Preface

Our world has witnessed extraordinary technological advancements impacting almost every field of human endeavor. Now more than ever, practical and empirically grounded research focused on education and technology is needed if we are to better understand the world, ourselves, and how we can advance. The field of Assistive Technology (AT) has come a long way since the term "universal design" was first coined and linear perspectives were at the forefront of assisting those with disabilities. Specialized software and devices once synonymous with AT are now commonplace. The unprecedented advancements in mobile computing, coupled with legislation and the collective movement towards inclusive settings, for example, makes it no better time than today to strive for AT equity in terms of universal implementation.

This book is a realization of a yearlong collaborative endeavor by professionals, practitioners, and researchers from both academia and industry in the U.S. and abroad dedicated to the advancement and promotion of AT in the everyday through enriching the lives of those with special needs. Those who contributed their time and expertise to this publication have been leaders and positive influences in the ever-changing technology and education landscape. These individuals come from a diverse set of disciplines to include computer science, curriculum and instruction, game development, human performance, industrial and operations engineering, instructional design, law, medicine, occupational therapy, special education, and social work to name only a few. Providing a transdisciplinary perspective, this book provides relevant theoretical frameworks, the latest empirical research findings, and the practical application of AT, setting this publication apart from other works providing insights into AT. Namely, this book addresses trends and issues related to AT, presenting the latest practices based on what is available to date with regard to research and emergent technologies. This book is intended for educational professionals and practitioners as well as researchers involved in special education along with other fields which benefit from AT.

SECTION ONE: THEORIES, CONCEPTS, AND LAWS

This book is comprised of 17 chapters presented in three sections. "Section 1: Theories, Concepts, and Laws" serves as scaffolding for the remainder of this book, by introducing theories, concepts, and laws either discussed or mentioned in many of the chapters. This book begins with a discussion of Universal Design for Learning (UDL)—an educational framework founded on research in the learning sciences to include cognitive neuroscience—intended to help guide in the development of educational content

accommodating individual learning differences (Rose & Meyer, 2002). In fact, UDL is so important in the context of this book that 2 chapters have been dedicated to its coverage.

In chapter 1, the challenges in accommodating the variety of students in today's diverse learning environments are presented along with the difficulties *all* students face in learning, not only those with disabilities. The authors present the case that Universal Design for Learning (UDL) can be successfully applied in helping reduce many of the barriers commonly found to access and learning. The authors explore the strides made in creating content that brain-based research supports as a way for not only motivating students to learn, but at the same time provide those with disabilities a means in which to learn that fits *their* specific needs. Namely, in this chapter, the authors examine and describe UDL to include its history, the framework, and the application of its principles, along with related laws and regulations at the federal level.

This line of thinking is continued in Chapter 2. Bryant, Rao, and Ok discuss how the UDL framework provides guidelines that can be leveraged to help educators consider where and how assistive features and technology can be utilized to increase flexibility and choice for students. The authors describe ways in which teachers can use the assistive features of commonplace technology tools and software for classroom-based lessons to give students multiple means of representation, expression, action, and engagement. Specifically, the authors provide three vignettes that illustrate how computer applications and Web-based tools can be used to support diverse students, including students with learning disabilities and struggling learners.

Bryant, Rao, and Ok maintain that with an awareness of the assistive features of various applications, educators can apply UDL principles to lessons by integrating technology in thoughtful and deliberate ways into instruction and assessment. Furthermore, the authors describe how teachers can consider UDL principles during the lesson design and implementation process and can proactively provide options and enable support features through the technologies they use in their lessons and classes. The case studies highlight ways in which educators can use a Web-based book builder that has built-in assistive supports, digital graphic organizer software, and an interactive whiteboard application on a tablet computer.

Finally, Bryant, Rao, and Ok submit that most intervention research on learning disabilities has focused on reading, writing, and mathematics, with reading garnering the most attention. Text-to-speech is one example of an AT feature that has become ubiquitous on various devices. Therefore, it should not come as a surprise that the next three chapters touch upon these kinds of skills.

