagement are not disability-accessible. The most basic act of citizen participation within a democracy, the right to vote, is not always an accessible process for people with disabilities. Paper ballots are inherently inaccessible to people with print disabilities, including those who are blind and those who cannot use their hands. People with low vision, or who experience dyslexia or other reading disorders may not find the paper-based voting experience completely accessible either. The low-technology workaround to these problems has been to allow an assistant in the voting booth with the person with a disability. Such a workaround may accomplish the ultimate goal of allowing the person to vote, but it comes at the cost of privacy and independence.

As with other print disability issues, digital ICT can provide effective solutions. With thoughtful planning and design, electronic voting machines can increase font size, contrast, provide for an audio interface with headphones, and allow for interoperability with various kinds of assistive technologies, making the voting experience directly accessible to people with many kinds of disabilities. In fact, citizens with disabilities and disability activists have generally supported the move toward electronic voting systems because of their potential accessibility benefits (Associated Press, 2004). The widespread adoption of electronic voting systems has faced criticism on concerns of data tampering or unreliability which must be taken seriously, but without electronic voting systems of some kind, people with disabilities will continue to face the less than ideal situation of requiring assistance to cast votes. Of course, inaccessibly designed electronic voting machines would be no better than inaccessible print-based voting mechanisms, and some current electronic voting machines are more accessible than others (Baker, Williams, Moon, & Roy, 2006). As with all ICT, attentiveness to the needs of people with disabilities is the only way to take full advantage of the accessibility potential of electronic voting machines.

The act of voting is only the tip of the iceberg in terms of political involvement, and problems with disability access can be found at all points of civic engagement. Citizens can seek information about topics, laws, or programs that interest them, or with which they are involved. They can communicate with government officials. They can associate with like-minded citizens about specific political issues. They can pay their taxes. They can file articles of incorporation with states as they start new businesses. They can run for political office. They can attend school board meetings. They can contribute to the election funds of favorite politicians. They can attend rallies, conventions, caucuses, town hall meetings, speeches, or other political events. The kinds of potential politically related activities that involved citizens can engage in is extensive. In all cases, well-designed ICT can enable greater accessibility of all of these kinds of civic engagement. Technology can facilitate many of these kinds of interactions through web-based interfaces on desktop computers, laptops, tablets, phones, or other devices. In lieu of attending a political rally or demonstration in person, an individual can create an online petition (or contribute to someone else's petition) and gather virtual signatures over the internet. Rather than attend a town hall meeting in person, an individual could connect to a two-way video or audio feed of the meeting and voice opinions from home. Rather than attend a speech in person, an individual can tune into a broadcast over the internet, radio, or television. Some of these events are easier to make accessible than others (live events generally often present more logistical or technical challenges than asynchronous events), but techniques and technologies are available now for all of these scenarios.

With many kinds of technology-mediated interactions, a person's disability status may never need to be disclosed. As long as the content and interfaces are compatible with assistive technologies, no one need know that the person who sent them the email, or who filled out the online form, or who interacted with them through ICT in other ways has a disability at all. With everyone—disabled or not—using technology as an intermediary for many forms of communication, technology can become an equalizing factor that puts all people on the same plane. Accessible ICT has the potential to make significant contributions toward a more inclusive and robust political society.

In recognition of the importance of making information published by the government available to citizens with disabilities, some policies, such as Section 508 in the United States and the forthcoming Mandate 376 in Europe, have targeted the procurement of ICT accessibility within government-related entities. In broad strokes, the intent behind these kinds of policies is two pronged: 1) to ensure the accessibility of work-related ICT to employees within government-related entities, and 2) to ensure that the general public can access the ICT materials produced by these entities. The pursuit of these goals moves a country closer toward the realization of inclusiveness for people with disabilities, and it is through the focus on accessible ICT that this inclusiveness can be possible.

**5. The capability to engage in market economies.** The capability approach generally views economic markets favorably within the grand scheme of increasing individual capabilities. The justification for this favorable view lies less in the financial outcomes of markets (such as increased wealth for some parties) than in the freedoms for individuals to engage in the act of exchanging goods and services.

> Even though the merits of the market mechanism are now very widely acknowledged, the *reasons* for wanting markets are often not fully appreciated.... In recent discussions, the focus in assessing the market mechanism has tended to be on the *results* it ultimately generates, such as the incomes of the utilities yielded by the markets. This is not a negligible issue...but the more immediate case for the freedom of market transaction lies in the basic importance of that freedom itself. We have good reasons to buy and sell, to exchange, and to seek lives that can flourish on the basis of transactions. To deny that freedom in general would be in itself a major failing of a society. (Sen, 1999, p. 112)

The interconnected, interdependent, transactional nature of markets is a condition worth valuing on its own merits, independent of the financial gains or losses that accompany markets.

All people—with or without disabilities—have needs and wants. To the extent that those needs and wants can be commoditized for exchange, markets can be of value to anyone. Market transactions can occur in person—between individuals, at retail locations, at auctions, and so forth—or at a distance, mediated by ICT such as computers, web browsers, web sites, mobile phones, tablets, and so on. For people with disabilities, who may be less able to travel to conduct commerce in person, technology-mediated commerce can allow them to engage in commercial activity without requiring them to leave home. The ability to research competing products and services, pay for them, and even interact with sellers through ICT-mediated interactions from the comfort of one's own home expands the capability set of people with disabilities tremendously, especially among those whose disabilities restrict their mobility.

Markets represent a type of freedom, making them a natural fit within the conceptual framework of an approach that characterizes development as freedom. Even so, the interpretation of markets within the capability approach requires a nuanced consideration of how markets can contribute to an individual's capabilities. Cognizant of the often over-zealous promotion of free markets by conventional economists, Sen (1999, pp. 117-118) cautions against over generalizing the case for free markets at the expense of the quality of capabilities that those markets might offer:

> The importance of substantive freedom has to be judged not just in terms of the *number* of options one has, but with adequate sensitivity to the *attractiveness* of the available options. Freedom has different aspects.... For the *freedom to achieve* in line with what one wants to achieve, we have to take note of the merits of the available options.

The measure of the usefulness of markets depends on the degree to which they can facilitate the achievement of one's desired quality of life in meaningful ways. Income and wealth figure into the equation, but they do not represent quality of life itself.

For all their benefits and freedoms, markets also introduce economic inequalities, as not all parties benefit equally from all market transactions. Economic inequalities raise ethical questions that have long consumed economic and political philosophers. The capability approach does not condemn economic inequality. In fact, the capability approach actually *requires* a certain kind of economic inequality, and not just because of the approach's emphasis on freedom. People in disadvantageous circumstances, such as those with disabilities, often require greater access to income and/or resources than those in more advantageous circumstances. "Equal incomes can still leave much inequality in our ability to do what we would value doing. A disabled person cannot function in the way an able-bodied person can, even if both have exactly the same income" (Sen, 1992, p. 20). The capability approach is deeply concerned with inequalities, but not of the financial kind. The inequality that matters in the unequal availability of meaningful opportunities to do or be the things that one has reason to value. As Sen (1999, p. 119) explained:

> The problem of inequality, in fact, gets magnified as the attention is shifted from income inequality to the inequality in the *distribution of substantive freedoms and capabilities*. This is mainly because of the possibility of some coupling of income inequality, on the one hand, with unequal advantages in converting incomes into capabilities, on the other. the latter tends to intensify the inequality problem already reflected in income inequality. For example, a person who is disabled, or ill, or old, or otherwise handicapped may, on the one hand, have problems in *earning* a decent income, and on the other, also face greater difficulties in *converting* income into capabilities and into living well. The very factors that may make a person unable to find a good job and a good income (such as a disability)

> may put the person at a disadvantage in achieving a good quality of life even with the same job and with the same income. This relationship between income-*earning* ability and income-*using* ability is a well-known empirical phenomenon in poverty studies. The interpersonal income inequality in the market outcomes may tend to be magnified by this "coupling" of low incomes with handicaps in the conversion of incomes into capabilities. (emphasis in original)

A study by Kuklys (2005) quantified the effect of disability in the lives of individuals and their families in the UK, showing that 47.4% of individuals in families with a disabled member experience economic poverty, which is a rate of 20% greater than the general population. Most of that gap (about three quarters of it) results from conversion handicap, meaning the inability to take advantage of the available money, due to the financial costs associated with disabilities. The other quarter of the difference results from income handicap, meaning that people with disabilities earn less on average than people without disabilities. The notion that people with disabilities should have access to greater income and/or resources than their fully able-bodied peers flies in the face of meritocratic thinking, and charts a course away from the pure market freedom that many market enthusiasts champion.

Proponents of the capability approach—Sen in particular—generally stop short of prescribing methods for overcoming income and conversion handicaps. The literature by Sen, Nussbaum, and others (e.g., Kuklys, 2005; Mitra, 2006; Terzi, 2005) contains more information explaining the philosophical underpinnings of the capability approach than it does about practical strategies to overcome the income and conversion handicaps of people with disabilities, though some recent articles have begun to acknowledge this gap and move toward bridging it (Biggeri, Bellanca, Bonfanti, & Tanzj, 2011; Trani, Bakhshi, Bellanca, Biggeri, & Marchetta, 2011). The problem of overcoming income and conversion handicaps is undoubtedly difficult and complex. No single intervention can come close to eliminating the disparities, but efforts to increase the accessibility of ICT are at least one effective component (among many) in a larger, broad-based strategy to address the market inequalities experienced by people with disabilities.

**6. Capability to interact with family, friends, and the community.** Consider the hypothetical example of a man in an old historical neighborhood of a city who—due to a recent car accident causing quadriplegia—cannot navigate his surroundings except in a wheelchair. His house has steps in the front in the back that prevent him from entering without assistance or, once inside, would prevent him from leaving without assistance. Family members built a ramp at the front entrance to allow him to enter and exit independently. The ramp is enormously beneficial, but extremely limited in the scope of benefits it can offer. The ramp cannot be transported to the man's parent's house, which also has stairs at the entrance. In fact, the ramp cannot be transported anywhere, and, as it turns out, all of his family members and friends live in houses with stairs at the entrance. Not only that, but because he lives in an older neighborhood, many of the buildings that he used to go to—his workplace, restaurants, shops, and so forth—also have steps at the entrance without ramps, making them inaccessible to him. This man's ability to interact with people has become extremely limited. Practically the only places he can interact with them are in his own home (now that it has a ramp) or outdoors. Unfortunately, this scenario is completely within the realm of plausibility, especially in areas of the world that do not have disability access legislation, or that have not enforced building accessibility guidelines, perhaps due to the historical nature of the old buildings in the neighborhood.

An ideal solution, at least from the perspective of the man with quadriplegia, would be for the buildings around him to be made wheelchair-accessible. Realistically, the likelihood of being able to add ramps to everyone's house is essentially zero. Making architecture accessible after-the-fact can be difficult and costly. Homeowners without disabilities, and without close friends with disabilities, have no immediate incentive to invest in changing their homes. Business owners likewise may feel that they have so few customers with disabilities that there is no rush to invest in accessibility changes for their places of business, especially if there are no legal sanctions.

How can this man interact with his friends and family? How can he conduct business with shops that cannot accommodate wheelchairs? Aside from the implausibility that everyone—including business owners—would always come to his house whenever he wants them to, this man can use ICT to communicate with them. Telephones, video chats, email, web-based discussion forums, and other technology-mediated forms of communication make interaction possible and convenient. They cannot literally bring his family, friends, and business associates to him, but they allow a second-best scenario of at least allowing communication. To the extent that these technologies provide accessible content and interfaces, they can provide this man with capabilities that he would not otherwise have.

**7. The capability to choose diverse forms of entertainment.** Extending the hypothetical example of the man with quadriplegia, let us say that he enjoys various forms of entertainment such as watching movies, playing board games, playing video games, attending plays, attending concerts, and viewing art in galleries and museums. Some of these will be easier to accomplish than others after his car accident, but he can still engage in all of these activities in some way, especially if we consider the possibility of using ICT as an intermediary. Viewing movies in the theater may still be possible, but not if the theater is not wheelchair accessible. Downloading movies to the computer or mobile devices can allow him to watch the same movie, even if it cannot bring home quite the same theater experience. He may not be able to move the pieces on a real chess board without assistance any more, but assistive technologies on the computer can allow him to play a full game of virtual chess, and his opponent does not even need to be in the same room. Video games of other types allow for many of the same possibilities. Plays and concerts could be recorded or broadcast live over television, radio, or internet. Art museums could provide a virtual gallery experience, perhaps even charging admission and restricting access to paying customers, to make the experience more accessible. With most forms of diversion and entertainment, there is a way to make them accessible using ICT. The experience may not be exactly the same as the nontechnology-mediated experience, but it can approximate it.

**8. The Capability to be Considered Equal, Normal, and Competent.** Perhaps one of the most important capabilities that accessible ICT can help people with disabilities achieve is the feeling that they are as human as everyone else, and fully worthy of being considered equal, normal, and competent. Sen (1999, p. 75) references the ability “to take part in the life of the community and [have] self-respect” as among the “very complex activities or personal states” that can be included within a person’s capability set. It can be difficult to feel this way if many of the goals and activities that a person values, and that other people take for granted, are impossible to achieve without significant and constant intervention and assistance by other people. Having to always ask for help can be demoralizing, and can limit the degree to which a person even wants to try to achieve some of the more difficult goals. Accessible ICT can reduce dependence on other people, giving people with disabilities the capability to choose and act for themselves in many ways. This ability to choose and act is itself an indicator of increased quality of life, though the use of accessible ICT does not eliminate the need for assistance from other people in all cases.

Some disabilities are severely limiting, placing high demands on other people to enable even the most mundane daily tasks. In less severe cases, accessible ICT can compensate for the limitations of a person’s body to the extent that the very use of the term “disability” becomes misleading because the people can perform all of the tasks that they need to, even if they perform them differently than other people. Accessible ICT does not change a person’s physical attributes that classify a person as “disabled,” but it can eliminate some of the sources of *disablement* within society the built environment by providing alternative ways of interacting with the world. When the sources of disablement are no longer disabling, a person with a “disability” has reason to feel as normal, as complete, as whole, and as competent as everyone else. These kinds of feelings go a long way toward improving one’s quality of life, which, after all, is the reason for the capability approach in the first place.

Nussbaum (2006, pp. 189-191) made a point of discussing at length the need to fully consider the capability-potential of people with disabilities, especially those with mental impairments, rather than dismiss them as exceptions to the rule or abnormal aberrations beyond the limits of normalcy.

> Using a different list of capabilities or even a different threshold of capability as the appropriate social goal for people with impairments is practically dangerous, because it is an easy way of getting off the hook, by assuming from the start that we cannot or should not meet a goal that would be difficult and expensive to meet...Such an emphasis on singleness is important not just strategically, but also normatively: for it reminds us of the respect we owe to people with mental impairments as fully equal citizens who are members of the human community and who have the ability to lead a good human life. It also reminds us of the continuity between so-called normal people and people with impairments.... Instead of segmenting off people with impairments, as if they belonged to a different (and lower) kind, we insist on their equal entitlement to the wherewithal of good lives Indeed, insisting on the singleness of the list for political purposes, a strategy that seems at first blush to ignore the individual situations of each person with a mental impairment, seems to be a good way of respecting the individuality of people with mental impairments. For what we are...is that they are just as much individuals as anyone else is, not types, not a lower kind that we set off from the human kind. That sort of typing [has] been one of the most pervasive ways in which people with disabilities get stigmatized. Erving Goffman's classic study of social stigma shows again and again that a central feature of the operation of stigma, especially toward people with impairments and disabilities, is the denial of individuality: the entire encounter with such a person is articulated in terms of the stigmatized trait, and we come to believe that the person with the stigma is not fully or really human. When such a person performs the most normal actions of a human life, "normals" often express surprise, as if they were saying, "Fancy that! In some ways you're just like a human being!" (Nussbaum, 2006, p. 190-191)

The ambition of the capability approach is to extend and enhance opportunities to all people, even to individuals whose bodies limit their ability to take advantage of those opportunities. Recognizing that some kinds of disabilities, by definition, limit some kinds of capabilities, Nussbaum (2006, pp. 194-195) continued:

> In more concrete terms, thinking about how the list [of basic capabilities] and its threshold might direct public policy toward [people with cognitive disabilities],

> we should attach more importance to the large items on the list than to their more specific subsections. Thus, even if [a person with a cognitive disability] cannot become a potential voter, we should ask what other ways there might be to give her political membership and the possibility of some political activity...Citizens with many mental impairments are capable of employment. If [she] cannot hold a job, well, what other ways might there be to give her some measure of control over her material environment?... If it turns out that [she] would not be able to raise and care for a child herself, even with assistance (this is not altogether clear), then what alternative relations to children might be devised to increase the richness of her life? Maintaining a single list of capabilities raises all these questions, and they are vital ones, if people with mental impairments and disabilities are to be fully equal as citizens.

Accommodating the needs of people with disabilities may be challenging, and in some cases the disabilities may make the achievement of certain kinds of capabilities impossible to achieve. The call to regard people with disabilities as equal does not imply that the disabilities are irrelevant or meaningless. Disabilities matter and have real consequences. The injunction is more of an affirmation of the value of all human lives, and the recognition that some creative thinking can increase the quality of life for even the most disabled among us. Like Nussbaum, Sen (1992, p. 91) contended that the inherent limitations caused by disabilities are no excuse to exclude people with disabilities from theories or strategies of justice or development:

> In the case of serious disabilities, attainment equality may be hard to achieve, and it may be particularly tempting to opt for shortfall equality. There might well be a good argument in that direction, but I would like to argue that it is not the case that the choice is made clear-cut simply by the nonfeasibility of attainment equality. It can be argued that even when a disabled person cannot, in any way, be given the freedom to enjoy the *same* level of the functioning in question (e.g., the same ability to move about freely as others), there is nevertheless a good case—based on fairness—for trying to *maximize* his below-par functioning ability, rather than settling for the same shortfall (absolute or proportionate) as others have from their—much higher—maximal functioning (as would be demanded by shortfall equality).

The capability approach does not require the perfect attainment of theoretically complete capabilities according to some absolute metric or standard. Development is seen as a work in progress. Incremental improvements count for something, especially when the hard realities of severe physical limitations dictate an apparent ceiling to what a person can achieve (at least within the limitations of current physical and medical science).

## Disability as a Category of Social Disadvantage

One of the primary concerns of the capability approach is that of inequality (Sen, 1979, 1992), primarily the inequality of opportunities to do or become what one has reason to value. Components of unequal relationships—such as unequal access to income, unequal ability to convert income into well-being, unequal ability to influence political processes, unequal power within social relationships, and so on—all contribute to the broader inequality of opportunities. Sen and Nussbaum repeatedly reference disability status as an important theme within the capability approach (e.g., Nussbaum, 2006, pp. 96-223; 2011, pp. 30, 39-41, 87-89, 149-152; Sen, 1992, pp. 5, 20, 27-29, 37-38, 81-85, 91; 1999, pp. 88, 314, 326; 2009, pp. 258-260) and a category of social disadvantage. In addition to disabilities, other categories of disadvantage that make frequent appearances in the literature about the capability approach include race (Sen, 1992, 1999, 2009), gender (Nussbaum, 1995; Sen, 1995), social class (Dreze & Sen, 2002; Nussbaum, 2002a, 2006; Sen, 1992, 2009), and to a lesser extent (at least so far), sexual orientation, religion, and national origin. The common thread between all of these topics is that they are socially constructed axes of identity that have historically contributed to disadvantages and to oppressive inequalities within many societies. These axes of identity are lenses through which one interprets life experiences, and one's relationship to others. Though all of the categories mentioned are quite different from each other, they all can contribute to social inequalities that reduce an individual's substantive freedoms.

Nussbaum (2006) went so far as to designate disabilities—mental disabilities especially—as one of the "frontiers of justice" needing more attention and practical solutions. The other frontiers of justice singled out by Nussbaum in the same book (2006) included transnational inequalities (i.e., the asymmetrical relationship between rich and poor countries in a global economy) and nonhuman animals (i.e., the responsibilities of humans toward other species). Nussbaum (2006, p. 1) made the case that these three issues have received scant attention and inadequate treatment in the literature about theories of justice. Nussbaum presents the capability approach as a way to bring these issues under a more inclusive and complete theoretical framework.

## A Disabling Null Curriculum or an Enabling Accessibility Curriculum

Not all ICT is created equal from an accessibility standpoint. Only *accessible* ICT has the power to remove disabling barriers for people with disabilities. Inaccessible ICT has the opposite effect, creating new disabling barriers, and wasting the potential to create opportunities for people with disabilities to be and do the things they value. Knowing the difference between accessible and inaccessible ICT is the first step in being able to create accessible ICT. This is where the role of the ICT curriculum takes center stage.

The most important part of teaching accessibility in the ICT curriculum is ensuring that accessibility is in fact in the curriculum at all. The topics that are absent in the curriculum are often referred to as the null curriculum (Eisner, 1985; Flinders, Noddings, & Thornton, 1986). In many ways, students learn as much from the exclusions in the curriculum as from the explicit educational because, as Eisner (p. 97) argued, "Ignorance is not simply a neutral void; it has important effects on the kinds of options one is able to consider, the alternatives one can examine, and the perspectives from which one can view a situation or problem." Students may never find out what topics the instructor (or the curriculum designer) could have included but did not, but this lack of knowledge is exactly what the null curriculum conveys to its students. If the ICT curriculum never addresses the needs of people with disabilities, it teaches that the needs of people with disabilities are not worth learning, whether this lesson is taught intentionally or not. Of course, the instructor is highly unlikely to explicitly declare, "The needs of people with disabilities are not worth learning." In fact, it seems improbable that most instructors would feel the kind of disdain toward people with disabilities that such a comment would imply, but by not teaching accessibility, instructors unwittingly demonstrate by example that disabilities are not high on their priority list.

Without some kind of intervention, the null curriculum can become a self-perpetuating cycle. The original curriculum designer fails to include accessibility in the curriculum. The first set of students fails to learn about accessibility. These students enter the workforce and fail to create accessible ICT. Some of these former students become ICT curriculum developers, and they fail to include accessibility in their new curriculum because they never learned about it themselves. This cycle of ignorance can be disrupted by incorporating accessibility into the ICT curriculum, preventing students from entering the workforce without the skills necessary to develop technologies for a wide range of people, including those with disabilities.

