Assistive Technology in Education:
Conceptions of a Socio-technical Design Challenge

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Abstract

This article offers a socio-technical framing of assistive technology design for in-classroom use to enable a better understanding of how to improve educational opportunities and outcomes for learners with disabilities. By addressing social inequities in public education and recognizing user-centered design faults and inadequacies in the current implementation of assistive technology in the educational environment, this paper focuses on understanding the experiences of learners with disabilities. This article discusses challenges faced when adopting such technology and the effects of the current well-intentioned but flawed implementation of assistive technology. The authors highlight the limitations and shortcomings of the existing approaches portrayed in previous research and educational practices. The article concludes with a call for a socio-technical approach to adopting assistive technology to augment the learning experience for a more inclusive atmosphere and encourages a deeper appreciation for the interrelatedness between people, educational organizations, and technology.

Keywords: accessibility; assistive technology; education; socio-technical framework; user-centered design

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Introduction

According to the National Center for Education Statistics (2017), the 4-year adjusted cohort graduation rate for American students enrolled in public education was 85% in the 2017-2018 school year. However, the equivalent on-time graduation rate for students with disabilities was significantly lower, at 67%. Furthermore, even with a high school diploma, many students with disabilities find themselves unprepared for the world outside of or beyond the K-12 education system. Only an estimated 35% of students with disabilities graduate with an associate degree; that estimate declines further at the bachelor's (16.9%-20%) and master's or higher degree levels (12%) (National Center for Education Statistics, 2017). The long-term social impact of this disparity is profound. In 2020, the US Bureau of Labor Statistics estimated that only 17.9% of people with disabilities enter the labor force (compared to 61.8% of the non-disabled population) with the proportional effects on lifestyle and economic well-being that this low employment rate entails.

While the political and educational responses to this issue may take many forms, we believe this is where information technology can play a constructive role. In particular, we suggest that a socio-technical framing of assistive technology design (with its strong emphasis on placing users and other stakeholders at the center of design and implementation decisions) might offer a

helpful approach to understanding how to improve educational opportunities and outcomes for learners with disabilities (Eason, 1988; Baxter and Sommerville, 2011). In this way, we believe leveraging appropriately designed assistive technology can address some of the critical social inequities apparent in public education while improving our own understanding of how to design for greater inclusion (Eason, 1988; Baxter and Sommerville, 2011).

Socio-technical thinking has generally been applied to industrial and business organizations, but we believe it is a basis for considering all information technology applications. For this research, we were particularly interested in using it as a lens to examine assistive technologies, which led to searches in the Association for Computing Machinery (ACM) and the EBSCOhost Education Source and PsychInfo databases for relevant papers using the following terms: assistive technology in K-12 education; assistive technology literacy; special education implementing assistive technology; assistive technology adoption and design barriers; and socio-technical assistive tech design. We selected empirical studies from the last 20 years while adding significant historical works based on their frequent citation to this literature. The majority of studies in this set were U.S.-based but global research was also included where appropriate. Though not a formal literature review, the results enable us to glean how assistive technologies are understood currently, how they are being studied methodologically, and where gaps in our thinking about their design might be bridged by a richer, user-centered perspective.

Assistive technology is a general term that refers to devices, software, and systems designed to increase, maintain, or improve the functional capabilities of people with disabilities (Assistive Technology Industry Association, 2020). While the term often connotes specially designed software and hardware, there are many low-tech options ranging from room layout to pencil grips that make information or learning experiences more accessible to particular users. Too often, the lack of understanding of how learners with disabilities experience the educational environment, at all levels, exacerbates their problems, and prevents us from recognizing the role of technology in tackling the educational challenges for such students. Dawe (2006) reported that about 35% of purchased assistive technology ends up being abandoned and not used, and current Pew Research data suggests people with disabilities avoid the internet at three times the rate of non-disabled users (Pew, 2017), so clearly there is a genuine need for improvement in the design and implementation of information technologies. Recognizing education as a socio-technical system within which user-centered design principles can be applied to assistive technologies may help us address the shortcomings of many current approaches.

