Learning Disabilities: A Contemporary Journal 18(1), 71-91, 2020

Opportunity in Crisis: The Role of Universal Design for Learning in Educational Redesign

James D. Basham*
Department of Special Education, University of Kansas
CAST

Jose Blackorby
CAST

Matthew T. Marino
School of Teacher Education, University of Central Florida

The COVID-19 pandemic initiated an unprecedented shift in special education practice from brick-and-mortar instruction to online learning. This manuscript explores factors related to the shift and argues the COVID-19 disruption creates an opportunity for systemic educational reform. The Universal Design for Learning framework is presented as a means to proactively anticipate learner variability while redesigning an education system to meet the diverse needs of students with learning disabilities. Issues surrounding FAPE in online instruction, digital inequity, and socioeconomic status are addressed. The article concludes with an example of how an online course, developed using the framework and supported with multiple technologies, can benefit students with learning disabilities.

Keywords: **Universal Design for Learning, K-12 Online Education, Technology, COVID-19, Learning Disabilities**

Introduction

Imagine you are a student with a learning disability (LD) living in a rural community. As the COVID-19 pandemic hit, you were transitioned to online instruction without any forewarning or training. Your parents are home. Your father was furloughed from his job at a meat packing plant, but your mother continues to work from home for an insurance company. She is using her laptop for work. Your parents are stressed and seem angry all of the time. You are forced to complete your online schoolwork using your dad's smartphone. This causes a number of problems. For example, the Internet is slow, and you are kicked out of the system often, leading your teachers to believe you are not attending virtual school. The text is small and the graphics are extremely difficult to discern. In addition, you do not know how to fluently navigate the operating system of the phone when it is working. Technology offers a potential solution to this new remote instruction, but does it work for you?

Another student with LD, named Tamika, is living in an urban environment and experiencing similar, yet distinct challenges related to the home-school experience. Tamika is in tenth grade and resides in a two-bedroom apartment on the third floor of a low-income housing unit. She lives with her mother, her mother's boyfriend, and four siblings, aged 13, 10, 8, and 3. Her mother maintained her job at an online shopping fulfilment center, which is within walking distance of the apartment.

*Please send correspondence to: James D. Basham, Ph.D., Department of Special Education, University of Kansas, Joseph R. Pearson Hall, 1122 W Campus Rd, Lawrence, KS 66045, USA, Phone: 785-864-4954, E-Mail: jbasham@ku.edu.

She is fortunate to be working 12-hour shifts during the pandemic. Her boyfriend is currently unemployed and spends his days away from the apartment looking for work. As a result, Tamika is caring for all of her siblings. Each day she walks to the local food pantry where the children are given breakfast and lunch. All five children share one school computer, which the school provided along with a hot-spot WIFI connection. The family was able to garner a second computer from their church. However, much like their rural counterparts, the connection is slow and unstable. The hot-spot freezes and must be rebooted to resume the connection if more than one sibling tries to stream information at a time. Tamika takes care of each of her siblings before herself, leaving her to do her schoolwork late in the day after she is already exhausted. She says this is because she needs to care for her siblings, but in reality, she finds it easier to take care of her siblings than focus on the disorganized manner in which her schoolwork is presented. As a result, she falls further and further behind in her studies.

The early part of the 21st century has been one of *disruption,* where entirely new ways of communicating, shopping, and working have emerged (Christensen, 2016). These dynamic changes now occur at unprecedented speed. For example, in the music industry, it took 90 years to move from a model where music was bought and sold on vinyl records, to cassette tapes, to digital CDs, and eventually to the streaming model in use today (Darlington & Darlington, 2018). The change from analogue to digital music took 50 years. The change from CDs to music streaming took half the amount of time. In education, there have been calls for disruption for some time, with accusations schools have been too slow to adapt to the technological, economic, and political changes happening in the world (e.g., Christensen, 2010; Freire, 1974; Schwab & Davis, 2018; Slavin, 1990). Significant resources from governments, philanthropies, and the private sector have flowed into the system as pockets of innovation emerged. Despite this fiscal and technological resource infusion, schools have exhibited only incremental change.