Some students may still learn something about accessibility—even if accessibility is completely absent from the curriculum—if they extend their personal studies beyond the official curriculum that their program has to offer, or if their future jobs require them to learn about it, but there is still a chance that these students will never learn about accessibility. Not all students are curious or self-motivated enough to seek information beyond the official curriculum, and even if they do, the topics they choose to study may not lead them to information about accessibility. Similarly, not all employers in the ICT industry expect their employees to know about accessibility. Some employers, such as those in the government sector or that work closely with the government sector, will likely be more attuned to accessibility requirements than employers in other sectors. In short, if students do not learn about accessibility from the official curriculum, they may not learn about it at all.

Some programs, such as the Instructional Technology program at George Mason University, view accessibility as a necessary part of the curriculum because of the faculty's impression that employers in the Washington DC area, with its high number of government-related jobs, value accessibility knowledge. Programs in other areas of the world may have less of a built-in incentive to include accessibility as part of the curriculum because of the presumed lower value placed on accessibility knowledge by employers in less government-centric locations. Even the programs without obvious connections to portions of the employment sector in which accessibility regulations apply can exert a dramatic impact on the lives of people with disabilities through the products they create, especially if those products become popular. The general public will take for granted than “everyone” can access popular products, making it all the more awkward and disadvantageous for people with disabilities when those popular products are inaccessible to them. On the flip side, popular accessible products open the same doors of opportunity for people with disabilities as they do for the general public, creating an equalizing set of expectations and capabilities for all users.

The curriculum is an ideal point of intervention because it represents the formation of knowledge and attitudes of students before they enter the workforce and make their impact in the ICT profession. The more students know about accessibility before creating ICT products, the greater the chance that these students will employ that knowledge, and the greater the chance that users with disabilities will be able to access the ICT products created by graduates of these programs. Educational interventions are possible and potentially beneficial at other points as well. On-the-job training in accessibility can reach ICT professionals that never learned about accessibility in their academic program, and it can strengthen the accessibility knowledge of those that did learn about it previously. Even if academia reaches a point at which accessibility is taught in all ICT curricula, additional workshops and on-the-job training could still be beneficial, as a way to keep professionals up to date with the latest technologies and techniques. Academia is still far from teaching accessibility in all ICT curricula, though, so there is still much work to be done to ensure that ICT students learn how to decrease the disablement of people with disabilities through accessible design rather than increase it through inaccessible design.

At this point it is worth acknowledging that there is much to learn as an ICT student, and an immense pool of knowledge from which to draw as an ICT curriculum developer. It would be impossible to teach everything within the formal curriculum. Part of the art of designing an effective curriculum is in deciding what to teach, and what not to teach. Curriculum design is necessarily a selective and discriminatory process in which the designer must decide which topics are important enough to include, and which topics fail to meet the minimum criteria for inclusion, even if they too are valuable to some degree. Is accessibility important enough to meet the minimum level of criteria for inclusion in the ICT curriculum? I have advocated throughout this dissertation for the inclusion of accessibility in the ICT curriculum, because of the impact on the lives of people with disabilities. Ultimately it is a question of values. The values of society and political institutions can influence individual curriculum developers, either through collective persuasion or legal requirements. In the absence of collective persuasion or legal requirements, the decision rests squarely on the curriculum developer, who will ultimately pass a judgment on the value of social inclusion for people with disabilities.

## Teaching ICT Accessibility: A Comparison to Architecture and the Built Environment

The ICT profession is somewhat like the field of architecture and related disciplines. Those who work in ICT create virtual environments and virtual methods of interaction. Those who work in architecture create real physical environments and spaces that allow in-person interaction. People with disabilities use both types of environments —virtual and real—so the creators of both of these types of environments need to design with accessibility in mind. Not everyone needs to know all of the accessibility techniques though. There is wisdom in specialization.

Creating a complex public space, such as a convention center, requires a team of professionals: architects, engineers, landscape designers, waste management engineers, general contractors, project managers, electricians, plumbers, heating/cooling technicians, sound engineers, interior designers, painters, tile and carpet installers, window and door installers, and many other workers in specific trades. It also requires interaction with city planners, lawyers, traffic planners, marketers, budget analysts and many other professionals who may not be involved in the intimate details of the design, but who are integral to the success of the project as a whole. Some of these workers may need to know nothing at all about disability access regulations to buildings. Others need to know a great deal, not only about the regulations, but also about the techniques for implementing the regulations effectively and wisely. Perhaps the team hires one or more accessibility experts to consult with the architects and landscape designers. That would be a valid approach. The design process would be easier and go more smoothly, though, if the designers themselves at least had a basic understanding of accessibility, to avoid having to constantly redesign things that do not meet accessibility codes. Similarly, even if the project planners do not know the accessibility codes themselves, their job will be easier if they at least know to plan for accessibility and to ask their designers to report on the disability features at various stages of the process, to avoid having to backtrack and change the design later, which can often be more expensive than designing for accessibility from the beginning. Some workers may have less need to understand accessibility, such as the painters, window installers, and waste management engineers. Accessibility knowledge for these workers would not hurt, but it may not be much of an advantage, compared to accessibility knowledge for the planners and designers.

The curriculum designers for the various professions and vocations that would be involved in the creation of a convention center have to make a decision about how much to teach their students about disability access. The architecture curriculum could require architecture students to learn accessibility regulations for building entrances, ramps, bathrooms, hallways, and other aspects of the building design. The curriculum for a landscape architecture program might teach accessibility principles for walkways, playgrounds, parking spaces, and other parts of the environment around buildings. A curriculum for project managers could teach some of the legal aspects of accessibility, the permit application and approval process, and some of the basic rules of accessibility, so the project managers can effectively and knowledgeably communicate with their planners and workers.

There are at least a couple of different layers to teaching accessibility to physical spaces. The easiest layer is teaching the legal regulations. Buildings with multiple levels require elevators and/or ramps. Ramps must be measure a minimum width specified by the regulations and not exceed the specified maximum slope. Bathrooms stalls require certain minimum measurements and certain kinds of handles to allow easy opening and closing. A specified number of designated parking spaces for people with disabilities must be placed near the entrance, and the parking spaces must meet the size requirements in the regulations. Drinking fountains must be shaped and placed in certain ways, according to regulations, to allow wheelchair access. At a conceptual level, teaching and learning these regulations is a relatively straightforward task. They are rules that one either knows or does not know. Some of the regulations are extensive, meaning that there is a lot to know, but the rules themselves are in many ways little more than items on checklists during the design process.

The second layer of accessibility knowledge requires a more complete understanding of what it means to navigate a building in a wheelchair, or as a blind person, or as a person with other kinds of disabilities. A building with many changes in floor level (e.g., with step-down lounges, platforms, steps up to doorways, etc., and uneven floor surfaces (e.g., rocks, bricks, etc.) can meet accessibility regulations with the proper accommodations, but that does not mean that it will necessarily be easy for a person to navigate with a wheelchair. Complex designs with protrusions from walls may be artistically interesting, but may cause blind people to trip or hit their heads more easily than designs with more conventional arrangements. Cabinetry and closets may be exempt from disability access regulations, but common cabinet designs are difficult to access from a wheelchair. This second layer of accessible design moves beyond the checklist mentality and into the realm of thoughtful expertise. Some architects and designers take it further by specializing in accessible design and marketing their expertise to other architects and designers. It may not be necessary to train all architects and designers to become accessibility experts, but the more they know, the better they will be able to create public spaces that work for all people, and not just for those without disabilities.

Like the fields related to architecture and design of the physical environment, the field of ICT is expansive and diverse. It includes electrical engineers, product designers, computer programmers, web designers, usability experts, interface designers, graphic artists, videographers, instructional designers, legal experts, business leaders, data architects, and numerous other specializations. Not all of these specializations involve creating products that interface directly with users with disabilities. Some specializations are highly technical, others much less so. There is no single profile of what it means to be an ICT professional, and there is no single definition of what it means to create an ICT curriculum. The various eventual career fields of the students determine a large part of the curriculum for the programs that prepare them for those careers. Within career fields there is still a great deal of room for interpretation and emphasis, to give each program its own unique approach. One size (or curricular approach) definitely does not fit all.

As with the design of physical spaces, there are layers of accessibility in the design of virtual spaces. The simplest layer consists of following guidelines and laws, much like the checklist approach to architectural accessibility. The curriculum content at this layer is rather technical and dispassionate. In many ways, the student does not need to know about the nuances of disability theory or social justice to learn the techniques and guidelines, though that kind of background knowledge could possibly provide motivation to learn the techniques. The techniques themselves, though, are just techniques, like any other technique that a student would learn that has nothing to do with disabilities. Like the architecture student who must learn the proper minimal width of hallways for wheelchair users, the web designer must learn things like the guidelines for minimum level of contrast between the font and the background. These standards are the rules of the game, so to speak, and instructors can teach these rules even if they understand little about disabilities. Similarly, students can learn and implement the rules even if the know (or care) little about disabilities. Though perhaps not ideal, if the curriculum does nothing more than teach the rules, it will likely be an improvement over a curriculum that fails to teach any of the rules.

Within disciplines in which a more complete approach would be appropriate, the curriculum would teach the rules *and* the deeper layers of the user experience. A deeper layer requires knowing how people with disabilities use technology, how they use assistive technologies, and what kinds of things make designs not merely accessible on a technical level, but also usable, useful, and desirable to people with disabilities. A more complete curriculum can include discussions about the social and political concerns of people with disabilities as well.

A few examples of specific knowledge domains within ICT may help to illustrate different ways of approaching the accessibility component in the curriculum. A curriculum for programs in user interface design ought to teach about the techniques and guidelines for interface accessibility as a minimum, but it can also go beyond this to teach details about the use case characteristics of the disabilities themselves, and students can learn how to use assistive technologies to test their own user interfaces. Web designers frequently create user interfaces too, so their curriculum needs would be similar. Graphic designers often create prototypes of user interfaces, or at least visual components for them, so they ought to have some basic knowledge of the visual aspects of accessibility, including the need for sufficient contrast, and the need to take into account color blindness. The curriculum for programs in data architecture probably do not need to teach much about assistive technologies or accessible user interfaces, but they could teach a few relevant concepts, such as the need for alternative text for images, so that data architects know to include a field for alternative text in data structures for images. Programs in ICT law or project management can teach about accessibility standards and laws. Other ICT specializations will need different types and different degrees of accessibility content in the curriculum. The Web Sciences program at the University of Linz uses a cross-disciplinary approach, requiring that students from the technical, legal, and design sides work together on projects, much as they would in projects in the workplace. Exposing students to people who approach projects with different skill sets and career paths can help broaden the accessibility understanding of all of those involved.

## ICT Curriculum Within an “Accessibility Ecosystem”

As important as the ICT curriculum is to achieving capabilities for people with disabilities, the curriculum is not a stand-alone product, independent of the social environment in which curriculum designers create it. Various groups, organizations, entities, trends, and socio-political structures play roles in influencing the “social climate” (Sen, 2009, p. 255) that can influence the ICT curriculum and other things that impact the creation of capabilities for people with disabilities. These influences co-exist in a kind of "accessibility ecosystem" in which the characteristics and actions of one component affect the characteristics and actions of other components. The comparative weakness of one component or disproportionately powerful influence of another component can alter the balance of the ecosystem, for better or for worse. Some of the components of this accessibility ecosystem include assistive technology creators, people with disabilities, disability advocacy groups, news and entertainment media, standards bodies, government and public policy makers, the professional business sector, accrediting bodies and professional organizations, universities and colleges, and the ICT curriculum. I do not present this list as all-inclusive, but it does highlight some of the major components within the accessibility ecosystem.

## Role of Assistive Technology Creators

Assistive technologies are a key part of the accessibility ecosystem because they act as intermediaries between the people with disabilities and ICT. Without assistive technologies, many people with disabilities would be unable to access ICT at all. Screen readers convert ICT content into audio or Braille for blind users. Screen enlargers allow users with low vision to read small fonts and see small images. Alternative keyboard and mouse devices make the hardware accessible to people with motor disabilities.

Assistive technologies can be expensive. At the time of this dissertation, the screen reader JAWS, by Freedom Scientific (http://www.freedomscientific.com), retails for US$895 to US$1095. Window Eyes by GW Micro (http://www.gwmicro.com) retails for $895. The screen enlarger software MAGic by Freedom Scientific retails for US$245 to US$885, depending on the edition. Refreshable Braille displays by Freedom Scientific retail for US$3895 to US$7795. These costs are in addition to the regular costs of a computer and software that everyone else must purchase. In some cases, employers pay for the assistive technologies of their employees. In other cases, particularly in Europe, some governments subsidize some or all of these costs, through public financing, insurance provisions, or grants through charitable organizations (Estreen, 2010). In areas where public financing is not as readily available, the cost of assistive technologies can be prohibitive, making access to ICT impossible for people with disabilities in low income brackets.

A frequent criticism of assistive technologies is that they are often unsophisticated compared to mainstream technologies, and they are updated too infrequently, making it difficult for people with disabilities to keep up with the latest ICT hardware and software. For example, Faulkner (2011) found that only two of the six brands of screen readers that he tested fully supported the ARIA roles (an accessibility feature for HTML) he was testing. One brand did not support any of the ARIA roles. Additionally, not all users have access to the latest versions of their preferred assistive technologies, perhaps due to the cost of upgrading, or the availability of the update in their language, or because they are unaware of the update, or for other reasons. This leads to a dilemma for ICT professionals who want to use the latest technologies, knowing (or not knowing, as the case may be) that assistive technologies may not yet be up to the task of interpreting these technologies. The more responsive the developers of assistive technologies can be—and the more quickly users upgrade to the latest assistive technologies—the more rapidly people with disabilities can enjoy full access to ICT.

**Role of People with Disabilities and Disability Advocacy Groups**

People with disabilities, and groups that advocate on the behalf of people with disabilities, are in the best position to educate the rest of the population on the issues that matter most to people with disabilities. At a basic level, getting involved in regular types of (nonadvocacy) interactions with friends, with the community, at the workplace, in politics, and in other social organizations can increase the frequency with which people without disabilities interact with people with disabilities. The frequency of interaction does not guarantee a reduction in the stigma associated with disabilities (Balter, 1999; Cahill & Eggleston, 1995; Farnall & Smith, 1999; Green, 2003; Nabuzoka & Rønning, 1997), but it can at least raise awareness about disabilities in a general sense. In a more specific sense, people with disabilities and disability advocacy groups can advocate for disability causes, through public policy, the media, the court system, as well as in interpersonal interactions. Ulrich (2007) said that “well behaved women seldom make history,” and the same could be said of people with disabilities. The more that people with disabilities remain on the sidelines, out of the public eye, and disconnected from the public discourse, the more they are likely to remain “out of sight/out of mind,” which can perpetuate a state of constant neglect of their priorities and needs.

Of course, not all individuals with disabilities are equally disposed to engage in political activism, and it would be too much of a burden to expect them all to do so. A complicating factor is the potential inaccessibility of some of the means to engage in political activism. Information from inaccessible sources may never reach people with disabilities, perhaps leaving them unaware of opportunities to engage in activism.

Inaccessible web-based petitions or forums may present unnecessary barriers to declarations of intent or support for causes. The threshold for participation in political processes can be higher for people with disabilities, which can perpetuate a cycle of under-participation and disenfranchisement. Therein lies the irony of the situation, as well as a reason to step forward to improve things.

**Role of News and Entertainment Media**

Portrayals of people with disabilities in the media (television, movies, music, news, literature, etc.) are often negative, falling back on unflattering prejudices (Balter, 1999; Hevey, 2006; Kriegel, 1987; Logmore, 1987; Norden, 1994). Nelson (1994) identified five major stereotypes in the media: people with disabilities as (a) pitiable and pathetic, or (b) "supercrip" (heroic stories of epic achievements that can make ordinary people with disabilities feel inadequate), or (c) sinister, evil, and criminal, or (d) better-off dead, or (e) maladjusted—his own worst enemy, or (f) a burden, or (g) unable to live a successful life. Not all media portrayals of disability are unflattering, and some writers have documented progressive, though incomplete, improvements in media portrayals over the years (Black & Pretes, 2007; James, 2010; Tollestrup, 2009; Wall, 2007). Others claim that some recent portrayals show a regression back toward prejudicial stereotypes (Kociemba, 2010; "Wheelchair Dancer: Glee," 2009), and a continued reluctance to cast people with real disabilities in disability roles (Smith, 2010). The question of whether the portrayals in the media shape public opinion or if it is the other way around is a bit of a chicken and egg scenario, in the sense that neither one necessarily precedes or follows the other. As with other social issues like race and gender, the media both reflect and shape public opinion (Holtzman, 2000).

As important as it is for the media to avoid perpetuating harmful stereotypes of people with disabilities, this is actually one of the lower hurdles for the media. General feelings of goodwill toward people with disabilities may not lead to specific actions in terms of making ICT more accessible. More salient to ICT accessibility is the extent to which the media draw attention to ICT accessibility barriers, and the solutions for removing those barriers. News outlets can feature stories about new assistive technologies, or show prominent people with disabilities using assistive technologies. Journalists can investigate claims of inaccessibility filed against businesses or organizations and report on the progress of lawsuits. The entertainment industry can write scripts with prominent roles for characters with disabilities, and can cast actors with real disabilities to play those roles. They can include writers with disabilities in their team of scriptwriters, to ensure accuracy and authenticity. With a little creativity and imagination, disability topics can occupy a place within the mainstream of news and entertainment media, helping to promote the quality of life of people with disabilities, and providing content that can capture the interest of the general public.

## Role of Standards Bodies

Standards bodies help answer the question of *how* to make ICT accessible. The types of technologies used in ICT are diverse, so standards and guidelines are distributed across a wide range of standards bodies and other organizations. The WAI of the W3C created sets of guidelines for making the web accessible in terms of web content (Caldwell et al., 2008; Chisolm et al., 1999), authoring tools to create web content

(Jacobs, Gunderson, & Hansen, 2002), user agents (e.g., web browsers) for accessing web content (Treviranus, McCathieNevile, Jacobs, & Richards, 2000), and rich internet applications (e.g., multimedia and interactivity; Craig & Cooper, 2011). The Electronics Industries Alliance developed standards for closed captioning of digital television in North America (Consumer Electronics Association, 2008). The International Standards Organization has published documents covering various aspects of ICT accessibility, including the ergonomics of human-system interaction, accessible user interfaces, accessible e-learning, and information technology in general ("Standards," n.d.). These and other standards represent a collaborative on the part of multiple stakeholders, often with committee members from several companies, universities, governments, or other interested parties. Standards are rarely at the leading edge of technology. They usually come about after competing techniques and/or products have battled it out in the marketplace, so they typically represent compromises of the various parties, in the interest of ensuring compatibility and interoperability across platforms.

Standards and guidelines often inform the creation of laws. Such was the case with U.S. Access Board Section 508 of the Rehabilitation Act (2000). The committee that drafted Section 508 paid close attention to the work by the WAI on the Web Content Accessibility Guidelines (Chisolm et al., 1999), deriving many of the rules in Section 508 from concepts originally presented in the WAI document. A much smaller number of rules ended up in Section 508 compared to the WAI guidelines, but Section 508 introduced a higher degree of verifiability, making compliance with Section 508 easier to confirm than compliance with the WAI guidelines. The WAI took note of this innovation, and made the second version of the Web Content Accessibility Guidelines easier to verify than the first version (S. Anderson, Bohman, Burmeister, & Sampson-Wild, 2004). The industry guidelines by the WAI influenced government policy, which then influenced industry guidelines. The process can be iterative, with standards and guidelines evolving along with advancements in technologies and methods.

**Role of Governments and Public Policy**

Some ICT professionals are fully aware and committed to designing with accessibility in mind under all circumstances, and have no need of laws to compel them to do so. It would be far too optimistic, though, to assume that all—or even a majority—of ICT professionals fit this description. Accessibility laws help define industry best practices and help to ensure that ICT professionals consider the needs of people with disabilities. Laws that require ICT accessibility help to equalize the levels of opportunities, or capabilities, available to people with or without disabilities.

One of the most influential accessibility laws for ICT accessibility was Section 508 in the United States. In simplified terms, Section 508 required federal government entities to take accessibility into account as a part of the ICT procurement process. Many of the world's biggest ICT companies, like Microsoft, Apple, Adobe, and IBM took notice of the law because the U.S. government was one of its biggest customers. Over time, these companies added accessibility features to many of their less-accessible products, which improved the state of accessibility for all users, not just users in the U.S. federal government. Section 508 also influenced policy in other countries. Mandate 376 in Europe (still currently a work in progress) is a procurement statute, similar in intent to

Section 508. When or if Mandate 376 is enacted in Europe, it will raise the bar for European governments in much the same way as Section 508 did in the United States.

Laws have their limitations though. Neither Section 508 nor Mandate 376 applies to corporations, nonprofits, or other entities. Other laws may apply, such as the Americans with Disabilities Act in the U.S., the Equality Act in the U.K., or the Equal Treatment Act in Austria, but other laws tend to approach accessibility in a more general sense of civil rights, and do not reference explicit accessibility guidelines in the same way as Section 508 or Mandate 376. All of these laws and mandates place much of the burden on the individuals with disabilities to report violations. There are no “accessibility police” constantly keeping vigil over the world’s ICT and punishing offenders. This leaves a lot of room for neglectful noncompliance with the laws. More optimistically, many government entities now have someone on staff tasked with the responsibility of ensuring compliance with Section 508, or they have access to external consultants who can provide occasional assistance when necessary. This self-monitoring within the government is certainly an improvement over previous conditions when accessibility was generally not taken into account with government purchases.