The Medical and Social Models of Disability

The recognition and definition of disabilities has a mixed history, but in formal terms, a distinction is often drawn between the medical and social models of disability. For most of the 20th century, the medical model dominated, and it tended to define disabilities as predominantly physical limitations or illnesses that needed to be treated at the individual level. While medical science wrestled with definitions and classifications of mental illnesses from the 1950s onward so as to expand the meaning of disability, the units of analysis continued to be the person or individual and the treatment they should receive. This emphasis on the single person has come to be seen as stereotyping or encouraging a view of people as being outside the norm and defined by their disability (Retief & Letšosa, 2018; Hogan, 2019). Olkin's (1999) summary of the medical model of disability states, "Disability is seen as a medical problem that resides in an individual. It is a defect or failure of a bodily system and as such inherently abnormal and pathological" (Olkin, 1999, p. 26). Critics, disability scholars, and self-advocates have repeatedly argued that

such a medical model stigmatizes individuals and can lead to a derogatory view of those with disabilities (Hogan, 2019).

Such criticisms, as well as a move in medical and social sciences to recognize the impact of the environment and context on human activities, have encouraged an alternative, social model of disabilities. The World Health Organization (2001) defined disability as an umbrella term that formally recognized not only the physical illnesses or individual conditions of the disabled as presented in the medical model, but also the various impairments and restrictions experienced in the world by people that caused them to be "disabled" from participation in many activities. This represents a radical change of perspective, first articulated by British scholar Michael Oliver in the 1970s (Hogan, 2019) who argued that we needed a broader understanding of the experiences of people with disabilities. In doing so, this important shift in the discourse on disability began to include a range of social, political, legal, and attitudinal experiences that also affect the lives of people living with disabilities. Where the medical model viewed disability as a personal impairment which the individual should learn to live around, there is now greater recognition that disability is not a medical condition but the outcome of social and environmental conditions that lack appropriate accommodation to particular impairments. The goal then becomes one of recognizing the barriers to participation by all to overcome what some see as a form of oppression of a group within our society (Retief & Letšosa, 2018; Riddle, 2020).

Berghs et al. (2019) claim that a true social model of disability should offer a means to change views and values, and to uphold the human dignity of disabled people's lives in every aspect of society. The social model has led the advocacy movement to create a view of disability that truthfully acknowledges the reality of the various external circumstances impacting the lives of people with disabilities. Olkin (1999) emphasized the need for continued research on factors that highlight experiences of persons with disabilities, such as practical difficulties caused by the surrounding environment, and the societal consequences of physical encounters and relationships that impact the psychological well-being and future aspirations of persons with disabilities (Olkin, 1999).

Acknowledging the Experiences of Students with Disabilities

From the outset, we believe having direct discussions that capture the perspectives and experiences of people with disabilities can help identify the barriers that lead to a lower quality of life, reduced educational attainment and professional ambitions. The World Health Organization (2020) defines quality of life as "an individual's perception of their position in life…in relation to their goals, expectations, standards, and concerns." Historically, the literature and research on the perspectives of children's quality of life while living with a disability rarely came from the child's perspective, but more from examinations of the parental view. Sylvester (2014) argues such work was mainly carried out in health-related fields, and emphasized the challenges and stressful impact on "parental functioning" in the context of living with a disabled child, not the experiences of the disabled children themselves.

Other studies explored disabled children's health-related quality of life but relied heavily on the parent's views or both the parent's and child's view, but rarely the views of the child alone. While the views of both are valuable, the results suggest there may be some differences between each. For example, the studies by Abbott (2012) and Sylvester (2014) reveal that parents typically rate the child's quality of life differently than the child. This should not particularly surprise us, but the researchers observe that parental views in such studies tend to dominate the data

collection and interpretation of results. Further, in studies where the views of so-called "disabled" and "non-disabled" children are captured by surveys, it is not uncommon for researchers to report that parents completed the forms. From a user-centered perspective, there is clearly a need for more direct input from those experiencing impairments if we are to really understand their quality of life and develop options to improve their situation.