In the spring of 2020, the COVID-19 pandemic struck. The rapid spread of the virus infected millions, killed hundreds of thousands, stressed health systems to the breaking point, and led to the worst economic collapse since the Great Depression (Izvorski et al., 2020). Within a few weeks, the pandemic changed the face of the education system. Schools from around the globe rapidly removed 1.6 billion learners from 193 countries from face-to-face environments (UNESCO, 2020). This means 91.3% of the global student population were out of school due to the pandemic. Within the United States, 48 of 50 states and 4 territories ordered schools closed for the remainder of the academic year, impacting 56.6 million students (Education Week, 2020). In the United States, students with disabilities comprise approximately 12% of the student population (U.S. Department of Education, 2019). This means nearly 2.5 million students with specific learning disabilities experienced an unprecedented shift to online instruction over the course of one-week.

While this rapid response was necessary for public health, it uncovered both expected and unexpected consequences within the education system. Across the United States, school districts reported they had lost touch with as many as 40% of their students (Bowie, 2020; Goldstein et al., 2020). Education systems throughout the country found themselves on the frontline of ensuring families had access not

only to learning resources, but also food sources necessary for survival. Educators quickly shifted to technology-based instruction. Many were unprepared without any formal training. School districts realized educators could not afford or did not have their own devices or adequate Internet connectivity for online teaching (Burnette, 2020). Many families reported limited resources, such as a lack of technological devices and limited bandwidth to support online instruction and assessment (Herold & Kurtz, 2020). Parents reported supporting their children in online learning was difficult because of the design of the environment, the difficulty of the content, a lack of technology-based pedagogical skills, and because, if they still had jobs, they were also attempting to work from home (Gallagher & Egger, 2020).

This article explores the context of the educational system at the height of a pandemic. Students with LD are first "learners", identified with a disability, within a larger system in need of major reform (Dorn et al., 2020). While it is critical to conduct research to support students with disabilities, a preliminary step is to ensure the underlying foundation of education is based on stable and substantiated assumptions, models, practices, and tools established to meet the needs of the current age. This article highlights how the underlying foundation and associated assumptions of the current education system were already unstable prior to the pandemic and minimally require evolutionary, if not disruptive change, as we redefine the new normal (Goldstein et al., 2020). Specifically, the gaps apparent in the current system for learners with disabilities will only grow wider if steps are not taken to embrace the realities of modernity. The authors argue the Universal Design for Learning (UDL) framework along with the integration of modern technology begins to provide a proactive mechanism to account for learner variability and maximizes student learning. While the long-term impacts associated with the pandemic are yet to be analyzed, the global education community must determine whether this is a temporary disruption to business-as-usual or a seismic shift in educational practice.

Traditional Education Systems

The pandemic provided parents and other caregivers with a glimpse into what it means to be an educator, special educator, paraprofessional, or guidance counselor. Parents quickly found it was more complex than anticipated. Communities began learning how the education system serves as a frontline social agency. On this frontline, educators take on the role of street level bureaucrats (Weatherly & Lipsky, 1977), balancing the requirements of teaching the formal curriculum and the need to support the community with limited authority, time, or resources.

Schools and families have always shared contributions to the education of children. In the best cases, communication and collaboration between educators and parents can support students' academic and social development. Business-as-usual was students coming to physical schools under the supervision of professionals for education and caretaking. This allowed parents or caregivers to work or participate in other events within the community.

During the crisis, these relationships changed overnight for all parties. Teachers needed to develop online lessons and practices while parents and caregivers were pushed into the role of co-educator. In online education, parents are heavily involved, responsible for logistics, supporting instruction, and monitoring progress

(Basham et al., 2015). This is complicated by the work status of parents/caregivers, some of whom have the flexibility and capacity to take on these new roles and others who could not (Hill, 2020).

In the post-pandemic era, assumptions, models, practices, and tools will need to be reassessed and likely changed as educators, students, and families work between traditional and online settings. Questions emerge such as how the current and future education workforce will be prepared; whether equity-driven education systems will be required to ensure students have the technologies and skills needed to work ubiquitously between traditional and online settings. A need for a stronger school/home connection might encourage more K-12 special education services in the home, such as during early childhood special education. Finally, research funding might place enhanced emphasis on underlying theories and policies of brick-and-mortar education practices.

Education as a societal practice is a wicked problem. According to Rittel and Webber (1973), a wicked problem is a problem where there is no single best solution because there is no definitive means to encapsulate and solve the actual problem. Additionally, when a solution is implemented it unravels new wicked problems that are often unforeseen prior to implementing the solution (Rittel & Webber, 1973; Zhao et al., 2019).