### Role of the Professional Business Sector

The business sector is the origin of most of the world’s ICT. Prominent ICT businesses include Microsoft, Apple, Adobe, Google, Time Warner, Vodafone, T-Mobile, Sony, Disney, Viacom, Comcast, Nokia, HP, Siemens, Panasonic, Motorola, Cisco, France Telecom, Deutsche Telekom, Hitachi, Verizon, AT&T, LG Electronics, and many more than could ever be named in a succinct list. The combined wealth of these large companies is staggering. The wealth just within Apple topped US$500 billion early in 2012, making it wealthier than most of the world's countries (Sarno, 2012). In fact, if Apple were a country, it would rank as the eighteenth wealthiest country, in terms of GDP ("GDP [current US$]," n.d.), on par with Switzerland. The wealth of these companies places them in a position of tremendous strength and influence. They set trends and make the rules within their industries, exerting their influence in the commercial sector, policy sector, and educational sector. Virtually all of these companies have delegates who participate in industry standards bodies, lobby politicians for favorable policies, and collaborate with nonprofits or universities on initiatives of interest to the company. These companies are savvy, and they wield their influence wherever it is strategically advantageous to be able to wield influence.

If at any point in time a company of this stature decides to emphasize accessibility, they have the power and resources to do so, which means that they will engage with standards organizations, lawmakers, and universities. In fact, representatives from many of these companies have actively participated in the creation of the WAI guidelines, Section 508 (including the draft of the still-unreleased second version), Mandate 376, and other guidelines and standards. These companies are also the ones that hire graduates of university programs, so it is understandable that these programs would want to prepare their graduates with the skills necessary to compete successfully for jobs with these employers. To use starkly capitalistic terminology, these companies are the clients who consume the products of universities, meaning the students. If a university fails to produce graduates worth hiring, companies will hire the graduates of other universities.

The universities with less competitive products (graduates) will find it more difficult to bring in the raw materials (potential students), which will make the universities less profitable, and diminish their market value and market share.

On the other hand, if large companies decide to resist calls to make their products accessible, they have sufficient wealth and bargaining power to do so. They can use delay tactics, enlist the advocacy of their legal team, engage in public relations campaigns, or use any other means to obscure or avoid the issue. They can make excuses for inaction (or resistance), valid or not, and continue to contribute to the disablement of people with disabilities in terms of ICT accessibility. Public opinion and/or the legal system may eventually catch up to these companies and force them to change, but a lot of time and wasted opportunities can pass in the meantime. Businesses wield power, and it is up to them to decide how to use it.

### Role of Accrediting Bodies and Professional Organizations

Accrediting bodies are organizations, external to colleges and universities, that evaluate the educational content of colleges and universities based on the accrediting body's predetermined criteria. In the United States, there are regional and national accreditation bodies as well as specialized accrediting bodies within the arts and humanities, education, law, social sciences, health care, and other specialties. Multiple accrediting bodies may accredit a single educational institution, depending on the subjects taught at the institution. Accreditation status is like a stamp of approval that says that the educational institution meets peer-reviewed standards for the curriculum and program governance. Institutions must pass the bar of accreditation on a recurring basis. Mariger (2011) described the procedure:

> Accreditation is an ongoing, cyclical process. Once an institution earns accreditation status, they participate in periodic reviews in order to maintain their status. This process involves several steps. The first step is self-study where the institution prepares a written summary of performance based on the standards of their accreditation agency. Second is a peer review of evidence materials and documents conducted by faculty and administration of similar institutions. Third, a site visit by the reviewers to view the institution and programs first hand. Next is the Judgment by the accrediting organizations commission who decide, based on the other steps whether the institution or program meets the requirements for accreditation or re-accreditation. Finally, periodic external reviews are conducted over time. (p. 34)

The process is time-consuming and resource-intensive, and is not meant to be taken lightly. The purpose of accreditation is to "improve quality, increase effectiveness, and endeavor for ongoing excellence" (Mariger, 2011, p. 34)

The incentives for achieving and maintaining accreditation are high. Unaccredited educational institutions cannot attract students nearly as easily as accredited institutions, and the reputation of unaccredited institutions within the educational community is significantly lower than the reputation of accredited institutions. Both of these translate into lower revenues for the institution, which can threaten its survival.

With so much riding on an institution's accreditation status, accrediting bodies are in a position of considerable influence. If all accrediting bodies were to declare that accessibility must be a part of the required curriculum for all ICT-related programs, virtually all ICT programs under the jurisdiction of these accrediting bodies would make the changes necessary to comply with the accreditation requirements. This is not to say that all ICT programs would teach accessibility equally well. Accreditation requirements for the curriculum tend to be worded broadly, with few specific operational mandates, to allow the institutions to exercise autonomy within their educational programs, and to allow them to differentiate themselves from programs at other institutions. Programs with a genuine commitment to accessibility would outperform programs that meet only the minimum accessibility requirements necessary for accreditation, in terms of successfully teaching accessibility to their students. Still, adding the requirement to teach accessibility in the ICT curriculum would move the field considerably closer to the goal of training all students in accessibility techniques.

**Role of Universities and Colleges**

Universities and colleges are more than just the curricula of their educational programs. Universities and colleges are complex systems of governance, research, teaching, community outreach, advocacy, social services, and other activities that interface with students, instructors, administrators, staff, legislators, businesses, the community, and families, any of whom may have disabilities. Many educational institutions are decentralized, with varying degrees of autonomy and communication between activities and departments. All of these activities rely on ICT in one way or another.

The attitude and approach of the institution as a whole—its culture—toward people with disabilities can go a long way toward determining the willingness of individual academic ICT programs to teach accessibility in the curriculum. One aspect of the institution's disability culture is the accessibility of its web presence, which is actually a rather complex thing to commit to:

> What constitutes web content? There are a few obvious answers to this question. The university's main web site is a good starting point. A click or two of the mouse (or keyboard) can take users to the web sites of different departments, colleges, offices, projects, institutes, organizations, or other academic entities within the institution. Already, this constitutes thousands, or possibly millions, of pages of content. Adding to this list are things like online courses, supplemental online materials for classroom-based courses, library databases, library subscription services, campus intranet services, employee and student records, bookstore purchasing services, and the personal web sites of students and faculty. Some of these web-based resources are simple HTML (Hyper Text Markup Language) files created by staff. Others are complex software products licensed from commercial vendors. In between these two extremes is an array of miscellaneous resources, such as word processor documents, slide shows, spreadsheets, videos, Java applets, etc. All of this is web content, and a holistic approach would seek to take it all into account. (P. Bohman, 2007)

Institutions can cultivate accessibility expertise across the university by seeking and hiring people with accessibility expertise, holding accessibility training workshops (perhaps with certificates of completion), and hiring people with disabilities. "For many people, accessibility is an abstract principle with little practical application. They may not have friends, family members, or coworkers with disabilities, so they have no natural incentive to think or act with accessibility in mind. Working alongside a person with disabilities may provide the impetus to change a person's paradigm and, consequently, their actions. At the very least, the presence of people with disabilities in the workplace will reveal the barriers that already exist and perhaps quicken the removal of those barriers" (P. Bohman, 2007). There are other ways as well. It can be helpful to think in terms of "spheres of accountability and opportunity" (P. Bohman, 2007).

> A holistic, systems-level approach suggests a distributed model of web accessibility expertise. There is more than one type of accessibility expertise, and more than one group of people in need of some form of accessibility expertise. Yes, web developers need to know the technical skills of accessible web design, but the larger realm of accountability includes vision and leadership, procurement policies and procedures, hiring practices, library management, online course

> materials, instructional technology services, student disability services, employee intranets, the main web site, faculty and student sites, curriculum design and development, research, and other areas within higher education. Not everyone in all of these areas must learn how to create accessible web pages, but key people in each area must know enough of the right kinds of information—within their spheres of accountability and opportunity—to prevent inaccessible practices from creeping into the system. They also must know how and where to receive additional accessibility assistance when needed.

A successful accessibility strategy must take into account the diversity of ICT on campus, as well as the constant changes in content and technology across those ICT sources.

Mariger (2011, p. 96) described four indicators for judging an institution's attention to web accessibility: (a) institutional vision and leadership commitment (administrative leadership and relevant stakeholder participation), (b) planning and implementation (inclusion of key personnel, comprehensive accessibility policy, written accessibility plan, and implementation of the plan), (c) resources and support (sufficient time and effort allocated to personnel, focus on personnel, sufficient budget, training and technical support, procurement, development, and use of technologies that will result in accessible web content), and (d) assessment (evaluation of progress, evaluation of outcomes, and the use of the assessment to improve institutional accessibility).

**Role of the ICT Curriculum**

The entirety of this dissertation expounds on the role of the curriculum in promoting ICT accessibility, so I will keep this last role description brief. In essence, the ICT curriculum trains people in the knowledge and skills necessary to create ICT in the workplace. If the curriculum includes accessibility knowledge and skills, it will qualify them to produce ICT products that contribute to the enablement of people with disabilities. If accessibility is not a part of the ICT curriculum, graduates of the program have to learn accessibility elsewhere, which means that there is a risk that they may not learn it at all. They may create inaccessible products that contribute to the disablement of people with disabilities.

## Responsibility to Create Capabilities for Others

Unless they have disabilities, the students in ICT programs are not the main beneficiaries of a curriculum that teaches accessibility techniques. People with disabilities who use ICT are the main beneficiaries. Teaching accessibility techniques as a part of the ICT curriculum gives students the knowledge and skills to create capabilities not for themselves (again, unless they have disabilities), but for others. With no direct benefit to most ICT students, one could argue that requiring them to learn accessibility techniques in college and to apply them in the workplace infringes on the freedoms of the nondisabled students. They are being made to spend time and energy doing things that they might not choose to do unless required to do so. This apparent compromise of individual freedom seems at odds with a theoretical approach with such a strong emphasis on freedom as the capability approach. Responsibilities and freedoms seem to contradict each other. Sen (1999) took this criticism seriously, and responded by turning the question around, giving examples of ways in which a lack of freedom diminishes a person's ability to act with responsibility.

> The bonded laborer born into semislavery, the subjugated girl child stifled by a repressive society, the helpless landless laborer without substantial means of earning an income are all deprived not only in terms of well-being, but also in terms of the ability to lead responsible lives, which are contingent on having

> certain basic freedoms. Responsibility *requires* freedom. The argument for social support in expanding people's freedom can, therefore be seen as an argument *for* individual responsibility, not against it. The linkage between freedom and responsibility works both ways. Without the substantive freedom and capability to do something, a person cannot be responsible for doing it. But actually having the freedom and capability to do something does impose on the person the duty to consider whether to do it or not, and this does involve individual responsibility. In this sense, freedom is both necessary and sufficient for responsibility. (p. 284)

Sen's response looks at the question from the side of people whose life circumstances limit their freedoms and capabilities. Only by changing their circumstances can these people be empowered to exercise the freedom to take advantage of the opportunities that they value.

Some might argue that Sen's response dodges the original question by shifting the focus away from those who would be inconvenienced by being required to perform actions that seem to only benefit others. Sen would respond that individual freedom within societies is achievable only when viewed as a "social commitment" (1999, p. 282).

> The alternative to an exclusive reliance on individual responsibility is not, as is sometimes assumed, the so-called nanny state. There is a difference between "nannying" an individual's choices and creating more opportunity for choice and for substantive decisions for individuals who can then act responsibly on that basis. The social commitment to individual freedom need not, of course, operate only through the state, but must also involve other institutions: political and social organizations, community-based arrangements, nongovernmental agencies of various kinds, the media and other means of public understanding and communication, and the institutions that allow the functioning of markets and contractual relations. (p. 284)

The ICT curriculum belongs in this list as part of "the media and other means of public understanding and communication." The task of situating the ICT curriculum within the capability approach can be summarized by saying that teaching accessibility as a part of the ICT curriculum is part of the necessary "social commitment" to individual freedoms.

## Indicators for Measuring Accessibility Content in the ICT Curriculum

Even though the capability approach is an evaluative framework, its basis is largely subjective and qualitative. A consistent criticism of the capability approach has been that it is difficult to subject to quantitative measurements (Roemer, 1996; Sugden, 1993), though Robeyns (2000) argued that those criticisms are problematic because of their narrow focus or misunderstanding of the purpose of the capability approach. Others have taken up the challenge of designing strategies for quantifying capabilities (Comim, Qizilbash, & Alkire, 2008; Kuklys, 2005), but so far none have attempted to devise guidelines for measuring the degree to which the ICT curriculum supports the creation of capabilities for people with disabilities. My ambitious in this regard are modest. I will not devise a mathematical index or calculation for comparative quantitative analysis. I will, however, list a few types of indicators that can serve as informal evidence of the presence or absence of commitment to teaching accessibility as an integral part of the ICT curriculum.

### Indicator 1: Does the Curriculum Require Students to Learn About ICT Accessibility?

This is the most basic of all indicators. Either a curriculum teaches ICT accessibility as a part of the required curriculum or it does not. If a curriculum offers only optional/elective classes that teach ICT accessibility, the curriculum as a whole fails to satisfy this indicator. The accessibility content should be part of the core curriculum.

**Indicator 2: Does the Curriculum Assess Students' ICT Accessibility Knowledge and Skills?**

Just teaching about ICT accessibility is insufficient. Instructors should assess students' knowledge of ICT accessibility in some way, whether through tests, projects, portfolios, or some other means that counts toward their final grade.

**Indicator 3: Do the Instructors Model ICT Accessibility?**

The instructors should employ accessibility techniques in their own teaching practices. In particular, instructors should model accessible techniques when teaching about subjects other than ICT accessibility.

**Indicator 4: Does the Official Class Description for at Least One of the Classes In the Required Curriculum Explicitly Mention Accessibility or Disabilities?**

Students should be able to identify classes in the course catalog that teach ICT accessibility by simply reading the official course title and description. The class description should include easily identifiable keywords, such as "disabilities," "accessibility," or other similar words appropriate for the content of the class.

# CHAPTER VII

## SUMMARY

The main substance of this dissertation was presented in three parts: (a) descriptive case study narratives of three different academic programs in Austria, the U.S., and the U.K.; (b) a cross thematic analysis, and (c) a discussion of the ICT curriculum in the context of the capability approach. In this summary section, I will review some of the main points of the dissertation and present some closing remarks.

Faculty at the University of Linz in Austria recognized the potential power of teaching ICT accessibility, so they created an academic program called Barrier-free Web Design to train web accessibility specialists. This was an intensive two-year program originally conceived as a master's degree, but bureaucratic hurdles prevented the program from receiving a master's degree designation, which meant it could award only an academic certificate. Without having the status of a degree, the faculty found it difficult to attract students to the program, so they discontinued the Barrier-free Web Design program after only one group of students. Subsequently the Linz faculty began a second web accessibility curriculum project on an international scale, thinking that the addition of international partners would help solve the problem of low demand in Austria. Logistical difficulties in working with some of the other universities caused that initiative to end prematurely as well. That curriculum is now in the public domain. The university's most recent attempt to create an accessibility curriculum is the new Web Sciences program, which began in 2011. This program was conceived as a mainstream curriculum, rather than an accessibility-specific curriculum, to appeal to a wider range of students.

Accessibility principles are integrated throughout the curriculum. This last model seems to hold more promise for sustainability than the previous two models, at least at the University of Linz. This integrated approach reaches a much larger audience of students, even though it cannot teach them as much about accessibility as the more specialized approaches.

The Instructional Technology program at George Mason University's Instructional Technology in the U.S. includes a required class on Web Accessibility and Design. The decision to add that class to the curriculum resulted from a culmination of influences and events. The first influence is the university's location within the Washington DC metro area, where the U.S. federal government exerts considerable influence over the local job market. Many of the ICT jobs in the area are associated with the federal government, either directly or through companies that contract with the government. With Section 508 of the Rehabilitation Act requiring federal government entities to adhere to ICT accessibility guidelines, the demand for accessible ICT services is higher in this region than in many other regions of the country. The Instructional Technology department sought and won several U.S. federal grants for instructional design projects. Because of the close alliance of the Instructional Technology program with the Special Education program, many of these grant projects had disability-related themes, which meant that the projects needed to adhere to Section 508 guidelines. During this time, one of the faculty members decided to learn about web accessibility and began teaching an elective two-credit course on web accessibility. Before long, the faculty determined that accessibility was important enough to add to the core curriculum, so they restructured the curriculum in 2005 and promoted the class to three credits. The class has been taught continuously since then.

The faculty members at Middlesex University in the U.K. have long been interested in disability-related projects and have been involved in accessibility-related committees, initiatives, and standards bodies in Europe, so the creation of a master's level program about Digital Inclusion in 2010 was a natural extension of the work that the faculty members were already doing. The degree was designed for working professionals, many of whom already had some experience in the field of digital inclusion and who attended the program to deepen their knowledge and gain the benefit of an academic degree. Students attended classes in person during the first week of each semester, then continued the coursework from home during the rest of the semester. The curriculum itself covered more than just disability topics. It included topics related to ageing, rural populations, recent immigrants, low income populations, low literacy populations, and other disadvantaged groups. The Digital Inclusion program was conceptually similar to the discontinued Barrier-free Web Design program at the University of Linz in that both programs sought to create experts in the field of inclusion and disability access, as opposed to the Instructional Technology program at George Mason University, which seeks to create experts in the more general field of instructional technology, while providing students with some knowledge of disability access. The faculty members at Middlesex recognized that there is some danger in trying to sustain a program with such a narrow focus. In the end, enrollment dropped and the program was forced to close after only about two years. Even though the Digital Inclusion program offered the extra incentive of a master's degree—unlike the Barrier-free web program at Linz which offered only an academic certificate—the enticement of a master's degree was not enough to attract a sufficiently large number of students to make the program sustainable.

The first topic in the cross-case thematic analysis is the curriculum goals and rationale. All three curricula exist with the goal to transform society to make it more accessible and inclusive for people with disabilities. They also had the goal of meeting the demands of the job market. In the case of the University of Linz, the job market proved to be too small in Austria to support an ongoing specialization program, so they changed strategies and infused accessibility into a more mainstream curriculum of Web Sciences. The students in the program at Middlesex University were already working professionals, so finding new jobs may not have been the primary concern for these students. The demand for accessibility expertise in Washington DC is more readily apparent than at the other locations, due to the influence of the Section 508 requirements for federal government accessibility. The Linz faculty and Middlesex faculty members are involved in international accessibility projects of various kinds, so they have far-reaching ambitions of transforming the ICT curriculum around the world to include more accessibility content, of raising the bar in the accessibility field, academically and professionally, and of increasing employment opportunities for people with disabilities. The instructional technology faculty members at George Mason, on the other hand, have different interests and areas of focus within the instructional technology field, mostly unrelated to disability access issues. None of the full time faculty members in the instructional design and development specialization concentrates on accessibility.

Adjunct faculty members have always taught the course on contract.

The second topic in the cross-case thematic analysis is the curriculum design process, from idea to implementation. In all cases, synergetic relationships with existing disability programs within and without the institution provided a foundation for the ICT curriculum efforts. Individual faculty members still had to champion the cause and move it forward. Involving people with disabilities helps legitimize the process and ensure it achieves the desired effects. All of the programs looked to existing curricula for ideas and models. All of them also underestimated the up-front development time required to turn the idea into a functioning academic program. George Mason's curriculum change was easier, because it did not start from scratch as the other two programs did. All of the programs submitted the curriculum to an internal review process, followed by an external review process.

The third theme is the task of defining the scope of the curriculum. Each of the programs had to decide the depth and breadth of the curriculum. The first two curricula at the University of Linz—Barrier-free Web Design and *web_access*—treated web accessibility in detail. The program at Middlesex University took a similar approach. The accessibility component at George Mason is necessarily less detailed because it consists of only one class. The Web Sciences program at the University of Linz is similarly less involved, but the accessibility content of the curriculum is spread out among multiple classes, rather than concentrated in a single class. All of the interviewees seemed to agree that it is better to add accessibility to general curricula than it is to create new accessibility specialization programs. Degree programs seem to more benefits than certificate programs in terms of attracting students and increasing the number of students who learn about accessibility. External collaboration and joint degrees with other universities may prove beneficial, but so far the efforts attempted at the University of Linz have proved disappointing.

The fourth theme is instructional materials and strategies. As with any pedagogical endeavor, sparking the interest of students and motivating them to learn is an important first step. Interacting with people with disabilities, watching videos about accessibility, using assistive technologies, or going to web sites and looking for accessibility features such as captions for videos can open the eyes of the students to the many ways in which people with disabilities face ICT accessibility barriers. Choosing which topics to teach will depend on the type of academic program. Web development modules will teach technical content that may be less appropriate in modules about disability law. It is important, especially in classes where accessibility is not the main topic, to include some form of evaluation, assessment, or test of the accessibility component of the class. Some students will have more technical skills and aptitude than others. It can be a challenge to balance the needs of students who are expert programmers with students who are more interested in ICT management, for example.

The fifth theme is instructional format and media choices. All of the cases include online learning, so the choices of format and media become important, in terms of making them accessible to both students and instructors with disabilities. Instructors in all of the cases admitted to running into some challenges making some parts of the course accessible, even though the instructors are supposed to be accessibility experts! Such is the nature of technology and accessibility. Most content can be made accessible without a great investment of time or effort, but there are circumstances that are trickier than others, and not even the instructors of these classes were immune to those challenges.

The sixth theme is program sustainability. The first two efforts at the University of Linz failed because of a confluence of unfavorable external influences and conditions. Not being able to offer a master's degree was one of the primary downfalls of the first initiative. Not being able to work effectively around the bureaucracies of other universities was one of the primary downfalls of the second initiative. The third initiative has fared much better so far. The Digital Inclusion program at Middlesex University started well enough, but diminishing enrollment forced the program to close. The accessibility component of the Instructional Technology curriculum at George Mason University has the longest track record of any in this study, going back to 2005 when it was added as a required element of the curriculum. The demand for accessibility expertise (or lack of demand) in the job market is an important external factor. The faculty in all of the cases agreed that the more sustainable approach is to teach accessibility to a greater number of students as a part of a mainstream program, rather than to create new specialized programs. Even with favorable circumstances and a good curriculum design strategy, adding accessibility to the curriculum requires someone to champion the cause. Disability interests are still widely neglected. It is likely that no one will miss the accessibility component if no one proposes it. It helps when the educational institution as a whole is committed to accessibility. Institutions should also try to minimize the opportunity cost to students. With the right combination of circumstances, effort, and smart strategy, it is possible to reach a tipping point and create a successful curriculum.