A fundamental tenet of human-centered design is to determine the needs and preferences of the users for whom any product or service is being developed (Dillon, 2000). The approach of engaging users in the design process, however, is not simple, and the pressure to design and deliver a product often means the inputs of real users are limited or deemed to be met by superficial or inappropriate evaluations, as outlined in Ritter et al. (2014). However, the education experience (specifically during the K-12 years) has a profound impact on a person's long-term quality of life. Receiving meaningful education, having appropriate social interactions between peers and teachers, and participating in an inclusive, accessible environment impacts how students with disabilities perceive themselves and their potential to pursue opportunities. Currently, there is a shortage of data on the real-life experiences of learners with disabilities to help us design and implement better technological infrastructures to support their education. In the following sections we outline key themes from the literature we surveyed.

Social Inclusion and the Idea of 'Normalcy'

Social relations, or friendships, are highly valued among young children—with or without disabilities. Unfortunately, children with disabilities experience more barriers and difficulties in making and maintaining friendships. Sylvester (2014) asked children with disabilities whether there was anything their non-disabled peers could do at school that they would also like to do, and the most common answers were having friends or being included more in social activities. This desire to lead a "normal" life and to be included in society's conceptions of normal is a reccuring theme when exploring the views people with disabilities have on their own social lives (Ashby, 2010; McMillen, 2002).

In the Ashby (2010) study, 'normalcy' was described as "an elusive phenomenon" affecting students in multiple and complicated ways. For example, some students had physical disabilities, others had learning impairments, and some had communication or verbal disabilities that were regarded as "unusual" and "different" by their peers and instructors. Studies frequently show that being labelled as a "person with disabilities" in a social setting leads to being seen and treated in a different way, and such individuals frequently report they experience alienation, ableism, and segregation in social environments or gatherings (Ashby, 2010; Karisa et al., 2020; McMillen, 2002; Sylvester, 2014). It should not surprise us then that students with disabilities sometimes reject the support or assistance provided in an attempt to maintain anonymity and not be singled out as different. Ashby (2010) concluded that "if more students were granted access to alternative support, and modifications were more broadly available to all students perhaps [students with disabilities] would [be] more likely to embrace the support when it was provided" (p. 355). Clearly there is a design and implementation challenge here to create inclusive learning environments, from classrooms to technology, that treat all learning styles and needs as routine.

Increased Exclusion through 'Special' Education

Students with disabilities are often targeted by well-intentioned interventions, technological or otherwise, that are frequently labelled "special." In the U.S., special education focuses on diagnosis followed by instructional plans to "correct" the reported differences in students with disabilities— much like the medical model (Karisa, et al., 2020). A concern special education faces is further excluding students with disabilities from normal learning opportunities and segregating them from the mainstream education environment. Categorizing students based on such intervention plans often results in their experiencing school only within these confines. Karisa et al. (2020) argue the inclusion of students with disabilities in the school system should be the "catalyst" to adopt a universal learning design environment that "caters to the needs [of learners], not a motivation to provide a separate schooling system parallel to the mainstream one [where] special education sustains ableist assumptions about disability through longstanding practices of categorization and separation of children according to deficits" (p. 1520). From this perspective, "special" education is well-intentioned but like many interventions or designs, it leads to unintended consequences.

Even when learning issues are identified and a plan developed, there are numerous implementation challenges. Ashby (2010) studied education access for students with disabilities in middle school and observed a lack of meaningful education provided to students with disabilities even with limited education plans provided. Students with disabilities are often expected to perform in class and complete assignments that mimic the appearance of their non-disabled peers rather than encouraging the adoption of more effective methods that cater to individual needs of the student. There are long-term consequences as studies repeatedly show that students with disabilities have lower expectations of either gaining qualifications or attending and succeeding in higher education (Sylvester, 2014). Clearly, there is significant work to be done to address this outcome.