Solutions to the Wicked Problem of Education

There has been significant policy attention and investment in improving learner outcomes over the last two decades. The Every Student Succeeds Act (ESSA; 2015) and the Individuals with Disabilities Education Act (IDEA; 2004) both provided a framework for the adoption of modern content and competency standards by states, who established goals and benchmarks for performance. The laws required all students to be held to those standards, and provided accountability systems to measure progress towards those goals. In addition, there have been multiple large scale initiatives focusing on critical challenges such as the Office of Special Education Programs (OSEP) Results Oriented Accountability (ROA) and the more recent Rethink Initiative, the Reading First program, as well as Multi-Tiered Systems of Support (MTSS) and Response-to-Intervention (RtI) efforts, all of which have mobilized schools to improve practice and outcomes. Further, in the last decade, there has been far greater attention to the central role of non-cognitive factors in education, such as growth mindset (Dweck, 2006), grit (Duckworth et al., 2007; Hochanadel & Finamore, 2015), and social emotional learning (Yeager, 2017).

Each of these efforts have been supported with financial resources. Substantial investments exceeding two billion dollars have been made by the federal government (e.g., Education Innovation Research, Investing in Innovation, Race to the Top), philanthropic foundations (e.g., Chan Zuckerberg, Gates Foundation), and the private sector (e.g., Pearson, Scholastic). The venture capital community invested $1.4 billion in education technology startup companies in 2018 alone (Wan, 2019). Right or wrong, the global education community has made substantive investments to enhance technology-enriched education opportunities. Unfortunately, despite this significant legislation, investment, and innovation, our results have been uneven at best, and unacceptably disappointing at worst.

International comparisons such as PISA continue to indicate U.S. students' mediocrity in reading, mathematics, and science when compared to international peers (Organization for Economic Cooperation and Development [OECD], 2019). The most recent NAEP, known as the Nation's Report Card, shows that only 35% of 4th graders and 34% of 8th graders are proficient in reading, and 41% of 4th graders and 34% of 8th graders are proficient in mathematics (National Center on Education Statistics, 2019). Similarly, a review of states ESSA accountability reports show uneven and slow improvement in most states with performance gaps among subgroups remaining large. For example, in 2019, 32% and 29% of tested students in California scored proficient or above on the Smarter Balanced Assessment in reading and math, respectively (California Department of Education, 2019). Across the board, these data are especially alarming for students with disabilities, who continue to lag behind typically developing peers in academic and social outcomes. In 2019, just 6% of students with disabilities were proficient or above in reading and math, and only 66% graduated with a diploma (California Department of Education, 2019). The effects of the school closures related to COVID-19 crisis will have lasting effects on student learning. It is estimated that the 'COVID' slide will range from 6 months to 12 months and magnify existing gaps across racial and class lines (Dorn et al., 2020). These disheartening results underscore the inequity in our education system and the need for disruptive reform.

The Special Education Paradox

The special education field has no shortage of researchers, innovators, and developers who have generated educational approaches and methods intended to remedy these troubling data. Schools today have many models, approaches, and programs to choose from such as, explicit instruction (Hammond & Moore, 2018), strategy-based instruction (Nguyen & Gu, 2013), cooperative learning (Slavin, 1983), problem-based learning (Dolmans et al., 2016) game-based learning (Israel et al., 2016), peer mediated instruction (Fuchs et al., 1997), executive function training (Nomi et al., 2017), applied behavior analysis (Iwata et al., 2000), and success for all (Slavin, 1996). Each of these instructional practices has some level of research evidence suggesting they can be effective for students with disabilities. Except for game-based learning, these practices have been studied and utilized in traditional brick-and-mortar environments. How these practices translate beyond the traditional classroom to more online and blended settings remains unclear.

Technologies such as smartphones and other mobile devices have become ubiquitous throughout society (Jingrong et al., 2018). These technologies have the potential to provide students with LD with enhanced learning outcomes. Researchers have demonstrated learners with LD are more engaged and motivated to learn using technology-based instruction when compared to traditional approaches (Marino et al., 2014; Vasquez et al., 2015). Numerous technologies and pedagogical practices have been investigated during the last decade ranging from online instruction (Lorenzo et al., 2013), video modeling (Scheflen et al., 2012), serious video games (Israel et al., 2016), using robots (Saadatzi et al., 2018), virtual reality (Garland et al., 2012), mobile technologies and augmented reality (Lumbreras et al., 2018), and personalized learning (Basham et al., 2016). According to Basham et al. (2016) personalized

learning supports the design of learning experiences that integrate an individualized instructional approach in the pace, process, and focus for each learner. Research conducted by Basham et al. (2016) found personalized learning environments are active, flexible, and align to the core tenets of UDL. For instance, within these environments students are taught how to learn, provided with multiple flexible ways to engage with the content, supported with multiple ways to learn key concepts and vocabulary, then provided with a variety of ways to demonstrate understanding. Overall, these studies demonstrated how effective practices combined with technology can enhance learning outcomes for students with disabilities. However, the education system continues to underutilize technology to effectively support learner variability, including but not limited to students with LD (Marino et al., 2013).