The last part of the dissertation discussed accessibility in the ICT curriculum within the capability approach framework. The more accessible the world's ICT infrastructure becomes, the more people with disabilities will be able to perform the daily tasks that require the use of ICT, whether in the workplace, in their educational pursuits, in their recreational activities, or other areas of their lives. Increased ICT accessibility reduces barriers to full inclusion in society, and helps mitigate the effect of physical limitations, giving people with disabilities more freedoms and more meaningful opportunities to choose their paths in life. These kinds of freedoms and opportunities—or capabilities, as they are called within the capability approach—do not spontaneously appear out of nowhere, especially not on a large scale. They require purposeful ethics-driven decisions to design, create, and maintain systems and infrastructures that support real capabilities for people with disabilities.

Providing training in accessibility and design-for-all as a part of the regular ICT curriculum can dramatically change the landscape of the ICT profession by making accessibility and design-for-all core components of what it means to be an ICT professional. The more people in the profession that are aware of the issue, the more likely it is that they will follow through with the need to create accessible digital information and technologies. If they do not have the expertise themselves, they will at least know that they ought to seek out someone who does have the expertise. Some basic indicators for measuring accessibility content in the ICT curriculum include: (a) whether the curriculum teaches ICT accessibility, (b) whether the curriculum assess the students' ICT accessibility and skills, (c) whether the instructors model ICT accessibility, and (d) whether the official class description for at least one of the classes in the required curriculum explicitly mentions accessibility or disabilities. Approaching accessibility and design-for-all through the curriculum is a grass-roots method of affecting change by transforming the way the industry thinks about their responsibility toward people with disabilities. The new generation of ICT graduates, with their accessibility training, will see accessibility as integral to the design process and professional workflow When accessibility becomes a normal, regular part of doing business in the digital realm, digital technology will finally reach its potential for facilitating the creation of capabilities in people with disabilities, rather than holding out as yet another obstacle to them.

**REFERENCES**


Abrahams, P. (2009). *Bloor accessibility survey highlights need for continuing research*. Retrieved from http://www.bloorresearch.com/analysis/11331/results-from-bloor-accessibility-survey.html

AECT. (n.d.). *What are the advanced standards?* Retrieved from http://www.aect.org/standards/advstand.html

Anderson, C. L. (2009). *Ideological dissonance, disability backlash, and the ADA amendments*. Retrieved from http://works.bepress.com/cheryl_anderson/3

Anderson, E., DeBolt, V., Featherstone, D., Gunther, L., Jacobs, D., Jensen-Inman, L.,Mills, C. S., … Walter, A. (2010). *Interact with web standards*. Berkeley, CA: New Riders.

Anderson, S., Bohman, P. R., Burmeister, O. K., & Sampson-Wild, G. (2004). User needs and e-government accessibility: The future impact of WCAG 2.0. *User-Centered Interaction Paradigms for Universal Access in the Information Society: Lecture Notes in Computer Science, 3196,* 289-304.

Apple, M. (2004). *Ideology and curriculum: Google book search* (3rd ed.). New York, NY: Routledge.

Associated Press. (2004, October 3). *E-voting fans: The disabled*. Retrieved from http://www.wired.com/politics/security/news/2004/10/65206

Baker, P. M. A., Williams, M. D., Moon, N. W., & Roy, R. G. B. (2006, September). *(e)Voting for people with disabilities and the aging: A survey of technological, social and process barriers to participation*. Paper presented at the annual meeting of the American Political Science Association, Philadelphia, PA.

BakerLaw. (2010). *Blind MBA to have her day in court over inaccessible government websites*. Retrieved from http://www.bakerlaw.ca/sites/bakerlaw/Blind_MBA_to_have_her_day_in_court.pdf

Balter, R. (1999). From stigmatization to patronization: The media’s distorted portrayal of physical disability. In L. L. Schwarts (Ed.), *Psychology and the media: A second look* (Vol. 2, pp. 147-171). Washington, DC: American Psychological Association.

Barnett, R., & Coate, K. (2005). *Engaging the curriculum in higher education*. New York, NY: Open University Press.

Behinderteneinstellungsgesetz. (2005a). Retrieved from http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10008253

Behindertengleichstellungsgesetz. (2005b). Retrieved from http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen& Gesetzesnummer=20004228

Bhagwati, J. N. (2002). Democracy and development: Cruel dilemma or symbiotic relationship? *Review of Development Economics*, *6*(2), 151-162.

Biggeri, M., Bellanca, N., Bonfanti, S., & Tanzj, L. (2011). Rethinking policies for persons with disabilities through the capability approach: The case of the Tuscany Region. *ALTER - European Journal of Disability Research*, *5*(3), 177-191.

Black, R. S., & Pretes, L. (2007). Victims and victors: Representation of physical disability on the silver screen. *Research and Practice for Persons with Severe Disabilities*, *32*(1), 66-83.

Bohman, J., & Zalta, E. N. (2010). Critical theory. *Stanford encyclopedia of philosophy*. Retrieved from http://plato.stanford.edu/archives/spr2010/entries/critical-theory/

Bohman, P. (2007). Cultivating and maintaining web accessibility expertise and institutional support in higher education. *ATHEN Access Technology Higher Education Network*, *2*. Retrieved from http://athenpro.org/node/55

Boyd, R. K., & Moulton, B. (2004). Universal design for online education: Access for All. *The distance education evolution: Issues and case studies* (pp. 67-115). Retrieved from https://sslvpn01.gmu.edu/,DanaInfo=portal.acm.org+citation.cfm?id=973549&dl=GUIDE&coll=GUIDE&CFID=8479662&CFTOKEN=77150294

Braithwaite, J., & Mont, D. (2009). Disability and poverty: A survey of World Bank Poverty Assessments and implications. *ALTER, European Journal of Disability*, *3*, 219-232.

Bridges, D. (2000). Back to the future: The higher education curriculum in the 21st century. *Cambridge Journal of Education*, *30*(1), 37-55.

Brobst, J. (2009). Evaluating the accessibility of Florida's public library home pages. *Libri*, *59*, 88-103.

Bromley, D. B. (1986). *The case study method in psychology and related disciplines*. New York, NY: Wiley.

Buckley, M., Kershner, H., Schindler, K., Alphonce, C., & Braswell, J. (2005). Benefits of using socially-relevant projects in computer science and engineering education. *Journal of Computing Science in Colleges*, *21*, 267-273.

Cahill, S. E., & Eggleston, R. (1995). Reconsidering the stigma of physical disability. *The Sociological Quarterly*, *36*, 681-689.

Caldwell, B., Cooper, M., Guarino Reid, L., & Vanderheiden, G. (Eds.). (2008,). *Web content accessibility guidelines (WCAG) 2.0.* Retrieved from http://www.w3.org/TR/WCAG20/

Carmichael, A., Newell, A. F., & Morgan, M. (2007). The efficacy of narrative video for raising awareness in ICT designers about older users' requirements. *Interacting with Computers*, *19*, 587-596.

Charlton, J. I. (1998). *Nothing about us without us*. Berkeley, CA: University of California Press.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Thousand Oaks, CA: Sage.

Chisolm, W., Vanderheiden, G., & Jacobs, I. (Eds.). (1999). *Web content accessibility guidelines 1.0.* Retrieved from http://www.w3.org/TR/WCAG10/

Clark, J. (2002). *Building accessible web sites*. Boston, MA: New Riders.

Cohen, R. F., Fairley, A. V., Gerry, D., & Lima, G. R. (2005). Accessibility in introductory computer science. *Proceedings of the 36th SIGCSE technical symposium on Computer science education* (pp. 17-21). St. Louis, MO. Retrieved from http://doi.acm.org/10.1145/1047344.1047367

Comim, F., Qizilbash, M., & Alkire, S. (2008). *The capability approach: Concepts, measures and applications*. Cambridge, MA: Cambridge University Press.

Conraths, B. (2001). *Towards accreditation schemes for higher education in Europe?* Geneva, Switzerland: CRE.

Consumer Electronics Association. (2008). *CEA standard: Digital television (DTV) closed captioning*. Retrieved from standards.ce.org/kwspub/published_docs/CEA-708-D-Preview.pdf

Council of the European Union. (2009). *The 2935th Transport, Telecommunications and Energy Council meeting Brussels, 31st March 2009*. Retrieved from http://europa.eu/rapid/pressReleasesAction.do?reference=PRES/09/73&format=HTML&aged=0&lg=et&guiLanguage=en

Craig, J., & Cooper, M. (Eds.). (2011). *Accessible rich internet applications (WAI-ARIA) 1.0.* Retrieved from http://www.w3.org/TR/wai-aria/

Craven, J., & Klaus, J. (2008). Accessibility: Education for web design and e-learning introduction to the special thematic session. *Computers Helping People with Special Needs: Lecture Notes in Computer Science, 5105*, 178-181. Retrieved from https://sslvpn01.gmu.edu/content/y243t872210tt52w/,DanaInfo=www.springerlink.com+

Cuban, L. (1992). Curriculum stability and change. In P. Jackson (Ed.), *Handbook of research on curriculum: A project of the American Educational Research Association* (pp. 216-247). New York, NY: Macmillan.

Danielsen, C. (2010a). *Law schools discriminate against blind applicants: National Federation of the Blind files complaints against nine law schools*. Retrieved from http://www.nfb.org/nfb/NewsBot.asp?MODE=VIEW&ID=587

Danielsen, C. (2010b). *Penn State discriminates against blind students and faculty: National Federation of the Blind files complaint against Penn State*. Retrieved February from http://www.nfb.org/nfb/NewsBot.asp?MODE=VIEW&ID=702

Darder, A. (1991). *Culture and power in the classroom*. Westport, CT: Bergin & Garvey.

Denzin, N. (1989). *The research act* (revised ed.). Englewood Cliffs, NJ: Prentice Hall.

Disability Discrimination Act 1995. (1995). Retrieved from http://www.legislation.gov.uk/ukpga/1995/50/contents

Disability Rights Commission. (2004). *The web: Access and inclusion for disabled people—A formal investigation conducted by the Disability Rights Commission*. London, UK: Author. Retrieved from http://www-hcid.soi.city.ac.uk/research/DRC_Report.pdf

Do-IT. (n.d.). *Web Accessibility 101*. Retrieved from http://www.doit.wisc.edu/accessibility/online-course/index.htm

DO-IT. (2009). *World wide access: Accessible web design*. Retrieved from http://www.washington.edu/doit/Video/index.php?vid=35

Doherty, B. (1995). Unreasonable accommodation: The case against the Americans with Disabilities Act. Retrieved from http://reason.com/archives/1995/08/01/unreasonable-accommodation/singlepage

DOJ Proposed Rule Making on Website ADA Compliance. (2010, July 26). *Federal Register*, *75*(142), 43460-43467.

Dreze, J., & Sen, A. (2002). *India: Development and participation*. Oxford, England: Oxford University Press.

Earle, R. S., & Persichitte, K. A. (Eds.). (2001). *AECT standards for the accreditation of school media specialist* (4th ed.). Retrieved from http://aect.site-ym.com/resource/resmgr/AECT_Documents/AECTstandardsREV2005.pdf

EDeAN. (2010a). *Curriculum guidelines for masters level modules in Design for All in ICT, including an overview of the full programme*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010b). *Curriculum guidelines for masters level modules in Design for All in ICT: Accessibility in games*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010c). *Curriculum guidelines for masters level modules in Design for All in ICT: Assistive technologies*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010d). *Curriculum guidelines for masters level modules in Design for All in ICT: Research project*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010e). *Curriculum guidelines for masters level modules in Design for All in ICT: Fundamentals of design for all in ICT*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010f). *Curriculum guidelines in Design for all in ICT: Interaction design and user experience*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010g). *Curriculum guidelines for masters level modules in Design for All in ICT: Overview of programme*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010h). *Curriculum guidelines for masters level modules in Design for All in ICT: Regulations legislation and standards*. Retrieved from http://www.edean.org central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

EDeAN. (2010i). *Curriculum guidelines for masters level modules in Design for All in ICT: Web accessibility*. Retrieved from http://www.edean.org/central.aspx?sId=64I160I771I323I264414&neID=311&neTa=3&tbid=0&lrID=2&oldUIID=aI499I2I2&acID=1&sigID=3

Ehrsenal, K. N. (2001). Training capitalism's foot soldiers: The hidden curriculum of undergraduate business education. In E. Margolis (Ed.), *The hidden curriculum in higher education* (pp. 110-113). New York, NY: Routledge.

Eisner, E. W. (1985). *The educational imagination: On the design and evaluation of school programs* (2nd ed.). New York, NY: Macmillan.

Elwan, A. (1999). *Poverty and disability: A survey of the literature*. Retrieved from http://siteresources.worldbank.org/DISABILITY/Resources/280658-1172608138489/PovertyDisabElwan.pdf

Equal Treatment Act (Gleichbehandlungsgesetz, GlBG). (2004). Retrieved from http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20003395

Equality Act 2010. (2010). Retrieved from http://www.legislation.gov.uk/ukpga/2010/15/contents

Erlandson, R. F. (2002). Universal design for learning: Curriculum, technology, and accessibility. *Proceedings of ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications*. Denver, CO: Retrieved from https://sslvpn01.gmu.edu/ERICWebPortal/custom/portlets/recordDetails/,DanaInfo=eric.ed.gov+detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED477004&ERICExtSearch_SearchType_0=no&accno=ED477004

Estreen, M. (2010). *Europe with free choice of assistive technology: The provision of assistive devices in specific European countries*. Sweden: Swedish Institute of Assistive Technology. Retrieved from https://docs.google.com/viewer?a=v&q=cache:dnOnLXiGuLcJ:www.hi.se/Global/Dokument/fritt-val-av-hjalpmedel/Europe%2520with%2520Free%2520Choice%2520of%2520Assistive%2520Technology%2520-%2520publ-10395.pdf+&hl=en&gl=us&pid=bl&srcid=ADGEESiCge6wCQdsEpR-LiZ784C5JH-HbR9V5_HFLrGgVqrw67nXfgx_Q4OzvQFGkwCjzPyab9fQSWvCndFfzMtXx3aOLSR_jFjAUduXrJyTTBBygqoHT3M1pM0bUlFyIdQHYaYqTh6v&sig=AHIEtbQ169kwOZhURjfittW9O08OCDdLtw&pli=1

European Commission. (2000a). *Council directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin.* Retrieved from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0043:EN:HTML

European Commission. (2000b). *Council directive 2000/78/EC of 27 November 2000 establishing a general framework for equal treatment in employment and occupation.* Retrieved from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0078:EN:HTML

European Commission Standardization Mandate M 376. (n.d.). Retrieved from http://www.mandate376.eu/

European Network of Legal Experts in the Non-Discrimination Field. (n.d*.). Country context (Austria). European Network of Legal Experts in the Non-Discrimination Field*. Retrieved from http://www.non-discrimination.net/content/country-context-0

Farnall, O., & Smith, K. A. (1999). Reactions to people with disabilities: Personal contact versus viewing of specific media portrayals. *Journalism and Mass Communication Quarterly*, *76*, 659-672.

Faulkner, S. (2011). *WAI ARIA Landmark Role Tests. HTML 5 Accessibility*. Retrieved from http://www.html5accessibility.com/tests/landmarks.html

Feyere, E., Miesenberger, K., & Wohlhart, D. (2002). ICT and assistive technology in teachers education and training. *Lecture Notes in Computer Science, 2398*, 297-334.

Filmer, D. (2008). Disability, poverty, and schooling in developing countries: Results from 14 Household Surveys. *World Bank Economic Review*, *22*(1), 141-163.

Fkiaras, E. (2005). Liability under the Americans with Disabilities Act for private web site operators. *Shidler Journal of Law*, *2*(2). Retrieved from http://hdl.handle.net/1773.1/370

Flinders, D. J., Noddings, N., & Thornton, S. J. (1986). The null curriculum: Its theoretical basis and practical implications. *Curriculum Inquiry*, *16*(1), 33-42.

Follette Story, M. (1998). Maximizing usability: The principles of universal design. *Assistive Technology*, *10*(1), 4-12.

Freire, P. (1972). *Pedagogy of the oppressed*. London, England: Penguin.

GDP [current US$]. (n.d.). Retrieved from http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?order=wbapi_data_value_2010+wbapi_data_value+wbapi_data_value-last&sort=desc

Geertz, C. (1993). *The interpretation of cultures*. New York, NY: Basic.

George Mason University. (2011). Instructional technology program home page. Retrieved from http://it.gse.gmu.edu/

Giroux, H. A. (1988). *Teachers as intellectuals: Toward a critical pedagogy of learning*. Westport, CT: Bergin & Garvey.

Grabowicz, P. (n.d.). *Print editions decline: The transition to digital journalism*. Retrieved from http://multimedia.journalism.berkeley.edu/tutorials/digital-transform/print-editions-decline/

Green, S. E. (2003). "What do you mean 'what's wrong with her?'": Stigma and the lives of families of children with disabilities. *Social Science & Medicine*, *57*, 1361-1374.

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Resources Information Center Annual Review Paper*, *29*, 75-91.

Harrison, S. M. (2005). Opening the eyes of those who can see to the world of those who can't. *ACM SIGCSE Bulletin*, *37*(1), 22-26.

Heilman, E. E., Amthor, R. F., & Missias, M. T. (Eds.). (2010). *Social studies and diversity education: What we do and why we do it*. New York, NY: Routledge.

Hengstberger, B., Miesenberger, K., Batusic, M., Chelbat, N., & Rodriguez Garcia, A. (2008). Joint study programme on accessible web design. *Computers Helping People with Special Needs: Lecture Notes in Computer Science*, *5105*. Retrieved from https://sslvpn01.gmu.edu/content/8k61266614264356/,DanaInfo=www.springerlink.com+?p=dff8e225be534b4ea64624a45eedf846&pi=25

Hevey, D. (2006). *The enfreakment of photography: The disability studies reader* (2nd ed.). New York, NY: Taylor and Francis.

Hobbes, T. (1651). *Leviathan*. Retrieved from http://oregonstate.edu/instruct/phl302/texts/hobbes/leviathan-contents.html

Holtzman, L. (2000). *What film, television, and popular music teach us about race, class, gender and sexual orientation*. New York, NY: Sharpe.

Hong, S., Katerattanakul, P., & Lee, D. (n.d.). Evaluating government website accessibility: Software tool vs human experts. *Management Research News*, *31*(1). Retrieved from http://www.emeraldinsight.com/journals.htm?articleid=1641957&show=abstract

Hoogeveen, J. (2005). Measuring welfare for small but vulnerable groups: poverty and disability in Uganda. *Journal of African Economies*, *14*, 603-631.

Hughes, J. (2010, May 31). *Defining disability in an age of enhancement.* Retrieved from http://ieet.org/index.php/IEET/more/hughes20100531/

Institute Integriert Studieren. (n.d.). Retrieved from http://www.jku.at/iis/

Iwarsson, S., & Stahl, A. (2003). Accessibility, usability and universal design: Positioning and definition of concepts describing person-environment relationships. *Disability & Rehabilitation*, *25*(2), 57-66.

Jackson, P. W. (1968). *Life in classrooms*. New York, NY: Teachers College Press.

Jacobs, I., Gunderson, J., & Hansen, E. (Eds.). (2002). *User agent accessibility guidelines 1.0.* Retrieved from http://www.w3.org/TR/WAI-USERAGENT/

Jaeger, A. J. (2003). Job competencies and the curriculum: An inquiry into emotional intelligence in graduate professional education. *Research in Higher Education*, *44*, 615-639.

Jaeger, P. T. (2006a). *Multi-method evaluation of U.S. federal electronic government websites in terms of accessibility for persons with disabilities* (Doctoral dissertation). Retrieved from http://etd.lib.fsu.edu/theses/available/etd-03062006-120905

Jaeger, P. T. (2006b). Assessing Section 508 compliance on federal e-government web sites: A multi-method, user-centered evaluation of accessibility for persons with disabilities. *Government Information Quarterly*, *23*(2), 169-190.

James, A. J. (2010). *Shifts in attitude towards disability observed through seven German films* (Unpublished master's thesis). Arizona State University, Phoenix, AZ.

Johnson, R. B. (1997). Examining the validity structure of qualitative research. *Education*, *118*, 282-292.

Joint Programme on Accessible Web Design (web_access). (2009). Retrieved from http://www.webaccess-project.net

Kane, S., Shulman, J. A., Shockley, T. J., & Ladner, R. E. (2007). A web accessibility report card for top international university web sites. *2007 International Cross-Disciplinary Conference on Web Accessibility (W4A)* (pp. 148-156). Paper presented at the International Cross Conference on Web Accessibility (W4A), New York, NY.

Keith, S., & Whitney, G. (2008). *Identification and evaluation of case studies*. Retrieved from http://www.dfaei.org/deliverables/D6.2.pdf

Keith, S., Whitney, G., & Kolar, I. (Eds.). (2009). *Review of work package W6: Design for All for eInclusion* (Project number IST CA 0033838). London, England: Middlesex University. Retrieved from www.dfaei.org/deliverables/D6.4b.pdf

Kelly, A. V. (1983). *The curriculum: Theory and practice*. London, England: Chapman.

Kenny, W. R., & Grotelueschen, A. D. (1980). *Making a case for case study*. Urbana-Champaign, IL: University of Illinois.

Kliebard, H. (2004). *The struggle for the American curriculum, 1893-1958*. New York, NY: Routledge.

Klironomos, I., Antona, M., Basdekis, I., & Stephanidis, C. (Eds.). (2006). White paper: Promoting design for all and e-accessibility in Europe. *Universal Access in the Information Society*, *5*(1), 105-119.

Kociemba, D. (2010). “This isn’t something I can fake”: Reactions to “Glee’s” representations of disability. *Transformative Works and Cultures*, *5*. Retrieved from http://journal.transformativeworks.org/index.php/twc/article/viewArticle/225/185

Krazit, T. (2009). *Web accessibility no longer an afterthought*. Retrieved from http://news.cnet.com/8301-30684_3-10414041-265.html

Kreps, D. (2008, September). *How the web continues to fail people with disabilities*. Paper presented at the ALT-C, Leeds, England. Retrieved from http://www.kreps.org/ papers/alt-c2008.pdf

Kriegel, L. (1987). The cripple in literature. In A. Gartner & T. Joe (Eds.), *Images of the disabled, disabling images* (pp. 31-46). New York, NY: Praeger.