The Socio-Technical Context of Assistive Technology

Assistive technology can be either low- or high-tech hardware or software that can help people who have difficulty communicating through speaking, typing, and writing; additionally, tools can aid users by increasing their functional capabilities in remembering, seeing, hearing, walking, learning, etc. (Assistive Technology Industry Association, 2020). As technology mediates more and more educational offerings and learning experiences, there is an opportunity to individualize and tailor instructional opportunities while maintaining learning contexts and environments that support collaboration and inclusion.

While research supports the view that successful assistive technology interventions can increase the quality of life for people with disabilities (McMillen, 2002), there are continuing obstacles to widespread technology adoption and implementation that speak to the complexities of any technological solution in education. A common concern expressed in the literature is whether there are sufficient resources for technologies that can not only assist but enable the adoption of the learning and educational retention process (Morash & Siu, 2017; Shaheen & Lazar, 2018). Cost will always be an issue to address but we must do more than treat the technology as an independent vector in the educational process, one that simply needs to be used by a learner to ensure improvements. Rather, we need to consider the educational environment in which technology resides as a socio-technical system of interdependent technical and social structures, as noted in other research studies (e.g., Eason, 1988). This framing requires us to consider the

multiple stakeholders involved (students, instructors, parents/families, schools and communities) as co-existing in an organizational context that both shapes and is shaped by the technologies involved. All stakeholders play a role in the processes of transformation that the educational organization, conceived broadly, is aiming to enable. The focus here extends beyond a student and a technical intervention, to include other students and teachers, even if not direct users, as well as the contexts of use beyond the classroom, such as the student's home. Socio-technical thinking treats successful design and adoption of technologies as an extended, multi-actor process that is not simply a product of functionality or usability but an outcome dependent on all stakeholders seeing more positive than negative value in its use. In the context of education, socio-technical theory requires us to recognize the stakeholders and the collective engagement required for success, and suggests that any technical solution will involve more than design and delivery, it requires training and ongoing support to function as intended (Baxter & Sommerville, 2011).

Education is a Collective Process

Research suggests that the diffusion of assistive technology in K-12 education has been slower than anticipated (Shaheen & Lazar, 2018). Teachers are typically viewed as the driving agents that support students and their families for the integration of assistive devices into the child's daily life (Sharma et al., 2020; Torrato et al., 2020). Research confirms the importance of teacher training for successful exploitation of assistive technologies. Chen et al. (2014) reported that education provided by instructors with less training and experience resulted in less knowledge and skill development in their students when interacting with assistive devices.

Teachers are one key stakeholder group and preparing them is a training challenge within schools, but ensuring that parents of students with disabilities understand how their children are using assistive technologies is vital in exploiting the power of new tools to enhance education. The recognition of multiple stakeholders requires a broadening of our views of technology literacy. Genuine assistive technology literacy involves being able to refer students and their families to all resources and professionals; knowing how to choose or recommend an appropriate device; enabling the process of funding for suitable devices; and, knowing how to integrate any device into the lives of students with disabilities (Morash & Siu, 2017). Low levels of understanding of assistive technology's types and meaningful applications often leads to device abandonment (Dawe, 2006; Shaheen & Lazar, 2018). In short, socio-technical thinking encourages us to recognize that the impact of assistive technology is mediated by the stakeholders involved, and to ensure the greatest positive impact, we need to engage the broader social network in which a learner resides to help inform the design and implementation of positive learning experiences.

Adoption is an Extended Process

A further tenet of socio-technical and user-centered thinking is that a technology is not adopted in a simple, one-time process, but over an extended period of time that necessarily involves trial and error, training, adjustment, and on-going support as routine practices are implemented. Generally, the introduction of assistive technology is the responsibility of a team of professionals that may include doctors, regular and special education teachers, occupational therapists, speech pathologists, etc. (Assistive Technology Industry Association, 2020). We need to, however, treat the process as extended, not just a matter of diagnosing a need and selecting the technological "solution." Socio-technical theory makes the case that successful adoption

invariably involves uses that were different than initially imagined, that a new technology changes the group that uses it, and that real acceptance by all stakeholders only comes when outcomes can be identified over time. As Eason (1988) argues, socio-technical thinking reminds us that exploitation of any technology is necessarily evolutionary, not a one-step activity.