For example, in Chapter 3, Baker focuses on reading skills and explicitly presents the case for mainstreaming text-to-speech software for students with reading difficulties in the educational environment through the use of a socio-constructivist approach. The author contends that a purely functional approach for students with assessed specific reading disabilities limits the delivery of text-to-speech software outreach and use. This is because, despite increased consumer involvement with attendant potential to increase student participation and use, the target population of students with reading disabilities is typically defined in the context of human function. By transitioning to a socio-constructivist approach, the author presents the case that there is greater potential to assist a larger number of students.

The focus moves to writing skills in Chapter 4, where Dunn discusses the challenges that today's students face while providing solutions and recommendations from the perspective of Assistive Technology (AT). The author begins the chapter by providing a brief overview, defining AT; he helps to put the state of writing skills in context by presenting what recent U.S. and international writing assessment results indicate; he continues with a discussion focused on the characteristics of struggling writers; finally, he explains how AT can be used effectively to help these students improve and manage the complex

and interdependent task of creating prose, story in particular. Key examples of AT services discussed include self-regulated strategy development and mnemonic strategies. The author also reviews his own research focused on story writing and how integral AT is to helping struggling writers. Finally, the need for students' pre-requisite practice with AT is also emphasized.

While in Chapter 5, Seok, DaCosta, and Kim focus on ecological perspectives surrounding the design of self-determination-enhanced Problem-Based Learning (PBL). The authors present a PBL conceptual framework that can be leveraged in the implementation of the skills needed for the 21st century, specifically self-determination for students with disabilities in inclusive settings. The framework is built upon an extensive research synthesis of the principles behind PBL instructional design with an emphasis on special education. Findings of the research synthesis revealed the relationships between self-determination learning and PBL.

A collaborative learning model—SHARE: Structure, Hypothesis, Analysis, Research, and Evaluation—is proposed as a positive intervention in implementing PBL. Overall, the research synthesis points to a trend whereby technology-enhanced PBL is practiced with students with disabilities in inclusive settings and teacher education programs (Brown, 2005; Raskind & Bryant, 2002; Wehmeyer, 1999). In addition to the recommendation to use the SHARE learning model as a positive intervention, the authors propose that educator quality is essential in designing and implementing self-determination-enhanced PBL, as can be implemented using the proposed PBL conceptual framework. Educators, educational policymakers, and researchers involved in inclusive education practices will find that this chapter has far-reaching implications in the context of problem solving, as 21st century learning skills become increasingly vital in today's society.

Finally, this section of the book concludes with chapter 6, in which Kinsell offers a broad overview of federal civil rights laws that ensure equal opportunity and fair treatment to people with disabilities. Although great strides have been made to make information about federal civil rights laws and regulations transparent and freely available to everyone, particularly with the ease of information dissemination on the Internet, the abundance of information available today can also be overwhelming. This is especially true given the complexity of some of these laws and regulations and the subtle differences in the manner in which states operate programs and offer services. Since some of these laws and regulations bring with them a wide range of rights and services, some of which translate to entitlements in the form of assistive technology services and devices, it is imperative that those with disabilities, their family members, and individuals who support people with disabilities become familiar with these various laws and regulations.

Although this chapter does not cover all laws and regulations, such as the Higher Education Opportunity Act of 2008 (briefly discussed in chapter 1 in the context of UDL), much of the legislation presented by the author is either discussed or presented in the chapters found in this book. Most notably are the Americans with Disabilities Act and the Individuals with Disabilities Education Act, which are referenced in almost all of the chapters. This chapter should therefore be used as a reference in not only learning more about the specific laws and regulations but also in finding additional resources to the respective governing office, agency, or outside organization in order to obtain the latest up-to-date information.

SECTION 2: SOFTWARE, DEVICES, AND GAMES

In the second section of this book, "Section 2: Software, Devices, and Games," the emphasis moves away from theories, concepts, and laws to focus on the AT itself. As the title implies, this section of the book focuses specifically on software, devices, and games. As previously stated, text-to-speech is one example of a once synonymous AT feature that has become ubiquitous across various devices, most notably mobile technology (e.g., smartphones, tablets, and eReaders). Technology now considered everyday forms of communication, such as email, instant messaging, and texting, have made a huge impact on the lives of those with certain disabilities. Even video games now hold the interest of educators and researchers, as potential interventions in teaching children with certain neurodevelopmental disorders.