Kuchinskas, S. (2005). *Is Google shutting out the blind?* Retrieved from http://www.internetnews.com/ent-news/article.php/3518741

Kuklys, W. (2005). *Amartya Sen’s capability approach: Theoretical insights and empirical applications*. Berlin, Germany: Springer.

Law Office of Lainey Feingold. (2010). *Accessibility lawsuit filed against JetBlue Airways*. Retrieved from http://lflegal.com/2010/10/jet-blue/

Lazar, J. (2002). Integrating accessibility into the information systems curriculum. *Proceedings of the International Association for Computing Information Systems* (pp. 373-379). Retrieved from http://www.iacis.org/iis/2002_iis/PDF%20Files/Lazar.pdf

Lazar, J., Beavan, P., Brown, J., Coffey, D., Nolf, B., Poole, R., … Wenger, B. (2010). Investigating the accessibility of state government web sites in Maryland. In P. Langdon, P. Clarkson, & P. Robinson (Eds.), *Designing inclusive interactions* (pp. 69-78). London, England: Springer-Verlag.

Lazar, J., Dudley-Sponaugle, A., & Greenidge, K.-D. (2004). Improving web accessibility: A study of webmaster perceptions. *Computers in Human Behavior*, *20*, 269-288.

Lazar, J., Jaeger, P. T., Adams, A., Angelozzi, A., Manohar, J., Marciniak, J., … Walton, M. (2010). Up in the air: Are airlines following the new DOT rules on equal pricing for people with disabilities when websites are inaccessible? *Government Information Quarterly*, *27*, 329-336.

Liffick, B. W. (2004). Introducing assistive technology in an HCI course. *Proceedings of the 9th annual SIGCSE Conference on Innovation and Technology in Computer Science Education* (pp. 232-232). New York, NY: ACM. Retrieved from http://doi.acm.org/10.1145/1007996.1008061

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.

Locke, J. (1689). *Second treatise on government*. Cambridge, England: Cambridge University Press.

Logmore, P. K. (1987). Screening stereotypes: Images of disabled people in television and motion pictures. In A. Gartner & T. Joe (Eds.), *Images of the disabled, disabling images* (pp. 65-78). New York, NY: Praeger.

Loiacono, E. T. (2004). Cyberaccess: Web accessibility and corporate America. *Communications of the ACM: The Blogosphere*, *47*(12), 83-87.

Longstreet, W. S., & Shane, H. G. (1993). *Curriculum for a new millennium*. Boston, MA: Allyn and Bacon.

Lopes, R., Gomes, D., & Carriço, L. (2010, April). *Web not for all: A large scale study of web accessibility*. Paper presented at the 2010 International Cross Disciplinary Conference on Web Accessibility, Raleigh, NC.

Loriggio, P. (2010). *Court orders Ottawa to make websites accessible to blind*. Retrieved from http://www.theglobeandmail.com/news/national/ontario/court-orders-ottawa-to-make-websites-accessible-to-blind/article1817535/?cmpid=rss1

Ludi, S. (2002). Access for everyone: Introducing accessibility issues to students in internet programming courses. *Proceedings of the ASEE/IEEE 32nd Annual Frontiers in Education Conference* (pp. s1C7—S1C9). Presented at the ASEE/IEEE Frontiers in Education Conference. Washington, DC: IEEE Computer Society Press.

Ludi, S. (2007). Introducing accessibility requirements through external stakeholder utilization in an undergraduate requirements engineering course. *Proceedings of the 29th International Conference on Software Engineering* (pp. 736-743). Washington, DC: IEEE Computer Society.

MacPherson, D. L., Pothier, D., & Devlin, R. (2006). Damage quantification in tort and pre-existing conditions: Arguments for a reconceptualization. In D. Pothier & R. Devlin (Eds.), *Critical disability theory: Essays in philosophy, politics, policy, and law* (pp. 248-266). Vancouver, BC, Canada: UBC Press.

Margolis, E. (Ed.). (2001). *The hidden curriculum in higher education*. New York, NY: Routledge.

Mariger, H. A. (2011). *The social validation of institutional indicators to promote system-wide web accessibility in postsecondary institutions* (Unpublished doctoral dissertation). Utah State University, Logan, UT.

May, S., & Zhu, Q. (2009). A web accessibility assessment on the Texas public school system. *Universal Access in the Information Society*, *9*(1), 87-96.

McColl, M. A., James, A., Boyce, W., & Shortt, S. (2006). Disability policy making: Evaluating the evidence base. In D. Pothier & R. Devlin (Eds.), *Critical disability theory: Essays in philosophy, politics, policy, and law* (pp. 25-46). Vancouver, BC, Canada: UBC Press.

McLaren, P., Macrine, S., & Hill, D. (Eds.). (2010). *Revolutionizing pedagogy: Educating for social justice within and beyond global neo-liberalism*. London, England: Macmillan.

Merriam, S. B. (1998). *Qualitative research and case study applications in education* ($2^{nd}$ ed.). San Francisco, CA: Wiley.

Merrian-Webster. (2012). *Poverty*. Retrieved from http://www.merriam-webster.com/dictionary/poverty

Middlesex University. (n.d.). *Overview & facilities*. Retrieved from http://www.mdx.ac.uk/courses/postgraduate/computing_and_it/digital_inclusion_msc.aspx

Middlesex University. (2009). *Programme specification and curriculum map for MSc / PG dip digital inclusion*. Retrieved from http://www.google.com/url?sa=t&rct=j&q=%22digital%20inclusion%22%20curriculum%20map&source=web&cd=1&ved=0CCAQFjAA&url=http%3A%2F%2Fwww.mdx.ac.uk%2FAssets%2FMSc_DI_09_10.pdf&ei=rDWiTpCEMaL00gG86-XQBA&usg=AFQjCNF1EBoy-1oJnkjTMuS3E5xbAwL6Fw&sig2=Z4B6OzuBTHes9v9XWPVLyA&cad=rja

Middlesex University. (2010). *MSc/PG dip digital inclusion student programme handbook 2010/11*. Retrieved from http://www.mdx.ac.uk/courses/postgraduate/computing_and_it/digital_inclusion_msc.aspx

Middlesex University. (2011a). *MSc Digital Inclusion Degree*. Retrieved from http://www.mdx.ac.uk/courses/postgraduate/computing_and_it/digital_inclusion_msc.aspx

Middlesex University. (2011b). *MSc digital inclusion course info*. Retrieved from http://www.mdx.ac.uk/courses/postgraduate/computing_and_it/digital_inclusion_msc.aspx

Miesenberger, K. (2006, September). *BFWD and Assistec: Two university degrees relevant to design for all: Accessible web design and assistive technologies*. Paper presented at the International Design for All Conference, Rovaniemi, Finland. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.103.4073&rep=rep1&type=pdf

Miesenberger, K., Hengstberger, B., & Batusic, M. (2010). Web_Access: Education on accessible web design. *Computers Helping People with Special Needs: Lecture Notes in Computer Science, 6179*, 404-407. Retrieved from http://www.springerlink.com.mutex.gmu.edu/content/415267384l12nj80/

Miesenberger, K., & Ortner, D. (2006). Raising the expertise of web designers through training—the experience of BFWD—accessible web design (Barrierefreies Webdesign) in Austria. Retrieved from http://www.springerlink.com.mutex.gmu.edu/content/d162g35q55100574/

Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: A sourcebook of new methods*. Beverly Hills, CA: Sage.

Milley, D. (2010). *Scarborough woman wins accessibility challenge against federal government*. Retrieved from http://www.insidetoronto.com/news/local/article/911351--scarborough-woman-wins-accessibility-challenge-against-federal-government

Mischler, E. G. (1986). *Research interviewing: Context and narrative*. Cambridge, MA: Harvard University Press.

Mitra, S. (2006). The capability approach and disability. *Journal of Disability Policy Studies*, *16*, 236-247.

Mulvey, C. (2008). *Web accessibility of eGovernment websites.* Retrieved from http://www.comp.dit.ie/dgordon/Courses/ResearchMethods/AT-thesis1.pdf

Nabuzoka, D., & Rønning, J. A. (1997). Social acceptance of children with intellectual disabilities in an integrated school setting in Zambia: A pilot study. *International Journal of Disability, Development and Education*, *44*, 105-115.

National Federation of the Blind v. Amazon. (2007). Retrieved from http://www.dralegal.org/cases/private_business/nfb_v_amazon.php

National Federation of the Blind v. Law School Admissions Council. (2009). Retrieved from http://www.dralegal.org/cases/education_testing/nfb_v_lsac.php

National Federation of the Blind v. Target. (2007). Retrieved from http://www.dralegal.org/cases/private_business/nfb_v_target.php

Nelson, J. A. (1994). Broken images: Portrayals of those with disabilities in American media. In J. A. Nelson (Ed.), *The disabled, the media, and the information age* (pp. 1-24). Westport, CT: Greenwood.

Norden, M. F. (1994). *The cinema of isolation: A history of physical disabilities in the movies*. New Brunswick, NJ: Rutgers University Press.

Nussbaum, M. (1988). Nature, functioning and capability: Aristotle on political distribution. *Oxford Studies in Ancient Philosophy (Suppl), 6,* 145-184. Retrieved from http://www.wider.unu.edu/publications/working-papers/previous/en_GB/wp-31/_files/82530817633224741/default/WP31.pdf

Nussbaum, M. (1992). Human functioning and social justice: In defense of Aristotelian essentialism. *Political Theory*, *20*(2), 202-246.

Nussbaum, M. (1995). Human capabilities: Female human beings. In M. Nussbaum & J. Glover (Eds.), *Women, culture and development* (pp. 61-104). Oxford, England: Clarendon Press.

Nussbaum, M. (2002a). Capabilities and social justice. *International Studies Review*, *4*(2), 123-135.

Nussbaum, M. (2002b). *Beyond the social contract*. Cambridge, MA: The Belknap Press of Harvard University Press.

Nussbaum, M. (2003a). Capabilities as fundamental entitlements: Senior and social justice. *Feminist Economics*, *9*(2/3), 33-59.

Nussbaum, M. (2003b). Interview. *Ethics and Economics*, *1*(1). Retrieved from https://papyrus.bib.umontreal.ca/jspui/handle/1866/3293

Nussbaum, M. (2006). *Frontiers of justice: Disability, nationality, species membership*. Cambridge, MA: The Belknap Press of Harvard University Press.

Nussbaum, M. (2011). *Creating capabilities: The human development approach*. Cambridge, MA: The Belknap Press of Harvard University Press.

Ortner, D., Batusic, M., & Miesenberger, K. (2004). Postgraduate course on accessible web design. *Computers Helping People with Special Needs, 3118*, 183-186. Retrieved from http://www.springerlink.com/content/dtg8b0q7vpqlb4ha/

Ortner, D., & Miesenberger, K. (2005, August). *Improving web accessibility by providing higher education facilities for web designers and web developers following the design for all approach*. Paper Presented at the DEXA'05 conference, Copenhagen, Denmark.

Österreichiches Parlament. (2004). *E-Government-Gesetz*. Retrieved from http://www.parlament.gv.at/pls/portal/docs/page/PG/DE/XXII/BNR/BNR_00149/fname_014980.pdf

Patrick, D. L. (1996, September 9). *US Department of Justice Civil Rights Division - Letter - tal712*. Retrieved from http://www.scribd.com/doc/310866/US-Department-of-Justice-Civil-Rights-Division-Letter-tal712

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: Sage.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Persson, T., & Tabellini, G. (2006). Democracy and development: The devil in the details. *American Economic Review*, *96*, 319-324.

Ponterotto, J. G. (2006). Brief note on the origins, evolution, and meaning of the qualitative research concept "thick description." *The Qualitative Report*, *11*, 538-549.

Potok, A. (2002). *A matter of dignity: Changing the world of the disabled*. New York, NY: Bantam.

Rawls, J. (1971). *A theory of justice*. Oxford, England: Oxford University Press.

Rioux, M. H., & Valentine, F. (2006). Does theory matter? Exploring the nexus between disability, human rights, and public policy. In D. Pothier (Ed.), *Critical disability theory: Essays in philosophy, politics, policy, and law* (pp. 47-69). Vancouver, BC, Canada: UBC Press.

Robeyns, I. (2000). *An unworkable idea or a promising alternative? Sen's capability approach re-examined*. Retrieved from http://www.econ.kuleuven.be/ces/discussionpapers/default.htm

Rodrik, D., & Wacziarg, R. (2005). Do democratic transitions produce bad economic outcomes? *American Economic Review*, *95*, 50-56.

Roemer, J. (1996). *Theories of distributive justice*. Cambridge, MA: Harvard University Press.

Rosmaita, B. J. (2006a). Accessibility first! A new approach to web design. *Proceedings of the 37th SIGCSE technical symposium on computer science education* (pp. 270-274). Houston, TX: SIGCSE. Retrieved from http://doi.acm.org/10.1145/1121341.1121426

Rosmaita, B. J. (2006b). Accessibility now! Teaching accessible computing at the introductory level. *Proceedings of the 8th international ACM SIGACCESS conference on computers and accessibility* (pp. 277-278). Portland, OR: ACM SIGCSE. Retrieved from https://sslvpn01.gmu.edu/,DanaInfo=portal.acm.org+citation.cfm?id=1169053&dl=GUIDE&coll=GUIDE&CFID=8479662&CFTOKEN=77150294

Rosmaita, B. J. (2007). Making service learning accessible to computer scientists. *ACM SIGCSE Bulletin*, *39*, 541-545.

Rosmaita, B. J., Katherine, D., Cohen, R. F., & Egan, M. A. L. (2006). Accessibility and computer science education. *ACM SIGCSE Bulletin*, *38*, 63-64.

Rousseau, J.-J. (1762). *The social contract, or principles of political right*. Retrieved from http://etext.lib.virginia.edu/toc/modeng/public/RouSoci.html

Safran, S. P. (1998). The first century of disability portrayal in film: An analysis of the literature. *Journal of Special Education*, *31*, 467-479.

Sanders, J. R. (1981). Case study methodology: A critique. In W. W. Welsh (Ed.), *Case study methodology in educational evaluation* (pp. 41-49). Minneapolis, MN: Minnesota Research and Evaluation Center.

Sarno. (2012, February 29). Apple's market value tops $500 billion. *Los Angeles Times*. Retrieved from http://articles.latimes.com/2012/feb/29/business/la-fi-apple-value-20120301

Schiro, M. (2007). *Curriculum theory: Conflicting visions and enduring concerns*. Thousand Oaks, CA: Sage.

Schmetzke, A. (2001). Web accessibility at university libraries and library schools. *Library Hi Tech*, *19*(1), 35-49.

Sen, A. (1979). *Equality of what?* Retrieved from http://www.uv.es/~mperezs/intpoleco/Lecturcomp/Distribucion%20Crecimiento/Sen%20Equaliy%20of%20what.pdf.

Sen, A. (1984*). Rights and capabilities. Resources, Values and Development*. Cambridge, MA: Harvard University Press.

Sen, A. (1985a). *Commodities and capabilities*. Delhi, India: Oxford University Press.

Sen, A. (1985b). Well-being, agency and freedom. *The Journal of Philosophy*, *82*, 169-221.

Sen, A. (1987). The standard of living. In G. Hawthorn (Ed.), *The standard of living* (pp. 1-38). Cambridge, MA: Cambridge University Press.

Sen, A. (1988). The concept of development. In H. Chenery & T. N. Srinivasan (Eds.), *Handbook of development economics*. New York, NY: Elsevier.

Sen, A. (1992). *Inequality reexamined*. Oxford, England: Clarendon.

Sen, A. (1993). Capability and well-being. In M. Nussbaum & A. Sen (Eds.), *The quality of life* (pp. 30-53). Oxford, England: Clarendon.

Sen, A. (1995). Gender inequality and theories of justice. In M. Nussbaum & Glover (Eds.), *Women, culture and development: A study of human capabilities* (pp. 259-273). Oxford, England: Clarendon.

Sen, A. (1999). *Development as freedom*. Oxford, England: Oxford University Press.

Sen, A. (2009). *The idea of justice*. Cambridge, MA: The Belknap Press of Harvard University Press.

Shapiro, J. P. (1993). *No pity: People with disabilities forging a new civil rights movement*. New York, NY: Three Rivers.

Shenton, A. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, *22*, 63-75.

Shields, Boggs, and Stockton v. Disney, Case No. 10-cv-5810. (2011).

Sloan, D., Gregor, P., & Gibson, L. (2002). Auditing accessibility of UK higher education web sites. *Interacting with Computers*, *14*, 313-325.

Sloan, D., Nelson, B., & Sloan, M. (2007). How should inclusivity influence teaching of ICT design? *Annual Joint Conference Integrating Technology into Computer Science Education* (pp. 307-308). Dundee, Scotland: ACM. Retrieved from http://portal.acm.org/citation.cfm?id=1268873&dl=GUIDE&coll=GUIDE&CFID=8479662&CFTOKEN=77150294

Smith v. Hotels.com L.P. (2009). Superior Court of California, County of Alameda Case No. RG07327029.

Smith, S. E. (2010, August 19). No glee for disabled people. *The Guardian*. London, UK. Retrieved from http://www.guardian.co.uk/commentisfree/2010/aug/19/no-glee-for-disabled-people

Spector, M. J., Klein, J. D., Reiser, R. A., Sims, R. C., Grabowski, B. L., & de la Teja, I. (2006, April). *Competencies and standards for instructional design and educational technology*. Retrieved from http://www.ibstpi.org/Publications/pubsbymembers.htm

Standards. (n.d.).*International organization for standardization*. Retrieved from http://www.iso.org/iso/search.htm?qt=accessibility&searchSubmit=Search&sort=rel&type=simple&published=true

Standen, A. (2010). *Unfriendly skies? Blind passengers sue United*. Retrieved from http://www.npr.org/templates/story/story.php?storyId=130921227

Stone, M. L., Yu-Hsuan, E. L., & Mensching, L. M. (2010). *World digital media trends 2010*. Retrieved from http://www.wan-press.org/article18699.html

Sugden, R. (1993). Welfare, resources, and capabilities: A review of inequality reexamined by Amartya Sen. *Journal of Economic Literature*, *31*, 1947-1962.

Terzi, L. (2005). A capability perspective on impairment, disability and special needs: Towards social justice in education. *Theory & Research in Education*, *3*, 197-223.

Thatcher, J., Burks, M. R., Heilman, C., Lawton Henry, S., Kirkpatrick, A., Lauke, P. H., … Waddell, C.D. (2006). *Web accessibility: Web standards and regulatory compliance*. New York, NY: Apress.

Thompson, T., Burgstahler, S., & Comden, D. (2003). Research on web accessibility in higher education. *Information Technology & Disabilities*, *9*(2). Retrieved from http://people.rit.edu/easi/itd/itdv09n2/thompson.htm

Tollestrup, B. N. (2009). *Challenging normalcy? Masculinity and disability in murderball* (Master;s thesis). Retrieved from http://catspaw.its.queensu.ca/handle/1974/5150

Trani, J.-F., Bakhshi, P., Bellanca, N., Biggeri, M., & Marchetta, F. (2011). Disabilities through the capability approach lens: Implications for public policies. *European Journal of Disability Research*, *5*(3), 143-157.

Treviranus, J., McCathieNevile, C., Jacobs, I., & Richards, J. (Eds.). (2000). *Authoring tool accessibility guidelines 1.0. web accessibility initiative*. Retrieved from http://www.w3.org/TR/WAI-AUTOOLS/

Trulock, V. (2006). *A comparative investigation of the accessibility levels of Irish websites* (Master's thesis). Retrieved from http://www.iia.ie/filestore-orig/documents/resources/irishaccessibility.pdf

U.S. Access Board Section 508 of the Rehabilitation Act. , Pub. L. No. 36 CFR Part 1194 (2000). Retrieved from http://www.access-board.gov/sec508/standards.htm

U.S. Department of Justice. (n.d.). *Fact sheet: Advance notice of proposed rulemaking on accessibility of web information and services provided by entities covered by the ADA*. Retrieved from http://www.ada.gov/anprm2010/factsht_web_anrpm_2010.htm

U.S. Department of Labor. (1998). Section 504, Rehabilitation Act of 1973. Retrieved from http://www.dol.gov/oasam/regs/statutes/sec504.htm

Ulrich, L. T. (2007). *Well-behaved women seldom make history*. New York, NY: Vintage.

University of Linz. (2005). *Curriculum: Barrierefreies webdesign*. Retrieved from http://www.bfwd.at/curriculum.html

University of Linz. (n.d.). *Barrierefreies webdesign*. Retrieved from http://www.bfwd.at/

Wald, M. (2008). Design of a 10 credit masters level assistive technologies and universal design module. *Computers Helping People with Special Needs*: *Lecture Notes in Computer Science, 5105*, 190-193. Retrieved from http://www.springerlink.com/content/07uk19m8225m0102/

Wall, S. L. (2007). *Newspaper coverage of people with disabilities: A New Zealand perspective* (Master's thesis). Retrieved from http://researchcommons.waikato.ac.nz/bitstream/handle/10289/2402/thesis.pdf.txt?sequence=2

WebAIM. (n.d.). *United States laws: Overview of the Americans with Disabilities Act (ADA)*. Retrieved from http://webaim.org/articles/laws/usa/ada

WebAIM. (2006a). *Experiences of students with disabilities*. Retrieved from http://webaim.org/intro/#video

WebAIM. (2006b). *Keeping web accessibility in mind*. Retrieved from http://webaim.org/intro/#video

Wheelchair Dancer: Glee. (2009).*Wheelchair dancer*. Retrieved from http://cripwheels. blogspot.com/2009/11/glee.html

Whitney, G., & Keith, S. (2008). european developments in the design and implementation of training for einclusion. *Computers Helping People with Special Needs: Lecture Notes in Computer Science, 5105*, 156-161. Retrieved from https://sslvpn01.gmu.edu/content/n0398113565670l2/,DanaInfo=www. springerlink.com+?p=f860e1b148974fee9f747c510de579e4&pi=20

Whitney, G., & Keith, S. (2011). *MSc digital inclusion*. Retrieved from http://www.play. mdx.ac.uk/videos/hiio

Whitney, G., Keith, S., Bühler, C., Hewer, S., Lhotska, L., Miesenberger, K., … Velasco, C. A. (2011). Twenty five years of training and education in ICT Design for All and Assistive Technology. *Technology and Disability*, *23*(3), 163-170.