Adopting assistive technology in K-12 classrooms ensures students with disabilities have the chance to develop new skills, engage in learning opportunities, and ensures that educators have the ability to customize their teaching material to accommodate individual learning needs (Torrato et al., 2020). Efforts to prepare teachers for interacting with students with disabilities typically concentrate on diagnosis and intervention in the classroom; however, there is minimal attention given to the adoption and integration of assistive technology in the classroom (Ashby, 2010; Chen et al., 2014; McMillen, 2002; Shaheen & Lazar, 2018). Additionally, devices that do not show direct usefulness out-of-the-box are less likely to be adopted and more likely to be abandoned, which hinders academic success and possible future skill development (Morash & Siu, 2017).

Dawe (2006) presents a case of assistive technology adoption where parents were encouraged to purchase an assistive device during their child's senior year in high school; however, by the time the device was received the child was near the end of their school year. Because of this, educators did not successfully integrate the new device into the last few months of instruction, leaving parents with no training or support on how to best assist their child in utilizing the device after graduation. In short, without the necessary social support, students and parents were left ignorant of the functionalities of the device, effectively rendering it useless. McMillen (2002) found that people with disabilities experienced a very cumbersome process in adopting assistive technologies later in life due to the absence of resources provided in their earlier years. This is also a common issue in K-12 environments as educators are given limited resources, and as a result are encouraged to provide their students with devices that are readily available and less costly; in addition, if students do not show any signs of improvement within a short period of time, teachers are pressured to repossess the assistive device and give it to another student in need rather than allow the student more time to acclimate to the assistive device (Dawe, 2006). These barriers to funding, lack of resources, and mishandling of device training periods hinder educators' ability to serve as the gatekeepers for the adoption and integration of assistive technology that have the potential to provide students a better quality of life.

Designing Based on the Range of Stakeholder Needs

Socio-technical thinking argues that while all users are stakeholders in a technology, not all stakeholders are direct users (Eason, 1988). People with disabilities are the direct users of assistive technology, but they are not the only stakeholders that should be considered when designing these devices. Both individuals with disabilities and their close social networks interact with assistive technology, especially when children are the primary user. Oftentimes, parents and friends take on the role of facilitating the integration of the device into the child's life. Again, a fundamental principle of user-centered design is the consideration of how people will be affected by the design beyond the direct interaction any one user has with it (Ritter et al., 2014). For example, if parents or teachers cannot understand instruction materials associated with the device, the usability of the technology is greatly reduced and the onus is placed on the learner directly to figure it out.

Furthermore, designers should approach the creation of assistive technology with a holistic view in relation to the user's environment (Vardouli, 2016). In other words, designing assistive technology should not be solely about the interaction between the user and device in some idealized location; rather, the design should also consider how users will integrate the device into their daily life and the range of environments, both school and domestic, in which the learner resides. If the user continually needs assistance with set-up, or requires adjustments to be made along with arranging space to make those adjustments every time it is to be used, this can cause users to feel burdensome or unnecessarily intrusive on others, leading to a negative social environment experience, a constant problem in special education. Only by observing users interacting with a design in situ can we determine if the technology works well for its intended users and where it interfaces with all stakeholders in the process of adoption.

Research Implications in Assistive Technology and Adoption Process

With continuous innovations and improvements of assistive technology and the widespread use of computers in all areas of educational delivery, it is an important time for us to think seriously about how we can design and implement better and more just solutions for all learners. Too often the application of assistive technologies is isolated, narrowly targeted, and fails to recognize and accommodate the lived experiences of real people. Further, the failure to envisage assistive technology as part of a socio-technical system involving teachers, paraprofessionals, family members, and other students, inside and outside the classroom over an extended period of time, leads to well-intentioned but flawed implementation, as evidenced too often in the literature. Without learning from the lived experiences of users, we are continually limiting our own understanding of how to design better environments. As a result, the opportunities and aspirations for people with disabilities to grow independently, lead abundant lives, and to meet their needs in a societal context will remain limited. Incorporating a socio-technical approach to the adoption of assistive technology in an educational environment differentiates the use of a device beyond a mere human-technology interface to acknowledging the interrelatedness between people, organizations, and technology, and how that relationship affects the experience of users and associated stakeholders in their given environment.