Chapter 7 begins the discussion with Stachowiak presenting the effect Assistive Technology (AT) has had on people with disabilities, particularly in the areas of reading, writing, communicating, and accessing information. The author notes that one of the roadblocks for use has always been the expense of AT. Advancements in computing and mobile technology, however, are making some technology more readily available, accessible, and cost-effective for people with disabilities. Using this line of thinking, the author presents *accessible technologies*, discussed in terms of mobile, personal computer, and cloud computing, that have or are quickly becoming part of the mainstream and every day, but which have already shown, or have the potential, to be incredibly helpful to those with disabilities, in particular those who have visual and hearing impairments. Take for example, computer operating systems, to include Microsoft Windows® and Apple Mac OS®, which continue to be feature rich with AT capabilities, such as the ability to magnify the screen for reading and in the entering of text, or the mobile movement of smartphones, eReaders, and tablets, that have also been changing the way people with disabilities access information. The capabilities of these devices combined with the immediate availability, affordability, and ease of use, has been making the world more accessible for people with disabilities, and with mobile devices increasingly becoming a necessity for most, this trend is anticipated to only continue.

In Chapter 8, the discussion of AT continues, but from the perspective of Information and Communication Technology (ICT) and the need for validation research that contributes to AT evidence-based practices. The authors present the findings of a study aimed to identify latent dimensions of ICT that can serve as the basis for the eventual development of a standardized instrument for ICT assessment and selection in the context of AT. The ICT preferences and practices of 1,258 postsecondary students across 7 major universities were examined. A confirmatory factor analysis within the framework of structure equation modeling revealed the 5 latent dimensions: communicating, socializing, downloading and sharing, gaming, and learning. These dimensions, examined in the context of age, gender, and income, further revealed that these demographics, as sole determinants of ICT usage, are not supported. Noteworthy findings were also found with regard to participants' preferences for ICT to include a tendency to text over all other technologies.

As with the Nasah et al. (2010) study, claims that students are much more adept at all things digital are not borne out of the findings in this chapter, but instead the findings call into question the overarching suppositions made about young people and their technological prowess, to include the belief that young people are more interested in using technology for social networking and personal reasons (Keen, 2007). At the same time, DaCosta and Seok point out that there is no denying the significance of ICT in modern society. The latent dimensions of ICT fleshed out in this chapter, accordingly, provide a reference point in which to begin examining the ICT preferences and practices of those with special needs, and more importantly, may lead to the eventual development of a standardized instrument for ICT assessment and selection in the context of AT.

An extension of a chapter found in the book, *Handbook of Research on Human Cognition and Assistive Technology: Design, Accessibility, and Transdisciplinary Perspectives* by Seok, Meyen, and DaCosta (2010), chapter 9 continues the discussion on communication-related AT with Slotznick presenting the tools being developed to help remedy the challenges facing users of Augmentative Communications (AAC) systems and the "phatic" approach on which these tools are based. Namely, the author explains these users sometimes have difficulty participating in conversation outside of a script they already know, repairing a derailed conversation, or engaging in the quick and varied banter demanded of many social situations. Although the intent of this chapter is not to advocate for the replacement of standard AAC vocabularies, it does show how phatic vocabularies, through the use of tools and devices, can be successfully used to enhance a user's language development, particularly social language and social development, by creating vocabularies that encourage a user to engage in social settings.

In the last 2 chapters found in this section of the book, the benefits of video games, specifically simulation-based games, are presented, and how this genre of game, when coupled with the element of storytelling, may be effectively used as an intervention in helping children with Autism Spectrum Disorders (ASD), who have trouble with everyday social situations and/or communication difficulties not seen with neurotypical children. It has been suggested that game technology can be successfully used to aid in social skills development among those with special needs (Griffiths, 2002). In the context of these 2 chapters, such technology has been used in social skills development for children and adolescents with ASD, along with other developmental challenges (Gaylord-Ross, Haring, Breen, & Pitts-Conway, 1984; Grandin, 2012; McElroy, 2011; Porter, 1995; Tartaro & Cassell, 2006), to include helping children with limited vocal speech acquisition (Horn, Jones, & Hamlett, 1991), disabilities in spatial ability development (Masendorf, 1993), problem-solving (Hollingsworth & Woodward, 1993), and mathematics (Okolo, 1992).