In a long-standing research paradox, school districts have many promising evidence-based practices. Yet at scale, schools tend to produce incremental gains in student learning that are not reflective of the rapid iteration of technologies they have procured. This continued failure to adopt research suggests a need to consider learner variability within the local context while building capacity to implement and sustain research-based practices, such as practices associated with improvement science (Bryk, 2009; Bryk et al., 2015; Lewis, 2015).

Variability is Greater Than We Thought

Just as the 20th century economy built factories, offices, and products for the average worker or average citizen, our current education system remains focused on an average student (Christensen et al., 2010). This is illustrated in age-based standards, which expect all students of a particular age to learn exactly the same content, at the same point in their development, and more or less at the same rate (Basham et al., 2016; Zhang et al., 2020). Variability in classes around the world suggests this assumption is questionable at best (Zhang et al., 2020; Zhao, 2018). In his book *The End of Average,* Todd Rose illustrates the notion of jaggedness, in multiple sectors including education, where individuals vary tremendously in physical, psychological, cognitive, and attitudinal dimensions but are not average on any one of them (Rose, 2016). A generation of research has consistently pointed to variability within and across disability groups, which creates challenges in identifying common practices to reach all students. For example, multiple researchers have identified challenges distinguishing between students with learning disabilities and other non-identified low achieving peers in general education (Fuchs et al., 2004; Jenkins, 1987; Marino et al., 2014).

While standards provide a peer-reviewed framework to teach and assess student learning, they also have unintended consequences. Our standardized system - standards, curriculum and materials - create incentives to prioritize the teaching of skills measured on accountability systems, whose results suggest poor outcomes for unacceptably large numbers of underrepresented students and create a deficiency-based model of education (Zhao et al., 2016). At its most extreme, one can argue a system designed for the average is designed for no one (Zhang et al., 2020; Zhao, 2018).

For students with disabilities and those of other diverse learning needs, hurdles within the system are numerous. The current special education system was de-

veloped, and in many places is interpreted, as a separate track for students who do not conform to the average (Skrtic, 1991; Zhang et al., 2020). For instance, while it might be agreed that students should be able to read, modern literacy requires much more than processing text. This new literacy requires deciphering information through multiple mediums such as text, video, audio, graphics, emojis, and interactive simulations. A future-ready education system must recognize the normative practices of today while making strides to meet the needs of tomorrow. Recognizing the variability inherent in learning, the education system must consider how multiple pathways of learning and assessment can be integrated to support a wider range of variability.

Inequality & Socioeconomic Status

The inequality of schools and learning environments has been a persistent issue throughout time. Coleman (1966) released a bellwether report that was supposed to help reshape the U.S. education system. However, a recent report by Meotto (2019) argued today's schools remain separate and unequal despite the 65-year time lapse since the passing of the Brown vs. Board of Education Supreme Court decision. Mervosh (2019) reported more than half of the schoolchildren in the U.S. are in racially concentrated school districts where white school districts outspend nonwhite districts by 23 billion dollars annually. Inequality in schools and communities has been magnified during the pandemic, with some districts moving to online instruction, while others have moved to paper and pencil packets, which further the digital divide (Herold & Kurtz, 2020). The results of this inequity translate to statistically significantly lower scores for nonwhite students in almost every academic content area.

While hardly surprising in an era of unprecedented income inequality, the pandemic has exposed, and magnified how communities, schools, and families face and respond to this major shift in society. Some families have adequate wifi, technology, physical space, and flexibility for parents to act in a co-educator role. For others, these are difficult conditions to meet, particularly for an extended period of time. In addition, the economic fallout of the crisis has many families rightly focused on basic needs and crisis management where the world of lessons and projects appear less relevant.