We believe that adopting a richer, socio-technical framing of learner experience would encourage a deeper appreciation of the dynamics that shape outcomes. Recognizing all stakeholders, acknowledging the experiences of learners and instructors, and then designing and implementing assistive solutions in a truly user-centered manner offers a path forward. Indeed, by considering assistive technology less as an effort to remediation or special education, but as another example of general technology design with an emphasis on the same values we would wish to be applied everywhere (a design which is, for example usable, inclusive, acceptable, and sustainable) then we might move assistive technology from the sidelines to join the more mainstream efforts at participatory and human-centered design, which form a core part of the research efforts on inclusive design. Designing with the intent of universal use has the potential to augment the learning experience for more than just disabled students, enabling the creation of a more inclusive, collective educational environment for all.

Acknowledgements

References

Abbott, D. (2012). Other voices, other rooms: Reflections on talking to young men with Duchenne Muscular Dystrophy and their families about transition to adulthood. *Children & Society*, *26*(3), 241-250. https://doi.org/10.1111/j.1099-0860.2012.00437.x

Ashby, C. (2010). The trouble with normal: The struggle for meaningful access for middle school students with developmental disability labels. *Disability & Society*, *25*(3), 345-358. https://doi.org/10.1080/09687591003701249

Assistive Technology Industry Association. (2020). *What is AT?* https://www.atia.org/home/at-resources/what-is-at/

Baxter, G. & Sommerville, I. (2011) Socio-technical systems: from design methods to systems engineering. *Interacting with Computers*, *23*(1), 4-17. https://doi.org/10.1016/j.intcom.2010.07.003

Berghs, M., K. Atkin, Hatton, C., & Thomas, C. (2019). Do disabled people need a stronger social model: A social model of human rights? *Disability & Society*, *34*(7-8), 1034-1039. https://doi.org/10.1080/09687599.2019.1619239

Chen, M.C., Chu, C.N., & Ko, C.-C. (2014). The literacy of integrating assistive technology into classroom instruction for special education teachers in Taiwan. In K. Miesenberger, D. Fels, D. Archambault, P. Peňáz, & W. Zagler (Eds.), *Proceedings of the ICCHP Conference on Computers Helping People with Special Needs, Vol. 8548*, (pp. 350–357). Springer. https://doi.org/10.1007/978-3-319-08599-9_53

Dawe, M. (2006). Desperately seeking simplicity: How young adults with cognitive disabilities and their families adopt assistive technologies. In R. Grinter, T. Rodden, P. Aoki, E. Cutrell, R. Jeffries, & G. Olson (Eds.), *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems-CHI '06*, (pp. 1143-1152). *Association for Computing Machinery*. https://doi.org/10.1145/1124772.1124943

Dillon, A. (2000) Group dynamics meet cognition: combining socio-technical concepts and usability engineering in the design of information systems. In E.Coakes, D. Willis, & D. Lloyd-Jones (Eds.), *The new socio-tech: Graffiti on the long wall*. Springer, pp. 119-125. https://doi.org/10.1007/978-1-4471-0411-7

Eason, K.D. (1988). Information technology and organisational change (1st ed.). CRC Press. https://doi.org/10.1201/9781482275469

Hogan, J. Andrew. (2019). Moving away from the "Medical Model": The development and revision of the World Health Organization's classification of disability" *Bulletin of the History of Medicine*, *93*(2), 241-296. https://doi.org/10.1353/bhm.2019.0028

Hogan, J. A. (2019). Social and medical models of disability and mental health: Evolution and renewal. *CMAJ: Canadian Medical Association Journal*, *191*(1), 16-18. https://doi.org/10.1503/cmaj.181008