In chapter 10, Jin, DaCosta, and Seok discuss the potential that video games have in assisting children with ASD in the development of social skills. The importance of storytelling is discussed in the context of video games in part based on the role story plays in human development from early childhood (Eisenberg, 1985; Fivush, 1994). There is research to suggest, for instance, that storytelling in video games can be beneficial because it can be used to help players identify with characters and their goals, creating a greater sense of immersion, positive feelings, and more physiological arousal. Furthermore, when the content is specific and targeted, these games are well suited for promoting acquisition, maintenance, and generalization of skills and knowledge. The authors articulate that findings such as these hold immense promise in the context of improving social skills for children with ASD. Thus, the use of computers and video games, combined with more traditional storytelling, may serve as hopeful tools for motivating and engaging students as well as promoting learning. The authors expound upon this line of reasoning and explore the use of interactive storytelling games as an effective intervention in social skills development for children with ASD, proposing a conceptual model that may be used to guide such an effort.

In chapter 11, Kinsell, DaCosta, and Nasah continue the discussion on the use of video games in promoting social skills development for children with ASD, building upon the work of Jin, DaCosta, and Seok in chapter 10, but narrowing the focus from the general application of video games to that of simulation-based games. The authors present the characteristics of this video game genre that help make this technology particularly attractive in education, especially as an intervention for social skills development. The authors also discuss the pivotal storytelling component contributing to the successful development of simulation-based games in an instructional context. This includes a discussion on the importance of immersion and motivation.

Although these 2 chapters only begin to scratch the surface as to the potential benefits and challenges of leveraging video games in helping children with special needs, the discussions presented by Jin, DaCosta, and Seok and Kinsell, DaCosta, and Nasah should be viewed as a call for researchers and practitioners who see potential in game technology. There are many factors that must be taken into consideration when leveraging such technology, and learning how to use these factors together is imperative if game technologies, such as simulation-based games, are to be effective in helping children with ASD develop needed social skills. Researchers and practitioners should, therefore, push for practical examples that can be shared as to how such games can be used to help mitigate the many challenges experienced by these children. It is through such investigation that the authors argue the manner in which this technology can present greater possibilities in promoting the generalization of social skills among children with ASD and other disabling conditions.

SECTION 3: IMPLEMENTATION, ASSESSMENT, AND EVALUATION

Finally, "Section 3: Implementation, Assessment, and Evaluation" focuses on the challenges in the implementation, assessment, and evaluation of AT for those with disabilities of all ages, both in and out of the classroom. Namely, in the chapters that follow, common barriers experienced by professionals, educators, as well as students with disabilities are discussed, such as difficulties endured in securing permanent employment, obstacles (i.e., physical and virtual) in accessing quality education, and limited opportunities offered to those seeking quality AT interventions for infants and toddlers. More importantly, solutions are offered in mitigating such barriers by providing strategies and best practices in the implementation, assessment, and evaluation of AT for students with disabilities both in and out of the classroom.

In chapter 12, Threlkeld introduces the shifting and dynamic barriers that make the implementation of new media a challenge, while at the same time illuminating convergences between the goal of new media and Assistive Technology (AT). While the author explicitly concentrates on opportunities within the classroom, educators can also employ the guidelines outlined generally in out-of-school contexts. Barriers discussed by the author include electronic curb cuts and aggressive Internet filters. After discussing such barriers, solutions, including some classroom protocols and a list of resources, are shared to help educators evaluate new media as well as in the integration of new and old media as AT.

The discussion on the challenges facing educators who wish to effectively implement AT continues in chapter 13. Courduff, Duncan, and Gilbreath maintain that effective implementation of AT is transformative for educator practice and student learning outcomes. Educators who embrace this effort are faced with a set of challenges that are not found in typical technology integration efforts, and in order to successfully and deeply integrate technology into instruction and learning, a change in pedagogy must be made. The authors, therefore, identify the unaddressed perspectives that impede technology implementation in diverse learning environments, contending that when this unique set of perspectives is addressed, strategies for effective practice can emerge.

Courduff, Duncan, and Gilbreath first provide a brief discussion on special education law and AT to help frame the chapter. Next, foundations of AT and effective implementation strategies at the classroom level are discussed. The process by which educators can be supported in integrating technology tools into learning tasks is reviewed. This includes the presentation of a matrix that connects student-learning tasks with technology tools common to every classroom. The importance of making emotional connections

and providing time to practice and share in an environment where failure is seen as an opportunity for growth is also discussed. Finally, systemic implementation issues and strategies for success are shared.