Whitney, G., Keith, S., & Schmidt-Belz, B. (2010). The challenge of mainstreaming ICT design for all. *Proceedings of the 12th International Conference on Computers Helping People with Special Needs: Part I* (pp.  583-590). Berlin, Germany: Springer-Verlag.

World Association of Newspapers. (2008). *World digital media trends report*. Retrieved from http://www.wan-ifra.org/reports/2008/05/07/world-digital-media-trends-2008-0

World Audit. (2012). *Press freedom*. Retrieved from http://www.worldaudit.org/ press.htm

Yao, D., Qui, Y., Du, Z., Ma, J., & Huang, H. (2009). A survey of technology accessibility problems faced by older users in China. *Proceedings of the 2009 International Cross-Disciplinary Conference on Web Accessibility (W4A)* (pp. 16-25). New York, NY: ACM. Retrieved from http://portal.acm.org/citation.cfm?id= 1535659&CFID=9691509&CFTOKEN=86044746

Yeo, R. (2001). *Chronic poverty and disability*. Somerset, England: Chronic Poverty Research Centre.

Yeo, R., & Moore, K. (2003). Including disabled people in poverty reduction work: nothing about us. without us. *World Development*, *31*, 571-590.

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks, CA: Sage.

Zuga, K. F. (1992). Social reconstruction curriculum and technology education. *Journal of Technology Education*, *3*(2), 48-58.

# APPENDICES

# Appendix A

## Acronyms and Abbreviations

Table A1

*Acronyms and Abbreviations*

| Acronym/abbreviation | Explanation |
|---|---|
| AAATE | Association for the Advancement of Assistive Technology in Europe |
| ADA | Americans with Disabilities Act (legislation in the United States) |
| AECT | The Association for Education Communications and Technology (a professional organization in the United States for education and instructional technology) |
| AJAX | Asynchronous JavaScript and XML (a group of interrelated technologies used to provide dynamic interaction within web content) |
| ANEC | European Association for the Co-ordination of Consumer Representation in Standardization |
| AT | 1) Assistive Technology *OR*<br>2) The Assistive Technology concentration in George Mason University's master's degree program in Curriculum and Instruction |
| BCS | British Computer Society |
| BfWD or BFWD | Barrier-free Web Design (or *Barrierefreies Webdesign* in German) |
| CEHD | College of Education and Human Development (an academic unit at George Mason University) |
| CSS | Cascading Style Sheets (a technology used to add styling—colors, positioning, background images, etc.—to web designs) |
| DATSCG | Design for All And Assistive Technologies Standardization Coordination Group |
| DDA | Disability Discrmination Act of 1995 (in the UK) |
| ECTS | European Credit Transfer System |
| EDeAN | European Design for All eAccessibility Network |
| EDF | European Disability Forum |
| EDIT | Education - Instructional Technology (An abbreviation in the course catalog at George Mason University, e.g., EDIT 526) |
| EDSE | Education—Special Education (An abbreviation in the course catalog at George Mason University, e.g., EDSE 526) |
| FTP | File Transfer Protocol (a method of transferring files, such as web pages, to and from a web server) |
| GMU | George Mason University |
| HCI | Human-Computer Interaction |
| HTML | HyperText Markup Language (the most common text-based technology used to create web content) |

(*table continues*)

| Acronym/abbreviation | Explanation |
|---|---|
| IASP | Assistive and Special Education Technology Program (an academic concentration at George Mason University; also known as the Assistive Technology program, or AT program) |
| IBSTPI | International Board of Standards for Training, Performance, and Instruction (a professional organization for training and instructional technology) |
| ICCHP | International Conference on Computers Helping People with Special Needs |
| ICC | International Computer Camps for Blind and Partially Sighted Students |
| iCITA | Illinois Center for Information Technology and Web Accessibiltiy |
| ICT | Information and Communication Technologies |
| IDD | Instructional Design and Development (a concentration in George Mason University's master's degree program in Curriculum and Instruction) |
| ISTE | International Society for Technology in Education (professional organization for technology and education) |
| Linz | *short for* University of Linz |
| LTDR | Learning Technologies Design Research (a PhD program at George Mason University) |
| Mason | *short for* George Mason University |
| MSc or MS | Master of Science degree |
| NCATE | National Council for Accreditation of Teacher Education (an accrediting body in the United States for teacher education programs) |
| PDF | PostScript Document Format (a WYSIWIG document formatting technology) |
| PWD | People with Disabilities |
| RNIB | Royal National Institute of Blind People |
| SACS | Southern Association of Colleges and Schools (an accreditation agency for 11 states in the United States) |
| Section 508 | Section 508 of the Rehabilitation Act of 1973 |
| SITE | Society for Information Technology and Teacher Education (professional organization in the United States for education and technology) |
| T/TAC | Training and Technical Assistance Center (in reference to a network of assistance centers in the US state of Virginia designed to improve educational opportunities for K12 students with disabilities) |
| W3C | World Wide Web Consortium |
| W4A | International Cross-Disciplinary Conference on Web Accessibility |
| WAI | Web Accessibility Initiative (a subgroup/sub-project of the W3C) |
| WAI-ARIA | Web Accessibility Initiative - Accessible Rich Internet Applications (a technical specification of the W3C, specifying ways to increase the accessibility of web content, especially dynamic, or interactive components) |
| WCAG | Web Content Accessibility Guidelines |

(*table continues*)

| Acronym/abbreviation | Explanation |
| --- | --- |
| WebAIM | *short for* Web Accessibility in Mind (an initiative at Utah State University focusing on making the web accessible to people with disabilities) |
| WYSIWYG | “What You See Is What You Get”, an approach to programming and design where as little as possible is hidden. |
| XML | eXtensible Markup Language (a meta-language used to tag and organize text-based documents according to their content and data) |

Appendix B

Programs That Teach Accessibility

**PROGRAMS THAT TEACH ACCESSIBILITY**

Tables B1-B8 are of programs that teach accessibility in the curriculum was generated by a combination of web searches and posts on accessibility-related discussion forums (e.g., the WebAIM listserv http://webaim.org/discussion/). Searches were conducted with various combinations of the following terms and phrases: web accessibility curriculum, web accessibility classes, ICT accessibility, digital inclusion, masters accessibility, bachelor accessibility, accessibility certificate, accessibility degree, accessibility class, computer science accessibility, accessibility workshop, web design accessibility, teaching accessibility, accessibility syllabus, and accessibility specialization. This list is undoubtedly incomplete, but it represents a good faith effort to produce a preliminary survey of classes and programs with any mention of accessibility in the curriculum or syllabi of ICT programs. In order to make this list more complete and accurate, it would be necessary to contact key individuals at academic institutions and within accessibility-related professional organizations to enlist their assistance in identifying instances within the curriculum. A detailed survey of European institutions (Keith et al., 2009; Whitney et al., 2011; Whitney & Keith, 2008) produced a list of fifty instances of design-for-all in the curriculum, but many of these instances were only one-time lectures or were part of optional or occasional classes, so they did not meet the criteria for inclusion in this list. In some cases, the published information was ambiguous as to how much was taught, or whether the course was required. A future in-depth study could help clarify this ambiguity and lead to a more complete list of courses that address accessibility and design-for-all.

Table B1

*Academic Degree Programs That Specialize in Accessibility*

| Degree title | Accessibility credit hours | Notes |
|---|---|---|
| Digital Inclusion Masters<br>Middlesex University, London, UK<br>http://www.mdx.ac.uk/courses/postgraduate/computing_and_it/digital_inclusion_msc.aspx | Entire program | This program is included in this study. |
| Master of Design in Inclusive Design<br>Ontario College of Art and Design, Ontario, Canada<br>http://idrc.ocad.ca/index.php/workshops-aamp-trainings/masters-program | Entire program | Although relevant to this study, this program was not included due to logistical scheduling challenges |
| Universal Design of ICT Master's Degree<br>Oslo and Akershus University College of Applied Sciences, Oslo, Norway<br>http://www.hioa.no/eng/Programmes/Master-programmes | Entire program | This program meets all of the criteria for inclusion in this study, except that it does not begin until Fall of 2012. |

Table B2

*Academic Degree Programs That Require a Class in Accessibility (but do not Specialize in Accessibility)*

| Degree title | Accessibility credit hours | Notes |
|---|---|---|
| Instructional Technology George Mason University, Fairfax, VA, USA http://it.gse.gmu.edu/ | 3 | This program is included in this study. |
| MS Web Sciences, University of Linz, Linz, Austria http://www.jku.at/content/e262/e242/e2666/e104207/ | Integrated throughout, plus there are some required classes on accessibility | This program is included in this study. |
| Postgraduate Computer Science, University of Crete, Crete, Greece | One class | The class “Advanced Topics in Human-Computer Interaction” is mainly about design-for-all, “touching upon many related topics such as user-centered design, e-accessibility, universal design principles, adaptive interfaces, alternative interaction techniques, evaluation methods, examples of good practice, design for older users, design for children, design for cognitive impairments and Ambient Intelligence environments” (Whitney et al., 2011). Note: It is unclear whether this is a required or optional class in the sources describing this class. |
| BS Computer Science Oslo and Akershus University College of Applied Sciences, Oslo, Norway | 10 | “A 10 ECTS course called Universal Design, has been offered since 2008 with a focus on the universal design in ICT specifically. It is a compulsory module for all undergraduate students studying applied computer science” (Whitney et al., 2011) |

Table B3

*Academic Degree Programs That Teach Accessibility as an Integrated Component of Many Required Classes (in a Program that does not Specialize in Accessibility)*

| Program information | Accessibility credit hours | Notes |
|---|---|---|
| Master of Human-Computer Interaction,<br>Dundee University,<br>Dundee Scotland,<br>http://www.computing.dundee.ac.uk/internal/fullguide.asp?AC52003 | Integrated throughout the curriculum | |
| Title: Web Sciences<br>Institution: University of Linz<br>Location: Linz Austria<br>Web site:<br>http://www.jku.at/content/e262/e242/e2666/e104207/ | Integrated throughout, plus there are some required classes on accessibility | This program is included in this study. This program represents a change in focus from accessibility-only (in the former Barrier-Free Webdesign program) to accessibility-also (in the current program) |

Table B4

*Academic Degree Programs That Offer Elective Classes in Accessibility*

| Program information | Accessibility credit hours | Notes |
|---|---|---|
| Computer Science<br>University of Illinois at Champaign-Urbana<br>http://formsonline.cita.illinois.edu/contact.php | 3 | Classes are taught on an occasional basis. The topic varies. Past topics have included accessible HTML forms, Web 2.0 accessibility, WAI-ARIA, and others. |
| Media Technologies/Web Technology Concentration—Bachelor<br>Pellissippi State Community College, Knoxville, TN, USA<br>http://www.pstcc.edu/catalog/catalog.pdf | 3 | The class “Accessible Web Design and Compliance” is an elective |

Table B5

*Academic Certificate Programs Specializing in Accessibility*

| Certificate title | Accessibility credit hours | Notes |
| --- | --- | --- |
| (Barrier-Free Web Design)—Discontinued<br>(University of Linz, Linz Austria) | | (Discontinued in 2007; the program can be taught again by special request if a minimum of 9 students enroll) This program was much more intense than the other certificates listed here. It was a 2 year program equivalent to a master level degree in terms of the coursework, but without the degree. The accessibility component is being incorporated into a new degree program called "Web Sciences") |
| Web Usability and Accessibility Certificate<br>Georgia Tech, Atlanta, GA, USA<br>http://www.pe.gatech.edu/information-technology-computing/certificates/web-usability-and-accessibility | Unclear; at least .65 credit hours | Offered by special request |
| Accessible Web Design and Compliance Certificate<br>Harper College, Palatine, IL, USA<br>http://dept.harpercollege.edu/cis/certificates/awdc.html | 3 | Certificate is two classes: "Web Development I" and "Web Accessibility" |
| Understanding Web Accessibility (? Unclear)<br>University of Toronto, in collaboration with Accessibility Directorate of Ontario (ADO), Cantor Access Inc, and Vubiz Inc.<br>http://atutor.ca/services/courses.php | unclear | Four-week online course |
| Certificate in Accessible Information Technology<br>EASI and the University of Southern Maine<br>http://easi.cc/workshop.htm | | 5 courses about accessibility, each 4 weeks long, can be taken separately or as part of a certificate program. Classes are: 1) "Barrier-Free Web Design," 2) "Barrier-Free Information Technology," 3) "Barrier-Free E-Learning," 4) "Accessible Internet Multimedia: Podcasts, Vodcasts, and Streaming," 5) "Creating and Repurposing More Accessible Content". Also: "Train the Trainer" |
| Accessible Web Design and Compliance<br>Pellissippi State Community College, Knoxville, TN, USA<br>http://www.pstcc.edu/catalog/newcertificates.pdf | 3 credit hours | 4 semester-based courses are required (12 credit hours total); one is devoted entirely to "Accessible Web Design and Compliance" |

Table B6

*Academic Certificate Programs That Require a Class About Accessibility (But do not Specialize in Accessibility)*

| Certificate title | Accessibility credit hours | Notes |
|---|---|---|
| The Web: Mastering the Major Components Certificate<br>Georgia Tech, Atlanta, GA, USA<br>http://www.pe.gatech.edu/information-technology-computing/certificates/web-mastering-major-components | | Offered by special request; The web accessibility component is a one-day workshop |
| Web I<br>University of Wisconsin<br>http://www.doit.wisc.edu/training/stt/Certification.aspx?id=18&day=33 | none | This is a two week program covering a broad range of web design skills; |

Table B7

*Academic Certificate Programs That Offer an Optional Class About Accessibility*

| Certificate title | Accessibility credit hours | Notes |
|---|---|---|
| Workplace Accommodations and Home Modifications Certificate<br>Georgia Tech., Atlanta, GA, USA, Center for Assistive Technology and Environmental Access (CATEA)<br>http://www.pe.gatech.edu/assistive-technology/assistive-technology-certificates/workplace-accommodations | .66 Continuing education credits | This is a one-day course. Learners can take just the web accessibility class, without taking the other classes in the certificate program |
| Webmaster Certification<br>Austin Community College<br>http://www.austincc.edu/webcert/course_catalog.html#access1 | 12 classroom hours (not credit hours) | Two courses are offered: 1) “Web Accessibility (Beginning)” and 2) “Web Accessibility (Advanced)” |

Table B8

*Nonacademic Classes in Accessibility*

| Certificate title | Accessibility credit hours | Notes |
|---|---|---|
| Essentials of Web Accessibility<br>IBM<br>http://www-304.ibm.com/jct03001c/services/learning/ites.wss/us/en?pageType=course_description&courseCode=RT305 | none | Class lasts 2.5 hours |
| Web Design for Accessibility<br>Brainbench<br>http://www.brainbench.com/xml/bb/common/testcenter/taketest.xml?testId=488 | none | Self-paced online course with a final exam |
| Web Accessibility Workshop<br>International Webmasters Association<br>http://www.hwg.org/services/classes/accessibilitytechniques.html | 3 CEUs | It is unclear if this class is still being offered or not |

# Appendix C

## Mapping the Cases to the Selection Criteria

Table C1

*Mapping the Cases to the Selection Criteria*

| | University of Linz | | | | |
|---|---|---|---|---|---|
| Selection criteria | Barrier-free Web Design | *web_access* curriculum | Web sciences program | George Mason University: Instructional Technology Program | Middlesex University: Digital Inclusion Program |
| 1. Does the program provide specialized semester-based classes in how to create accessible digital technologies for all? | Yes. The entire program teaches web accessibility | Yes. All of the curriculum focuses on web accessibility | Yes. Web accessibility is integrated throughout the curriculum. | Yes. They offer a 3-credit course called Web Accessibility and Design. | Yes. The entire program specializes in accessibility and design-for-all. |
| 2. Is the accessibility and design-for-all training part of an academic degree-granting program? | No. It was part of a 2-year academic certificate | No. The curriculum, by itself, is not an academic program, but the materials were developed so they could be used by academic programs. | Yes. They offer a master's degree in Web Sciences. | Yes. They offer a master's degree in Curriculum and Instruction. Students choose between the three areas of concentration (IDD, AT, or ITS). | Yes. They offer a master's degree in Digital Inclusion. |
| 3. Is the training in accessibility and design-for-all a core, required, part of the curriculum? | Yes. All of the classes taught about web accessibility | | Yes. All students must take classes that teach web accessibility. | Yes. The 3-credit class in Web Accessibility and Design is required for all master's degree students in the Instructional Design and Development concentration (as well as in the nondegree E-Learning certificate), and is one of four core options in the Assistive Technology concentration. | Yes. All of the required courses teach some aspect of accessibility or design-for-all |
| 4. Is the program currently running? | No. The program ran from 2005-2007 | No. It was never an academic program. It was a curriculum development initiative. It began in 2007 | Yes. The program began in the fall of 2011 | Yes. The web accessibility component was first taught in 2004, and was integrated into the program as a required class in 2005 | Yes. The program began in 2010. |
| 5. Are the curriculum materials available in English? | No. They were written in German | Yes. | Yes. Materials are available in English and German. | Yes. | Yes. |
| 6. Conclusion: Does the program qualify for inclusion in this study? | No. It does not qualify by itself, but it is an important part of the history leading up to the Web Sciences program, which does qualify. | No. It does not qualify by itself, but it is an important part of the history leading up to the Web Sciences program, which does qualify. | Yes. | Yes. | Yes. |

**Additional Selection Criteria:**

1. Represent a diversity of nationalities
2. Represent a diversity of approaches and/or academic discipline

# Appendix D

## Original Qualitative Software Codes vs. Final Codes

**The Original Codes that I Created Before Beginning the Data Analysis:**

II. Research Question 1: How did the *context* (laws, institutional policies or conditions, faculty expertise, etc.) contribute to the development of the curriculum?
  A. Laws
    1. USA
      a. Section 508
      b. ADA
      c. Section 504
    2. UK
    3. Austria
  B. Standards
    1. WCAG, W3C
  C. Accreditation
  D. Culture
  E. Professional workforce expectations
  F. Disability activism

III. Research Question 2: Why did the faculty integrate accessibility into the curriculum (what was their *rationale*)?
  A. The desired societal impact
    1. Increase the quality of life for people with disabilities
    2. Change attitudes toward people with disabilities
  B. The desired university impact
  C. The desired student outcomes
    1. Inclusive design skills
    2. Accessibility remediation
    3. Research skills
    4. Policy and leadership
    5. Standards/Legal compliance
    6. Knowledge of disability types
      a. Motor disabilities
      b. Deafness
      c. Seizure disorders
      d. Low vision
      e. Cognitive disabilities
      f. Blindness
    7. Technologies
      a. Video
      b. HTML (interactive)
      c. HTML (static)
      d. Word and Office Suite
      e. CSS
    8. Technical mastery

9. Accessibility testing
10. Awareness
11. Using assistive technologies

D. Meet workforce demand

IV. Research Question 3: How did the process of creating the curriculum unfold (including any successes or setbacks along the way)?

A. The initial idea
B. Getting approval
C. Creating the materials

V. Research Question 4: What choices did the faculty make about *instructional materials and strategies* (instructional media, topics covered, target audience, instructional methods, etc.)?

A. Dialogic processes
B. Instructional Materials
   1. Books
   2. Web sites
C. Assessments
   1. Discussion participation
   2. Skill tests
   3. Essays and reports
   4. Creative projects
   5. Portfolios
   6. Thesis
   7. Multiple choice tests

VI. Theoretical analysis with the capabilities approach

A. Central capabilities
   1. Bodily Health
   2. Senses, imagination, and thought
   3. Practical reason
   4. Life
   5. Play
   6. Reciprocity, Interdependence, and Shared Responsibility
   7. Sustainability
      a. Political
      b. Environmental
   8. Disparity
      a. Structural
      b. Interpersonal
   9. Other species
   10. Bodily Integrity
   11. Emotions
   12. Control over one's environment
      a. Political
      b. Material

13. Affiliation

B. Basic capabilities
C. Combined capabilities
D. Capability security
E. Agency
F. Functionings
G. Curriculum Theory

**The Final Codes After Finishing the Data Analysis**

I. Theme 1: Curriculum Goals and Rationale
   A. The absence of external mandates, directives, or pressure
   B. Transforming society to make it more accessible and inclusive
      1. Change attitudes toward people with disabilities
      2. Increase quality of life for people with disabilities
   C. Meeting the demands of the job market
   D. Infusing accessibility and digital inclusion everywhere
   E. Raising the bar in the accessibility field, academically and professionally
   F. Increase employment opportunities for people with disabilities
II. Theme 2: The initial idea, getting the ball rolling
   A. Synergy with existing disability programs
   B. Championing the cause
   C. Leveraging professional relationships and networks
   D. Involving people with disabilities in the design process
   E. Learning from other curriculum models
   F. The up-front development time, effort
   G. Internal review and approval process
   H. External accreditation and validation
III. Theme 3: Defining the scope of the curriculum
   A. The relevant academic disciplines
      1. Intended audience
   B. Depth and breadth of the curriculum
      1. Required for all vs. optional
      2. Disability-specific vs. ALL ICT curricula
      3. Type of credential to offer
         a. Academic vs. nonacademic
         b. Length of program
      4. Internal collaboration, interdisciplinary degrees
      5. External collaboration and joint degrees
IV. Theme 4: Instructional materials and strategies
   A. Sparking interest/motivation
      1. People or fellow students with disabilities
   B. Topics
      1. Knowledge of disability types
         a. Motor disabilities
         b. Deafness
         c. Seizure disorders
         d. Low vision
         e. Cognitive disabilities
         f. Blindness
      2. Interacting with instructors and others with disabilities

        3. Focus groups, user testing, surveys
        4. Usability, fitness for purpose
        5. Accessibility testing
        6. Using assistive technologies
        7. Awareness
        8. Broad inclusive design (aging, rural, etc)
        9. Accessibility remediation
        10. Policy and leadership
        11. Research skills
        12. Standards/legal compliance
        13. Technical mastery
        14. Technologies
            a. Video
            b. HTML (interactive)
            c. HTML (static)
            d. Word and Office Suite
            e. CSS
            f. CMSs, blogs, etc
            g. PDF
            h. Flash
    C. Assessment methods
        1. Usability/fitness for purpose planning
        2. Accessibility evaluation of a web site
        3. Planning and commissioning
        4. Creative project
        5. Multiple choice tests
        6. Discussion participation
        7. Essays and reports
        8. Portfolios
        9. Skills tests
        10. Thesis
    D. Accommodating different levels of technical expertise in students
    E. Specific instructional materials chosen by instructors
        1. Books
        2. Web sites
V. Theme 5: Instructional format and media
    A. Blended online and face to face
    B. Effective instructional delivery mode of instructional design
    C. Making the curriculum itself accessible
    D. Media/platform choices and instructors with disabilities
VI. Theme 6: Program Sustainability
    A. External influences and conditions
        1. Perceived liability
        2. Laws, policies, standards

- B. Teach more people less
- C. Job markets and career paths
  1. Broadening the appeal to international audiences and larger geographical boundaries
- D. Follow the money: grants, endowments and industry partnerships
- E. Champions of the cause
- F. Institutional commitment
- G. Opportunity cost to students (money and time)
- H. Marketing to potential students
- I. Achieving critical mass
- J. Why the barrier free program was discontinued

VII. Capabilities approach
- A. Basic capabilities
- B. Internal capabilities
- C. Combined capabilities
- D. Central capabilities
  1. Life
  2. Bodily health
  3. Bodily integrity
  4. Senses, imagination, and thought
  5. Emotions
  6. Practical reason
  7. Afficilation
  8. Play
  9. Control over one's environment
     - a. Political
     - b. Material
  10. Reciprocity, interdependence, and shared responsibility
      - a. Disparity
        - a. Interpersonal
        - b. Structural
      - b. Other species
      - c. Sustainability
        - a. Environmental
        - b. Political
  11. Functionings
  12. Capability security
  13. Agency

VIII. Curriculum theory

# Appendix E

## Bracketing Interview

## Bracketing Interview

Before beginning the research for this dissertation, my advisor asked me to have someone else conduct a bracketing interview with me. The purpose of the interview was to help me talk through the purpose of my study and explain it to someone who was unfamiliar not only with my study, but with the field of accessibility and design-for-all in general. My advisor wanted me to talk through potential biases that I would bring to the study and try to make sure I would account for them as I wrote the dissertation. Here is a transcript of that bracketing interview, conducted by another doctoral student named Mark Mason.