Karisa, A., McKenzie, J., & De Villiers, T. (2020). To what extent is the schooling system willing to change to include disabled children? *Disability & Society, 35*(9), 1520-1526. https://doi.org/10.1080/09687599.2020.1809351

McMillen, AM., & Söderberg, S. (2002). Disabled persons' experience of dependence on assistive devices. *Scandinavian Journal of Occupational Therapy, 9*(4), 176–183. https://doi.org/10.1080/11038120260501208

Morash, V. S., & Siu, YT. (2017). Social predictors of assistive technology proficiency among teachers of students with visual impairments. *ACM Transactions on Accessible Computing, 9*(2), 1–27. https://doi.org/10.1145/2999569

National Center for Education Statistics. (2017, May). Disability rates and employment status by educational attainment. Annual Reports and Information Staff (Annual Reports). https://nces.ed.gov/programs/coe/indicator_tad.asp

Olkin, R. (1999). What psychotherapists should know about disability. Guilford Press.

Pew. (2017) Disabled Americans are less likely to use technology. Pew Research Report. https://www.pewresearch.org/fact-tank/2017/04/07/disabled-americans-are-less-likely-to-use-technology/

Retief, M., & Letšosa, R. (2018). Models of disability: A brief overview. *HTS Teologiese Studies/Theological Studies, 74*(1), 42-50. https://doi.org/10.4102/hts.v74i1.4738

Riddle, C. A. (2020). Why we do not need a 'stronger' social model of disability. *Disability & Society, 35*(9), 1509–1513. https://doi.org/10.1080/09687599.2020.1809349

Ritter, F. E., Baxter, G. D., & Churchill, E. F. (2014). User-centered systems design: A brief history. In F. E. Ritter, G. D. Baxter, & E. F. Churchill (Eds.), *Foundations for designing user-centered systems* (pp. 33–54). Springer London. https://doi.org/10.1007/978-1-4471-5134-0_2

Rogers, E.M. (1995) *Diffusion of innovations*. Free Press.

Sharma, S., Avellan, T., Linna, J., Achary, K., Turunen, M., Hakulinen, J., & Varkey, B. (2020). Socio-technical aspirations for children with special needs: A study in two locations— India and Finland. *ACM Transactions on Accessible Computing, 13*(3), 1–27. https://doi.org/10.1145/3396076

Shaheen, N. L., & Lazar, J. (2018). K–12 technology accessibility: The message from state governments. *Journal of Special Education Technology, 33*(2), 83–97. https://doi.org/10.1177/0162643417734557

Sylvester, D. (2014). A survey of disabled children and young people's views about their quality of life. *Disability & Society, 29*(5), 763–777. https://doi.org/10.1080/09687599.2013.848782

Torrato, J. B., Prudente, M. S., & Aguja, S. E. (2020). Technology integration, proficiency and attitude: Perspectives from grade school teachers. *Proceedings of the 2020 11th*

International Conference on E-Education, E-Business, E-Management, and E-Learning,
(pp. 70–75). ACM Press. https://doi.org/10.1145/3377571.3377624

US Bureau of Labor Statistics. (2020). *Persons with a disability: Labor force characteristics—2020.* https://www.bls.gov/news.release/pdf/disabl.pdf

van Gameron-Oosterom, H. B. M., Fekkes, M., Buitendijk, S. E., Mohangoo, A. D., Bruil, J., & Van Wouwe, J. P. (2011). Development, problem behavior, and quality of life in a population based sample of eight-year-old children with Down Syndrome. *Plos One, 6*(7), 21879-21888. https://doi.org/10.1371/journal.pone.0021879

Vardouli, T. (2016, June 25). User Design: Constructions of the "user" in the history of design research. In Lloyd, P. and Bohemia, E. (Eds.), *Proceedings of the DRS International Conference on Future Focused Thinking,* (27-30). Design Research Society. https://doi.org/10.21606/drs.2016.262

World Health Organization. (2020). *WHOQOL - Measuring quality of life.* https://www.who.int/toolkits/whoqol

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