In Chapter 14, Baker discusses the challenges facing those who wish to effectively implement Assistive Technology (AT) but from the perspective of infants and toddlers. This chapter first discusses the importance of play and then draws attention to some issues and tensions that limit play and AT in early intervention for infants and toddlers with special needs. The criticality of exploring the potential of play for infants and toddlers with disabilities is then discussed by presenting research on the subject and offering practice-based suggestions. The author makes submission for some easily applied practical solutions for providers and parents and discusses some of the tensions that currently limit the provision of AT and services for infants and toddlers. Finally, thoughts are presented for the future of AT through research, early intervention play-based practices, and on-going education and development of early intervention providers and parents of infants and toddlers with special needs.

In the remaining 3 chapters of this book, barriers to implementing AT are further discussed, but in the context of online learning. In chapter 15, Barrett claims 2 of the most disparaging barriers facing people with disabilities are difficulties endured in securing permanent employment and obstacles in obtaining a quality education. In presenting barriers to employment, the significance of culture is discussed. This includes a discussion on the values and assumptions held by organizations and the societal changes that must occur if people with disabilities are to be given the same opportunities toward employment as those without disabilities. In presenting the barriers to education, the important role that academic institutions play in preparing people with disabilities for the workforce is discussed. This discussion is followed by the challenges facing not only learners with disability but also the challenges facing educational professionals in today's technologically rich online learning environment. This chapter ends with the author discussing the creation of strategies to erode the barriers commonly found in course design and how to empower students with disabilities with strategic tools. This chapter serves as a catalyst in the facilitation of discussion between professionals in industry and academia in how to work together in what should be a symbiotic relationship in assisting those with disabilities in not only accessing a quality education but at the same time being prepared for meeting the employment needs and demands of the business community.

In chapter 16, Bastedo and Vargas focus exclusively on online learning, specifically distance learning courses and the benefits they can provide to people with disabilities. Through the exploration of current research and trends, the authors review Learning Management Systems (LMS), learner interaction styles and tools, and methods to design accessible course materials. The authors provide educators with not only a working vocabulary but also strategies and implementation methods for ensuring accessible content in online learning. Specifically, the authors investigate the types of interactions in distance learning, identify the distance learner and their technological needs, distinguish between two classifications of LMS (i.e., open vs. closed or proprietary), recognize the features of learning managements systems that incorporate accessible design, identify the laws related to accessibility of distance learning materials in K-12 and higher education, and most importantly, offer accessibility best practices to the creation of distance learning course materials.

Finally, this book ends with chapter 17, in which Kinsell and DaCosta offer a checklist comprised of 15 factors and 157 items rooted in cognitive psychology, instructional design, computer science, but most importantly, human-computer interface study. The checklist can be used to guide researchers and practitioners in assessing the usability and accessibility of website design. The authors explain that although academic researchers have long advocated the importance of assessing the effectiveness of

websites (Law, Qi, & Buhalis, 2010), with numerous approaches published (Law & Bai, 2006; Tullis & Stetson, 2004; Evans & King, 1999; Lu & Yeung, 1998; Stern, 2002; Stout, 1997) and efforts made to help improve the overall quality of websites (Law & Bai, 2006), website assessment is still a very much ill-defined practice, conducted by some and largely ignored by most.

The authors contend that instruments to help assess and measure the usability of websites are vital in ensuring that websites not only meet their intended purpose but are also usable and accessible. The checklist offered in this chapter has been extensively used and matured over a number of years in assessing the usability and accessibility of website design for clients in the private and public sectors, as well as government. Although the checklist should in no way be considered exhaustive, it should be viewed as a practical starting point, which can be augmented to meet the specific needs of companies, organizations, and individuals in their website assessment efforts.

We conclude by acknowledging our gratitude to have been afforded the opportunity to have assembled such a diverse collection of chapters into a single work. Although the benefits of technology for people with disabilities are widely recognized, much more needs to be done. It is our hope that this book is a step forward in advancing the field of AT and that it serves as a positive influence towards improving the lives of those with disabilities.

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