Mark: So tell me about your research interest; what it is you're going to do.

Paul: Well, the topic is accessibility of information and communications technology (ICT) resources. It's the same thing that I've been teaching at GMU here in the DC area, and I'm looking at the curriculum of ICT programs in universities: programs that have begun to teach accessibility as a part of their curriculum, to use them as case studies, so that other programs that don't yet teach accessibility as a part of their curriculum can look to them...not necessarily as examples, but can see what they've done, and if the model fits, then they can adapt it to their own needs. I'll be looking at 4 different programs, 4 different cases. One of them is a computer science program at the University of Illinois, Champaign-Urbana, and another one is the one that I teach at. It's George Mason University, and that's where possible bias is going to come in. The one at George Mason is instructional technology. Then I've got two more. One of them is at Middlesex University in the UK. Theirs is a masters degree called Digital Inclusion, so their whole purpose is accessibility. Then there's a third one at the University of Linz in Austria. They're in a transition. They used to have a program like the one in the UK, where they were dedicated entirely to accessibility, but they're transitioning away from that model, and going to a program which they're calling Web Sciences, so it's going to basically be a web design degree, and they're going to incorporate accessibility into it. So they're four different examples. Two in the U.S., and two in Europe, and four different approaches, and four different types of programs, so you've got computer science, instructional technology, digital inclusion, and web design. It's a diverse group and I'm not trying to match these. It's not like a matched pairing of any kind. The whole reason I'm choosing these four is because of their uniqueness.

Mark: Getting a broad look at the same problem, but just four different contexts.

Paul: Right. That was one of the things that one of my committee members didn't quite get at first, with my first version of my proposal. She kept insisting that these programs were too different, and I kept saying, yes, I know, that's why I chose them! I guess I should say that programs that have incorporated accessibility into the curriculum and made it a requirement are very few. There are some programs that teach accessibility as a unit within a web design class, or they talk about it briefly in a presentation, or they might have in-service-type workshops at the university for the employees of the university, so they can make the university web site accessible—that sort of thing—but it's pretty rare for a program to incorporated into its curriculum…

Mark: The problem that you're addressing is: we do have information available to us to help us create this kind of curriculum, but it's under-utilized.

Paul: Yeah, that's one way of putting it. They've had guidelines in place for over ten years from the World Wide Web Consortium, the group that kind of runs the standards for HTML and other technologies for the web. And they've had laws in place in the U.S. for federal government, requiring that web sites be accessible, for example, and other technologies, for almost as long: for about ten years. And there are laws in Europe as well and throughout the world. But what's lagging behind is the training and education. Almost everyone who learns it, learns it on the job or on their own, with the exception of these few programs that are out there.

Mark: I'm still having a hard time seeing what you're trying to create. Are you trying to create instruction or identify why it isn't happening? What's the angle you're taking on the problem?

Paul: Yeah, I haven't really talked about that yet. I'm taking these four programs and viewing them all as individual case studies on their own merits. So I'm going to look at the history: what led to the decision to incorporate accessibility into the curriculum, what materials they decided to use, whether they decided to make ...You know, one university designs a whole degree around it. Others, like George Mason has one class that's required for instructional technology students. Another, the University of Illinois has an optional class in computer science, but it's really in depth. I'm basically trying to look at the thinking, the intentions, the goals that they had in mind, and the process that they went through to come to the decisions that they put into place. In a way, it's kind of building a history of the program and their decision to incorporate accessibility into it. Why they did it, how they did it, what hurdles they had to overcome, and their thinking along the way.

Mark: So you're creating the moment of seeing what happened and more or less revealing the problem, is...what? That's where I'm stuck. And that, I think, has probably been the hardest part for me. I've read a billion things about what I'm studying, but then narrowing it down to saying, "here's what I'm doing, in a focused way...it's tough."

Paul: Yeah, it is. Well, it's like I was saying—and you actually put it pretty well yourself—that there are all these resources out there on how to make technology accessible, and yet it's not being taught at the curriculum level, so I guess you could ask why is it not being taught there? But I'm not really asking why it's not being taught in places that I'm not studying. What I'm asking is why *is it* being taught in the places that are teaching it, kind of as a backwards way of answering the question of why is it not being taught where it could be.

Mark: Yeah, showing what it is that they're using it for. That's interesting, because you and I then have a lot in common in what we're researching and the way that we're revealing something. And I can see why phenomenology would actually benefit you tremendously because of the role of what it does. I don't know if you've looked at phenomenology at all, but it's intertwined as an interpretive device in a lot of research, where people will take, for instance, your four cases, and looking at it from the perspective of people who are trying to use this instruction and understand the meaning of why they are, and then being able to interpret that to help people see why they aren't. What I've learned about it that's really opened my eyes is that—you and I have probably both had a similar experience where we've read something, and because of someone else's perspective, it challenged us to look at our own perspective, and then we began to self-evaluate: well, why don't I do that? Or why do I do that? Or why would I reject that? Or why would I accept it as a proposition? That's what phenomenology is all about. It's someone being confronted with another person's experience or something in a way that engages them, where they go, "oh, I never even considered that before, and I need to think about that." So anyway, I don't know if that helps you at all in speaking about your problem, but if you do end up going that route, I can definitely send you a couple of resources that I found just recently that have really helped me to see how to look at solving that kind of problem.

Paul: That could be helpful, and I know that Dr. Eastmond is a big fan of phenomenology and he's mentioned it a couple of times. I really haven't identified that as my main framework that I'm viewing things through, but who knows, maybe the committee will come back to me and say that's what I need to do anyway. But if you could forward those, that would be helpful.

Mark: Even if you read them and say, "oh, ok, I can see why he would see how that relates." So, as far as bias goes...I assume you're going to interview, or are you just reading what's been done by them in their curriculum...are you analyzing their curriculum? How are you collecting data?

Paul: I'm going to do interviews of faculty at the programs, and I'm also going to include the syllabi of the courses if they have those available. I'm going to include the program of study, especially for the programs that are dedicated entirely to accessibility...So, documents like that, and the descriptions of the programs on the web. Some of them have written scholarly papers, or at least conference papers, to kind of brag about them a little bit, and they provide information about them, and a little bit of their own logic and reasoning in those papers, so I'll draw on that as a resource. Not all of them have that, but for the ones that do, it makes sense to include that.

Mark: So those are some of your data sources. Those interviews are going to become your opportunity to validate what you've found in their biographies, their vitae, their portfolio. Because you're analyzing the description of their programs. You're going to get your own perception of them, right? Based on: here's your scholarly writing, here's your description on your web site; here's your syllabus. And you're going to have all that in front of you. Are you going to interview them before or after you read all of that?

Paul: I've already read most of it so...

Mark: Ok. So that's probably going to be your one challenge right there. You have your perspective that you've been studying about their program. You've obviously spent a lot of time reading about this issue yourself, and then you've read what they do. You know me, I'd be formulating opinions about them, right then and there, as I was reading, and then when I go into my interview, it would be hard to not want to validate what I'd already read.

Paul: True.

Mark: So that would be a moment where you'd have to suspend all of that reading and just let them reveal the way they see it. Otherwise, you're going to put your interpretation into the data, which is what you want to do *after* you've interviewed them. You want to get the information from their perspective, and not tainted by your reading of their perspective. Because at the end, you're going to put yours in there anyway. You've got to make sure that they're telling you what *they* think first, so you don't interject what you think. Does that make sense?

Paul: Yeah, it does. One thing that I'm aware of that would *not* be helpful would be to say: here's my version of how I think it should be done…

Mark: Right, like, “I’ve told you what I think, how do you see it?”

Paul: My end goal is not to present any one way of doing it. If I end up with the four case studies and end up saying, “here are four equally valid ways of approaching the same problem, and I don’t have any recommendations as to which to choose,” I’m ok with that, because I think all of those four approaches can be valuable in certain circumstances. So yes, I’m aware that I could inject some bias or some preferences into how I think the end product should look, but at the same time, I’m not sure that there even is such an ideal end product that I would encourage anyone to shoot for...other than I would hope that other programs would include accessibility *somehow*, and that they would not just do it as a token exercise, like just mentioning once during a ten minute section of one class and move on to something else, but to actually engage the students and design an assignment around it, and make it an actual part of their study, and not just “oh yeah, there’s this thing called accessibility, but don’t worry about that.” But in terms of how they incorporate it into the curriculum, I don’t think I have a “one right answer” because I don’t think there is one. But yeah, I will have to be aware of how I approach the questions when doing the interviews.

Mark: Well it sounds really interesting. I think I can see, definitely, the value of what you’re doing. I mean, I don’t know. I’ve never done an interview like this. I’m thinking, maybe as devil’s advocate for a moment, and saying...I know this is going to sound absolutely ludicrous, but I’m going to say it so it’s said. There’s an automatic assumption that you have that the world needs this kind of instruction.

Paul: Right.

Mark: And it’s almost at risk of validating it before you have collected your data. And I don’t know if this is really an issue or not. But the thought of “we shouldn’t just make it as a token ‘hey this is what we should do’” almost sounds like you know the way they have approached it isn’t the right way. And yet you assume that there is no right way. I know that sounds a little odd, but that’s kind of what I hear coming through, a little bit. If there is no one right way to approach this, and yet one group is approaching it a certain way, which is to pay only a token gesture to it, it assumes that way isn’t the right way. So then there must be a right way. So if we can eliminate one possibility, why can’t we eliminate others too? There’s obviously in your mind some judgment criteria for what is and isn’t acceptable, based on what you’ve been saying so far. I don’t think that’s wrong, but I think up front you’re going to have to address that bias, even if it’s a good bias. Because it isn’t necessarily that bias is always bad. But it seems to be completely open to the reader. They need to know in their minds that that bias exists, and you need to be aware of it too, because if we’re going to be honest about it, we all face issues like this, and we all want to act like we do the right thing. Because nobody wants to be the one that has the finger pointed at them and everyone goes “oh! You’re the one that ignores people with disabilities! What kind of a loser are you?"

Paul: Right.

Mark: You know what I mean? Nobody wants that stigma. But the reality is if we didn't do it, you wouldn't have a dissertation. So there's got to be people out there who think they're doing a good job, but who aren't. And maybe it's because they haven't looked at that particular bias that we're talking about right now. They're ignoring it because they think they're doing the right thing. Somehow that's got to come out. I teach, myself, and I just had three students in my class: one who is in a wheelchair, and can do nothing for himself at all. He can say a few words. There's a girl who cannot read or write, and then a young man who speaks occasionally. And as a teacher, I am so ignorant about what to do about people in that situation, and yet right now the culture in teaching is to mainstream them as much as possible because their parents want them to have that social experience, even though they're not going to learn, maybe, in the same way as my other students. I wouldn't want anyone to come in and say to me: yeah, you're the loser, you're the one that totally ignores them, you know?

Paul: Right.

Mark: But the reality is: I just don't even know what to do. And like you said, the training is out there. I know it has to be. But in my fifteen years of teaching: zero training. Never. No...one time. There was a guy who came in and said "this is what I do" and we all kind of applauded and said "you're so cool" and that's it. Because it wasn't practiced. It wasn't followed up with. I think you've got a cause that is so worth championing but the real bias is: yeah, we do know that it's out there but it's not a priority, and I don't know why. So I think a big thing that you're going to be revealing is people's bias that doesn't want to be shown, because they don't want to look stupid showing it, and how you're going to suspend your judgment of those people, so you can hear their perspective too. Because that's what I need to look at, at least from my perspective. I don't know if this helps at all.

Paul: Yeah...I don't anticipate spending a lot of time justifying why accessibility is important, but I do address that in my proposal, and I will address that to some degree in the dissertation itself, just because that's a necessary component. You know, I'm not including any case studies of places that don't include accessibility to ask them "why don't you," because that will definitely bring out the type of scenario you're talking about, where they'll say "I don't really want to answer those questions because that makes me look bad," you know, that sort of thing.

Mark: That's part of what I'm saying. Because this is so new to me, I haven't thought a lot about it the way you have, but I guess what I'm saying is that your bias is that you think it's good, and you're actively pursuing to make it function in the lives of people around you, and the bias that I see that you're going to run up against is that people might not act on it even though they might be aware of it or know it's good, and somehow you've got to reveal something in that area so that people recognize it. If you're focused so much on what others are doing, somebody like me might not see how come I'm not implementing it. What I'm telling you is that your bias to buy into this kind of instruction is automatically excluding a perspective that might be the problem.

Paul: Yeah, I can see that.

Mark: Does that make sense? Because you're already assuming that it's of value and we should do it and we've got to go that direction, whereas for me, you've got to convince me, and I might be looking at my ugly ignorance...anyway, I think that's probably enough. You're so on top of it. I can tell just by listening to you I think it's going to be fantastic. I'm excited for you.

Paul: Well I appreciate that, but I do understand what you're saying as well. My primary audience is programs where they have not yet incorporated accessibility, so yes, you're right, I do have to build a case as far as that goes. When I was saying that I don't have any preconceptions of how it should be addressed, I wasn't talking about whether it should be at all. That's kind of a foundational assumption that it should be, but...this is just me talking my opinions now...my biases...I don't think everyone in every program needs to know or become an accessibility expert. I just think that's completely impractical. But I do think that they need to have some experience with it, enough to know that it's an issue, enough to know that it's important, and that it actually affects people, and it's not just some academic exercise. The degree to which they become accessibility experts—part of it's going to be self-chosen paths that they go on—but the other part is going to be what type of technology they're dealing with. So those that go into web design, in my opinion, pretty much have to know accessibility and pretty much have to become accessibility experts to a reasonable degree simply to call themselves web developers. That's one side of it, as opposed to someone in instructional technology, where I teach, I'm not convinced that everyone in there really needs to become an accessibility expert because there are people who are more concerned with the psychology of learning or with the subject matter that they're teaching. There are different areas of expertise that a person is going to have. But once they commit that technology into a user interface, whoever's doing that, that person would need to have at least enough knowledge to know what they don't know, if nothing else, and to go get an accessibility expert. Here I'm just prescribing now, this is not how I would approach the dissertation, but this is my opinion.

Mark: Yeah, I think what you're talking about right now is at the heart of what this bracketing interview is about: is you acknowledging that you have that particular bias. The way that you see the problem. And almost, without thought, you could interject it by a comment, or “ok, we don’t need to go that far because…” And without having enough experience in this, I can’t point out the pitfalls, but listening to you right now, and what I’ve read about this, I think we’ve accomplished the purpose of this interview: acknowledging that you have that particular bias, and being aware of it when you’re collecting data so that you control your opinion and it doesn’t come out in the interviews. Because if you even hinted at that, from what I know about people, they’ll automatically start agreeing with you, some of them, some will become confrontational, “oh, you’re totally wrong, here’s how it is,” and that will change the way that they approach you. That’s what I think what this interview’s about, what you just acknowledged for yourself. I don’t know if it’s as much a written strategy as in the back of our minds we know that’s the area I’ve got to be careful on, so I don’t say the wrong thing and give the wrong impression and make them think what I think, so that I get their opinion. So (that way) their opinion doesn’t become my opinion, with people telling me the same thing that I think.

# Appendix F

## Topics in the Barrier-free Web Design Curriculum

Topics in the Barrier-free Web Design Curriculum (Adapted from University of Linz, 2005).

Table F1

*Semester 1*

| Class | Semester hours | European credit transfer system points |
|---|---|---|
| HTML, CSS, and XML | 3 | 4.5 |
| Document preparation | 2 | 3 |
| Basics of assistive technology | 2 | 3 |
| Web content accessibility guidelines | 2 | 3 |
| Legal basis | 2 | 3 |

Table F2

*Semester 2*

| Class | Semester hours | European credit transfer system points |
|---|---|---|
| Web programming | 3 | 4.5 |
| Human-computer interaction | 2 | 3 |
| Techniques for the implementation of accessibility guidelines | 2 | 3 |
| Evaluation and repair tools | 2 | 3 |
| Usability engineering | 2 | 3 |

Table F3

*Semester 3*

| Class | Semester hours | European credit transfer system points |
|---|---|---|
| Internet, web technology, and security | 2 | 3 |
| Basics of software accessibility | 2 | 3 |
| Accessing multimedia content on the web | 2 | 3 |
| Authoring tools and user agents | 2 | 3 |
| User interaction design | 2 | 3 |
| Web applications in practice | 2 | 3 |

Table F4

*Semester 4*

| Class | Semester hours | European credit transfer system points |
|---|---|---|
| Internship project in accessible web design | 10 | 15 |

Appendix G:

Topics in the *web_access* Curriculum

Table G1

*Topics in the* web_access *Curriculum*

| Content area | Class | European credit transfer system points |
|---|---|---|
| A. Fundamentals of web accessibility | A.1 Introduction to accessible web design | 3.0 |
| | A.2 Societal impacts and effects of accessible web design | 2.0 |
| | A.3 Technical foundations | 3.0 |
| | Total European credit transfer system points | 8.0 |
| B. Assistive technology | B.1 Basics in assistive technology | 1.5 |
| | B.2 Categories of assistive technologies | 4.0 |
| | Total European credit transfer system points | 5.5 |
| C. Guidelines and legal requirements | C.1 Web accessibility standards and guidelines | 3.0 |
| | C.2 National and international legal framework | 2.0 |
| | Total European credit transfer system points | 5.0 |
| D. Accessible content creation | D.1 Techniques for accessible web design | 3.0 |
| | D.2 Evaluation and repair methodology and tools | 3.0 |
| | D.3 Basics in software accessibility | 3.0 |
| | D.4 Rich internet applications and multimedia accessibility | 3.0 |
| | D.5 Authoring tools and user agents | 3.0 |
| | D.6 Accessible document design | 3.0 |
| | Total European credit transfer system points | 18.0 |
| E. Design and usability | E.1 Human computer interaction | 3.0 |
| | E.2 User interaction design | 3.0 |
| | E.3 Usability engineering | 1.5 |
| | Total European credit transfer system points | 7.5 |
| F. Project development | F.1 Accessibility and usability audit | 4.0 |
| | F.2 Design and redesign of web applications in practice | 12.0 |
| | Total European credit transfer system points | 16.0 |
| Total | 18 courses | 60.0 |

# Appendix H

## Notes on the Web Sciences Curriculum

**Notes on the Web Sciences Curriculum**

The Web Sciences curriculum has information about web accessibility integrated throughout the program. Students learn to work together on web design projects, taking into account the coding, artistic design, business and project management, and internet law. All students are exposed to the basics of web accessibility, assistive technologies, and the legal framework for accessibility in Austria, Europe, and other countries throughout the world. The program is not designed to create accessibility experts, but it does expose all of the students to the basic concepts and concerns. Students in the computer science concentration learn more detailed information about coding techniques, while the students in the business and legal concentrations spend more time on web accessibility laws and policies.

# Appendix I

## Topics in Web Accessibility and Design Class of the George Mason University Instructional Technology Curriculum

Table I1

*Topics in the Web Accessibility and Design Class of the George Mason University Instructional Technology Curriculum*

| Focus Area | Topics |
|---|---|
| Basic XHTML | • Creating a basic page using a text editor (paragraphs, headings, bulleted lists, numbered lists, tables, images, etc.)<br>• Using FTP<br>• Validating the code |
| Web accessibility | • Disability types: visual, auditory, motor/mobility, cognitive/intellectual, seizure disorders<br>• Assistive technologies<br>• Laws, guidelines, and standards<br>• HTML coding techniques for web accessibility |
| Using Dreamweaver | • Using Dreamweaver to create web content<br>• Using Dreamweaver templates |
| Basic CSS | • Applying an existing style sheet to a web page<br>• Creating your own style sheet<br>• Integrating a style sheet in a template-driven web site |

*Note.* Adapted from course syllabi.

# Appendix J

## Topics in the Digital Inclusion Curriculum

Table J1

*Topics in the Digital Inclusion Curriculum*

| Term | Module |
|---|---|
| Year One—Autumn | Fundamentals of digital inclusion |
| Year One—Winter | Design-for-all regulation, legislation and standardization |
| Year Two—Autumn | Inclusive design and user experience |
| Year Two—Winter | Accessible web design |
| Year Two—Spring, Summer and Autumn | Digital inclusion thesis |

*Note.* Adapted from Middlesex University (2009).