Low socioeconomic status (SES) leads to a systemic negative impact on critical learning outcomes in the education system. Beyond the obvious economic concerns, the SES of students and families has long been correlated to academic performance and disability status (Morris et al., 2012; O'Connor & Spreen, 1988). SES has also been associated with issues of racial disproportionality in special education identification (e.g., Shifrer et al., 2011), high school completion (Benner et al., 2016; Polinado et al., 2013), parent involvement in schools (Brenner et al., 2016; Hill et al., 2004), with later life implications related to higher education and career goal attainment (Walpole, 2003). Additionally, SES has a strong association with increased trauma (Hussey et al., 2006; Read et al., 2011; Santiago et al., 2013) and lifelong inequities, especially in African American and Latino populations in lower SES groups (Myers et al., 2015).

As the education system makes decisions to support the ongoing issues with COVID-19 or post-pandemic services that support societal enhancements, it should consider the comorbidity of SES on education and life outcomes. Ensuring online

access, including technology support for continuous learning opportunities during stay at home orders may not be enough. Supporting parents and families in understanding the importance of learning and school attendance in association with life outcomes is critical (Polinado et al., 2013). Ensuring proactive support for all students and families related to mental health (Read et al., 2011), especially during times of uncertainty and high stress will be important to consider.

Moving Beyond a Fixed, Standards-Based, Academic Curriculum

Educators from around the world are learning the online medium offers new possibilities for the design of learning environments and experiences. This new medium expands formalized learning from the structure of the classroom and distributes it across the learners to multiple digital and physical environments (e.g., school, home, coffee shops, libraries, and parks). The transformation supports multiple new learner and educator digital and physical interactions not accounted for in traditional educational research (Basham et al., 2015). An emerging potential for this environment is to move away from a one-size-fits all fixed curriculum. These new, more personalized, models allow learners to learn at their own pace, using not one, but multiple curricular pathways (Basham et al., 2015; Basham et al., 2016a). While the new models provide a great deal of opportunity for all students, they also offer challenges for some students, especially those with LD.

For instance, research supports a heightened emphasis on the importance of affective and metacognitive skills for students with LD (Hall & Webster, 2008). Affective skills, sometimes referred to as soft skills, are necessary for students to cooperatively work together to solve problems. They include the ability to interpret the meaning of body language (e.g., a person with a scowl on their face and arms crossed vs. a smile and arms open), interpreting conversational cues to participate in reciprocal communication, and the ability to receive and value constructive critical feedback (Casey & Fernandez-Rio, 2019). Metacognitive skills include an individual's ability to understand which learning strategies should be used at a given point in time. Metacognition (associated with and sometimes called self-regulation) is considered a behavioral expression of executive function, which includes planning, organization, working memory, task initiation, set-shifting, impulse control, and self-monitoring (Diamond, 2013). These skills are considered essential for students with LD who choose to pursue higher education (Flannery et al., 2017).

As the education system begins to design learning environments that embed a mix of face-to-face and digital learning experiences, integrating supports and encouraging use of metacognition is critical (Basham et al., 2015; Basham et al., 2016a). Early work in personalized learning environments showed higher than expected academic growth for students with disabilities. This work integrated multiple strategies for supporting independence in metacognitive and affective skill areas (Basham et al., 2016a; Basham et al., 2017). As the education system is redesigned for the future, challenges regarding how to scale and support more personalized learning through the design of digital or blended learning environments emerge for all students, including those with learning disabilities.

Legal Entitlement to Services Under IDEA

Within the U.S., IDEA (2004) provides the general structure for identifying and supporting students eligible to receive special education services. This law outlines the requirements associated with Free and Appropriate Public Education (FAPE), such as requiring individual education programs (IEP), ensuring access to the general education curriculum, and guaranteeing those services occur in the Least Restrictive Environment (LRE). In the best of times, there is considerable variation across schools and students in terms of services provided. Most students with disabilities spend a majority of their time in general education settings. However, it is still common for students to receive pull-out instruction from special educators and other support staff when receiving supplemental services (e.g., speech, occupational, or behavioral therapy). The coordination of these services is challenging in normal times and amplified during disruptive periods.

Generally, the laws and protections that support students and families in the special education system were developed prior to the digital age and not under pandemic conditions. Special education service delivery is especially challenging during the pandemic. If delivered, all services would be online. Previous research conducted in the Center on Online Learning and Students with Disabilities (COLSD) found that LRE was complicated online and often associated with the online technology being used and the educator's interpretation of placement (Basham et al., 2015). For example, in an online setting a student's access to general education peers may be associated with an educator turning communication (on/off) between a student with a disability and his/her peers. Additionally, while some support services could be supported in online settings, many were still provided by a professional outside the student's home (e.g., home school district; Basham et al., 2015).