**CURRICULUM VITAE**

**PAUL RYAN BOHMAN**

# Education

- **PhD:** Education: Curriculum and Instruction (December 2012, Utah State University)
  **Dissertation:** *Teaching Accessibility and Design-for-All in the Information and Communication Technology Curriculum: Three Case Studies of Universities in the United States, England, and Austria*.
- **M.S.:** Instructional Technology (Utah State University)
- **B.S.:** Psychology, with Spanish & Art minors (Brigham Young University)

# Research and Teaching Interests

- Web accessibility and universal design of technology for people with disabilities: curriculum, policies, and sustainable interventions
- International development: education, disabilities, gender equity, sustainability, and the capability approach
- Inequality, opportunity, and questions of social justice
- Social entrepreneurship and "for-purpose" businesses within market economies
- Qualitative research methods

# Teaching Experience

**George Mason University**, 2006-2011. Instructional Technology program.

- University course: *Web Accessibility and Design*, taught in both classroom and online settings

**WebAIM,** 1999-2005. Director of Training Products and Services.

- On-site web accessibility workshops and training events for universities, companies, government entities, and non-profits
- Conference presentations and workshops on web accessibility
- Online tutorials and articles on web accessibility

**Utah State University**, 2001. Department of Special Education and Rehabilitation.

- University course: *Inclusive Web Design: Disability, Usability, and Accessibility*, online

**Utah State University**, 2000. Department of Special Education and Rehabilitation.

- University course: *Web Accessibility and Universal Design*, online

# Professional Experience

## Web Designer and Web Accessibility Consultant (2000 - Present)

- **Web Accessibility Specialist:** Provided expertise, technical assistance, training, accessibility evaluations, compliance reports, etc. across sectors: higher education, government, corporate, non-profit.
- **Accessible Web Designer:** Created and/or retrofitted web sites for accessibility, recommended modifications, etc.
- **Strategist:** Recommended procedures, systems, and methods to coordinate web accessibility efforts within large organizations.

## Photographer and Graphic Artist (2009 – Present)

Paul Bohman Photography/White Ribbon Studios (Arlington/Alexandria, Virginia)

**Fine art and commercial photographer and designer**
http://www.paulbohman.com and http://www.whiteribbonstudios.com

## Faculty/Instructor (2006 - 2011)

Instructional Technology Program, George Mason University (Fairfax, Virginia)

- **Instructor:** Taught Web Accessibility and Design classes in both classroom and online formats to students of Instructional Technology and Special Education, covering web accessibility concepts and techniques, disability access to education, disability rights legislation, HTML, CSS, and Dreamweaver Skills, with hands-on workshops.
- **Author/Instructional Designer:** Created extensive web-based instructional materials, including written instruction, illustrations, and video tutorials.

## Instructional Web Services Developer (2007 – 2009)

School of Law, George Mason University (Arlington, Virginia)

- **Database Architect and Administrator:** Redesigned and implemented a comprehensive back-end database to be used for the public web site, intranet, and internal record-keeping purposes.
- **Webmaster/ Web designer:** Redesigned school of law web site and sub-sites; added content management system and database connectivity across web sites. Designed layout, functionality, scripting, templates, styles, and artistic elements.
- **Instructional Designer:** Designed and created illustrated tutorials for faculty, staff, and students, for web and print.

## Lead Architect of Web Services/Technology Coordinator (2006 - 2007)

Kellar Institute for Human disAbilities, and Office of Technology Support,
George Mason University (Fairfax, Virginia)

- **Database Architect and Administrator:** Designed and implemented a comprehensive back-end database to be used across multiple public web sites and an intranet. The database tracked and linked data related to people, academic entities, application requirements, and other related information.
- **Webmaster/ Web designer:** Redesigned an inter-connected system of approximately 100 sites and sub-sites; added content management system and database connectivity across college web sites.
- **Programming Project Manager:** Led the web programming team.
- **Blackboard and Moodle Administrator:** Created and maintained courses for three major academic units within the College of Education and Human Development; provided technical support to faculty and students.

## Director of Training Products and Services (1999 - 2005)

WebAIM, Center for Persons with Disabilities, Utah State University (Logan, Utah)

- **Director of Training**: Coordinated and created training products, services, and events, including on-site workshops, CD-ROMs, annual online training events, articles, tutorials, and curriculum initiatives.
- **Author:** Wrote numerous technical documents, conference papers, articles, books, and tutorials, some of which are still featured on the WebAIM site (webaim.org).
- **Programming Supervisor:** Oversaw the complete redesign of the Wave accessibility evaluator (wave.webaim.org), significantly extending its functionality.

## Invited Expert/International Working Group Member (2002-2003)

Web Content Accessibility Guidelines, Web Accessibility Initiative, World Wide Web Consortium

- **Web Accessibility Specialist**: Participated in weekly phone conferences and quarterly face-to-face meetings to decide on web accessibility standards and techniques.

- **Writer:** Contributed to the writing of the Web Content Accessibility Guidelines 2.0.

### Curriculum Translator, Courseware Designer (Sep. 1998 - Sep. 1999)

Center for Persons with Disabilities, Utah State University (Logan, Utah)

- **Spanish Translator:** Translated curriculum into Spanish.
- **Online Course Support Specialist**: Created online resources for web-based courses.
- **Courseware Designer:** Designed and implemented online course delivery systems.

### Literacy Specialist/Team Leader (Oct. 1996 - Aug. 1998)

Ogden Area Community Action Agency Head Start (Ogden, Utah)

- **Literary Specialist:** Designed and administered programs to encourage early childhood and adult literacy.
- **Team Leader:** Coordinated the work of teachers, health workers, and social workers.
- **Volunteer Coordinator:** Interviewed, screened, and trained volunteers.
- **Information Architect:** Designed and administered the intranet.
- **Spanish Interpreter:** Interpreted the speeches for parent nights, etc.

## Service Experience

#### Tutor/Early Childhood Educator (2006 - 2007)

SuccessLabs (Fairfax, VA)

- **Instructor:** Provided instructional guidance to k-12 children in cognitive skills development, including logic, pattern-recognition, hand-eye coordination, vocabulary-building, etc.

#### Community Development Team Member (2006)

Charity Anywhere Foundation, on location in the Dominican Republic

- **Collaborative Work Project:** Worked with a team of U.S. and Dominican volunteers to design and construct furniture (tables and benches) for a school in a rural community center outside of San Cristóbal, Dominican Republic. The project included an informal needs assessment, purchasing materials, constructing the furniture, and discussing the project with local government officials and the Dominican Republic's ambassador to the United Nations.

### AmeriCorps (1996 - 1997)

Midtown Community Health Center (Ogden, Utah)

- **Immunization Advocate:** Promoted and tracked immunizations among at-risk populations.
- **Spanish translator:** Translated medical services from Spanish into English for the physicians.

## Publications

#### In Progress

- Bohman, P. R. (n.d.). No supply, no demand? The life and death of specialist degrees in web accessibility and universal design.
- Bohman, P. R. (n.d.). Universal exposure to universal design: The virtues of teaching universal design as an integral part of the mainstream ICT curriculum.

#### Books

- Bohman, P. R. (2002). Web development tools and accessibility. In J. Thatcher, et al., *Constructing accessible web sites*. Birmingham, UK: Glasshaus Press.

### Refereed Publications

- Bohman, P. (2007). Book review of Matthew Kohrman's "Bodies of difference: Experiences of disability and institutional advocacy in the making of modern China." *International Sociology Review of Books (22)* 2: 243-246.
- Bohman, P. (2006). Cultivating and maintaining web accessibility expertise and institutional support in higher education. ATHEN E-Journal. Available at http://athenpro.org/node/55
- Anderson, S., Bohman, S., Burmeister, O., Sampson-Wild, G. (2004). *User Needs and eGovernment Accessibility: The Future Impact of WCAG 2.0*. Proceedings published by Springer (LNCS 3196 http://www.springerlink.com/content/ycqn3ehru332gjlq/

### Selected Non-Refereed Publications

- Bohman, P. R. (2004). *Cognitive disabilities part 1: we still know too little, and we do even less.* WebAIM article available at http://webaim.org/articles/cognitive/cognitive_too_little/
- Bohman, P. R., Anderson, S., & Pavithran, S. (2004). *Accessible taxes? A blind consumer's experiences with the U.S. tax system*. WebAIM article available at http://webaim.org/articles/archives/taxes/
- Lyman, M., Rowland, C., & Bohman, P. R. (2004). *Assessing assessments: the inequality of online testing*. WebAIM article available at http://webaim.org/articles/assessment/
- Bohman, P. R. (2003). *Using Opera to check for accessibility*. WebAIM article available at http://webaim.org/resources/opera/
- Bohman, P. R. (2003). *Do Web sites have to be boring? (Hint: it' up to you)*. WebAIM article available at http://webaim.org/articles/archives/boring/
- Bohman, P. R. (2003). *Visual vs. cognitive disabilities*. WebAIM article available at http://webaim.org/articles/vis_vs_cog/
- Bohman, P. R. & Rowland, C. (2001). *How accessible is the Internet for people with Disabilities?* Parent News, 24(3-4), 1-6.
- Bohman, P. R. & Rowland, C. (2001). *Updated section 508 regulations take effect*. CPD News, 24(2), 1-7.
- Bohman, P. R. (2000). *The applicability of the ADA to the Internet*. CPD News, 23(2), 1-2.

## Conference Presentations, Workshops, and Poster Sessions

- Bohman, P.R. & Anderson, S. B. (2005). *The next generation of web accessibility: Perceivable, Operable, Understandable, Robust (POUR)*. Workshop at OZeWAI 2005 (Australian Web Adaptability Initiative).
- Bohman, P.R. (2005). *We're not there yet, but do we know where we're going?* Keynote at OZeWAI 2005 (Australian Web Adaptability Initiative).
- Bohman, P. R. & Whiting, J. (2005). *The next generation of web accessibility: Perceivable, Operable, Understandable, Robust (POUR)*. Workshop at Accessing higher ground: Boulder, CO.
- Bohman, P. R. (2005). *Training and assessment of web accessibility competencies*. Presentation at Accessing higher ground: Boulder, CO.
- Sampson-Wild, G., Burmeister, S., Anderson, S. B., Bohman, P. R. (2005). *Information Needs: Overcoming Design Barriers Through the Adoption of International Standards*. HCI International: Las Vegas, NV.
- Bohman, P.R. (2005). *Panel: Do designers need to be engineers?* 2nd Annual International Cross-Disciplinary Workshop on Web Accessibility (W4A). Chiba, Japan.
- Bohman, P. R. & Anderson, S. (2005). *A Conceptual Framework for Accessibility Tools to Benefit Users with Cognitive Disabilities*. 2nd Annual International Cross-Disciplinary Workshop on Web Accessibility (W4A). Chiba, Japan. [Invited speakers]
- Bohman, P. R. & Whiting, J. (2005). *Web accessibility concepts and techniques*. Tech Fair 2005: Albuquerque, NM.

- Bohman, P. R. & Anderson, S. (2005). *Toward User-Centered, Scenario-Based Planning and Evaluation Tools*. 9th International Conference on Computers Helping People with Special Needs (ICCHP). Université Pierre et Marie Curie, Paris, France.
- Bohman, P. R. (2004). *Providing Web accessibility training within large organizations*. Presentation at Accessing higher ground: Boulder, CO.
- Bohman, P. R. (2004). *Web accessibility policies and procedures that work*. Presentation at Accessing higher ground: Boulder, CO.
- Bohman, P. R. (2004). *Real world Web accessibility techniques*. Half-day workshop at Accessing higher ground: Boulder, CO.
- Bohman, P. (2004). University Web Accessibility Policies: A Bridge Not Quite Far Enough. In P. Kommers & G. Richards (Eds.), Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2004 (pp. 5395-5400). Chesapeake, VA: AACE. Available at http://webaim.org/articles/policies/policies_pilot/
- Anderson, S., Bohman, S., Burmeister, O., Sampson-Wild, G. (2004). *User Needs and eGovernment Accessibility: The Future Impact of WCAG 2.0*. Workshop Proceedings to be published by Springer (LNCS 3196) http://www.springerlink.com/content/ycqn3ehru332gjlq/.
- Anderson, S., & Bohman, P. (2004). *Progress on WAVE: A Multi-Lingual Open Source Accessibility Tool*. World Conference on Educational Multimedia, Hypermedia and Telecommunications 2004(1), 5177-5180. [Online]. Available: http://www.editlib.org/p/11811
- Bohman, P. R. (2004). *An accessible method of hiding HTML content*. International Cross-Disciplinary Workshop on Web Accessibility (W4A): New York NY.
- Bohman, P. R. (2004). *Evaluating Web accessibility: a seven-step process*. CSUN International Conference on Technology and People with Disabilities: Los Angeles, CA.
- Smith, J., & Bohman, P. (2003). *No child left behind: is your Web site accessible?* EdMedia 2003, Waikiki, HI.
- Bohman, P. R. (2003). *Fast track to Web accessibility*. CSUN International Conference on Technology and People with Disabilities: Los Angeles, CA.
- Bohman, P. & Coombs, N. (2001). *Accessible website creation*. Accessing Higher Ground — Assistive Technology in Higher Education: Boulder, CO.
- Isom, J. Bohman, P. (2001). *Experiencing the unseen, the unheard, the blurry and the confusing*. WebNet 2001: 84-86.
- Rowland, C., & Bohman, P. R. (2001). *Keeping Web accessibility in mind — project WebAIM helps postsecondary education*. CSUN International Conference on Technology and People with Disabilities: Los Angeles, CA.
- Bohman, P. (2000). *Universal design and disability access to the Web*. Presentation at WebNET 2000: San Antonio, TX.

# Client Workshops, Presentations, and Webcasts

- Bohman, P. R. (2007). Systems-approach models of web accessibility: because techniques are not enough. Webcasted presented by Trainerspod.com. http://www.trainerspod.com/info/
- Bohman, P. R., Lewis, C., & Rowland, C. (2007). Cognitive disabilities and the web: what we think we know. Webcasted presented by The National Center on Disability and Access to Education (NCDAE). http://ncdae.org/webcasts/cognitive.cfm
- Bohman, P. & Smith, J. (2005). *Web accessibility for community colleges part 2*. Webcast sponsored by the Great Plains ADA and IT Center, Columbia, MO.
- Bohman, P. (2005). *Web accessibility for community colleges part 1*. Webcast sponsored by the Great Plains ADA and IT Center, Columbia, MO.
- Bohman, P. R. & Whiting, J. (2005). *Web accessibility concepts and techniques*. One-day workshop in Albuquerque, NM.
- Bohman, P. R. (2004). *Overview of Web accessibility*. Presentation to Web developers at Utah State University: Logan, UT.

- Bohman, P. R., & Smith, J. (2003). *Web accessibility concepts and techniques*. Two-day workshop at the University of Nebraska: Lincoln, NE.
- Bohman, P. R. (2003). *Overview of Web accessibility*. Presentation to Web developers at Utah State University: Logan, UT.
- Bohman, P. R. (2003). *Overview of Web accessibility*. Presentation to students of HTML at Utah State University: Logan, UT.
- Bohman, P. R., Smith, J., & Whiting, J. (2003). *Web accessibility concepts and techniques*. Two-day workshop in Omaha, NE.
- Bohman, P. R., & Smith, J. (2003). *Web accessibility concepts and techniques*. Two-day workshop at Oklahoma State University: Stillwater, OK.
- Bohman, P. R. (2002). *Overview of Web accessibility*. Presentation to Web developers at Utah State University: Logan, UT.
- Bohman, P. R. Smith, J., & Anderson, S. (2002). *Web accessibility concepts and techniques*. Two-day workshop for Utah state government employees: Salt Lake City, UT.
- Rowland, C. & Bohman, P. R. (2002). *Web accessibility concepts and technique*s. Two-day workshop for Utah state government employees: Salt Lake City, UT.
- Bohman, P. R., & Smith, J. (2002). *Web accessibility concepts and techniques*. Two-day workshop at Oklahoma State University: Stillwater, OK.
- Bohman, P. R., & Smith, J. (2002). *Web accessibility concepts and techniques*. Two-day workshop at the University of Nebraska: Lincoln, NE.
- Bohman, P. R., & Smith, J. (2001). *Web accessibility concepts and techniques*. Two-day workshop at Utah State University: Logan, UT.
- Bohman, P. R., & Smith, J. (2001). *Web accessibility concepts and techniques*. Two-day workshop at Broward County Community College System: Ft. Lauderdale, FL.
- Rowland, C., & Bohman, P. R. (2001). *Web accessibility concepts and techniques*. Two-day workshop at the University of Massachusetts: Amherst, MA.
- Rowland, C., & Bohman, P. R. (2001). *Web accessibility concepts and techniques*. Two-day workshop at the University of Wisconsin-Madison: Madison, WI.
- Bohman, P. R. & Isom, J. (2001). *Web accessibility concepts and techniques*. Two-day workshop at the University of Arizona: Tucson, AZ.
- Bohman, P. R. & Isom, J. (2001). *ADA and the Internet: Implications for Postsecondary Institutions*. Presentation at the University of Arizona-Tucson: Tucson, AZ.
- Rowland, C., & Bohman, P. R. (2000). *Web accessibility concepts and techniques*. One-day workshop at Utah Valley State College: Orem, UT.
- Rowland, C., & Bohman, P. R. (2001). *Keeping Web accessibility in mind*. Presentation to Web developers at George Mason University: Fairfax, VA.
- Rowland, C., & Bohman, P. R. (2001). *Web accessibility concepts and techniques*. Two-day workshop at the University of Idaho, Moscow: Moscow ID.
- Rowland, C., & Bohman, P. R. (2001). *Web accessibility concepts and techniques*. Two-day workshop at the University of Arkansas: Little Rock, AR.
- Rowland, C., & Bohman, P. R. (2001). *Keeping Web accessibility in mind*. Presentation to Web developers at UtahAHEAD Satellite Broadcast: Logan, UT.
- Rowland, C., & Bohman, P. (2000). *Overview of Web accessibility*. Educational Network Satellite Broadcast: Logan, UT.
- Bohman, P. R. (2001). *Overview of Web accessibility*. Presentation to Web developers at Utah State University: Logan, UT.
- Bohman, P. R., & Smith, J. (2000). *Overview of Web accessibility*. Presentation to Web developers at Utah State University: Logan, UT.
- Rowland, C., & Bohman, P. R. (2000). *Web accessibility concepts and techniques*. One-day workshop at Brigham Young University: Provo, UT.
- Rowland, C., & Bohman, P. R. (2000). *One-day Web accessibility workshop*. Two-day workshop at Utah Valley State College, Orem, UT.

- Rowland, C., & Bohman, P. R. (2000). *Keeping Web accessibility in mind*. Presentation to Web developers at Weber State University: Ogden, UT.
- Rowland, C., & Bohman, P. R. (2000). *Keeping Web accessibility in mind*. Presentation to Web developers at the University of Utah: Salt Lake City, UT.
- Rowland, C., & Bohman, P. R. (November, 2000). *Web Page Design and Accessibility*. Colloquium sponsored by Utah State University Information and Learning Resources: Logan, UT.
- Rowland, C., Bohman, P. R., Isom, J., & Anderson S. (November, 2000). *Keys To Accessibility*. A clinic presented to FIPSE and LAAP project directors. Annual Project Directors Meeting: San Diego, CA.
- Rowland, C., & Bohman, P. R. (November, 2000). *Are You Ready for All Learners? Designing an accessible architecture to sustain online learning*. Asynchronous Learning Networks Conference: Paper presented to participants of the Adelphi, MD.
- Bohman, P. R., & Smith, J. (1999). *Overview of Web accessibility*. Presentation to Web developers at Utah State University: Logan, UT.

## Selected Educational Materials

- Bohman, P. R. (2005-2011). *Standards-based HTML*. Web-based textbook for university courses.
- Bohman, P. R., Whiting, J., Smith, J., Virgin, J., Parkinson, S. & Rowland, C., (2005). CD-ROM: *The WebAIM Guide to Web Accessibility Concepts and Techniques*. Logan: Utah State University, Center for Persons with Disabilities.
- Whiting, J., Bohman, P. R., Smith, J., Anderson, S., Rowland, C., Blair, P., Virgin, J., & Lyman, M., (2004). CD-ROM: *WebAIM.org the 2004 Accessibility Training*. Logan: Utah State University, Center for Persons with Disabilities.
- Bohman, P. R., Smith, J., Anderson, S., Rowland, C., Whiting, J., Blair, P., Virgin, J., Lyman, M., & Pavithran, S., (2003). CD-ROM: *WebAIM.org the 2003 Accessibility Training*. Logan: Utah State University, Center for Persons with Disabilities.
- Smith, J., Bohman, P. R., Rowland, C., Virgin, J., Anderson, S., Pavithran, S., & Miller, L. (2002). CD-ROM: *WebAIM.org the 2002 Accessibility Training*. Logan: Utah State University, Center for Persons with Disabilities.

## International Panels and Committees

- Program committee co-chair: EdMedia (2005-2006). World Conference on Educational Multimedia, Hypermedia, and Telecommunications.
- Invited expert/Working group member: Web Content Accessibility Guidelines (WCAG) Working Group. (2002-2003).

## Book, Journal, and Grant Reviews

- EdMedia (2003-2006). World Conference on Educational Multimedia, Hypermedia, and Telecommunications. [Reviewer of papers submitted for the annual conference].
- Department of Education (2005). National Assistive Technology Public Internet Site, CFDA Number 84.224B-2. [Grant review.]
- *IBM Systems Journal Special Issue on Accessibility* (2004). [Guest review of article.]
- Deitel, H. M., Deitel, P. J., Listfield, J. A., Nieto, T. R., Yaeger, C. H., Zlatkina, M. (2002). *C#: A programmer' introduction*. Prentice Hall: New York, NY. [Review of accessibility chapters.]
- Deitel, H. M., Deitel, P. J., Nieto, T. R., (2002). *Internet & world wide web: How to program*. Prentice Hall: New York, NY. [Review of web accessibility chapters.]