Similarly, this situation has raised the issue of accessible materials, and how they are produced and used. Schools and parents both are struggling to understand what is and what is not required by IDEA during the crisis. Federally funded technical assistance centers are seeing record attendance at webinars about requirements, assessment, accessibility, and online education (National Disability Rights Network, 2020). In spite of this, advocates fear that many students with disabilities are not receiving services. These fears are not without merit. COLSD conducted a state-by-state policy scan and found that states varied in their policies around students with disabilities accessing online education services (Basham et al., 2015; COLSD, 2016). In addition, the scan found that only 2% of the U.S. states and territories clearly articulated compliance monitoring procedures for online environments (Basham et al., 2016a).

Other Challenges in Current Digital & Online Environments

Two additional concurrent issues are critical prior to reconceptualizing the educational system. These include the design of technology systems and the ability of (special) educators to effectively use them to promote efficacious learning experiences. First, research in online learning indicated the technology, rather than student and family needs, often drove the learning interactions for students with disabilities in online learning environments (Carter & Rice, 2016). While sensory accessibility is a primary focus of accessibility standards, these standards often overlook the range

of learner variability associated with students with disabilities (Basham, 2016b). Future technologies should consider designs that support a wider range of variability. Basham et al. (2016b) identified the potential for the UDL to provide a basis for these designs.

Second, over the last two decades numerous initiatives have been undertaken to support educators in their understanding and use of technology. Unfortunately, the move to emergency online learning demonstrated many educators remain unprepared to use technology in support of learning, especially related to students with disabilities. Research in online learning indicated special education pre-service educators have very little preparation in online instruction (Smith et al., 2016). Additionally, Carter et al. (2016) identified the complications educators have in supporting students with disabilities in online settings. Often, it is not the technology itself, but how to support the pedagogical design of effective digital learning environments for students with disabilities and their families (Carter et al., 2016).

Redesigning the New Education System

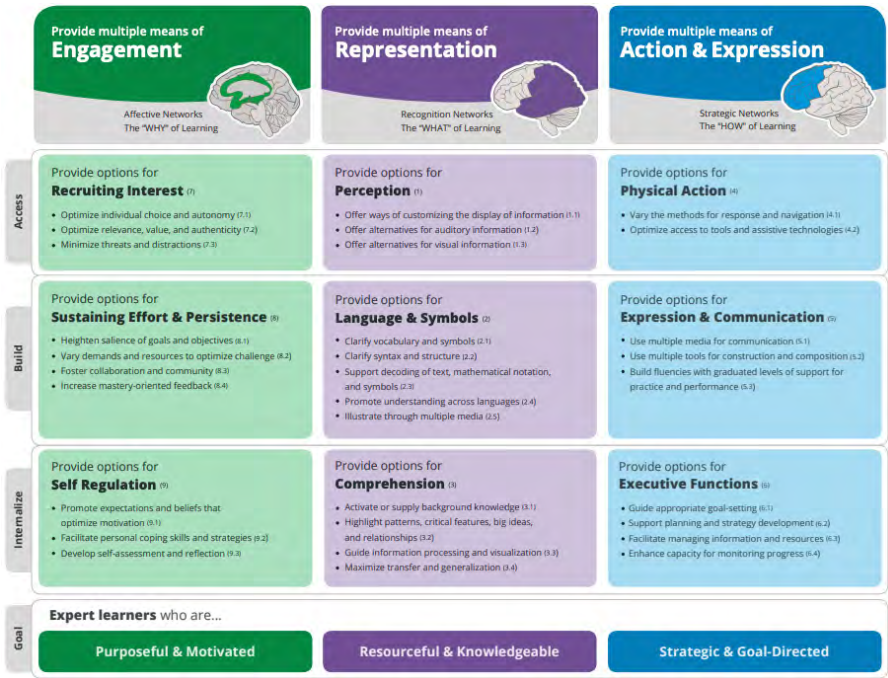

Figure 1. ***Universal Design for Learning Guidelines Version 2.2***
Note. From CAST (2018). Universal design for learning guidelines version 2.2 [graphic organizer]. Author. Reprinted with permission. Learn at http://udlguidelines.cast.org/

There is an unequivocal need for education systems to undertake comprehensive redesign and reform. This redesign should concentrate on supporting equity across all constituents, while supporting the variability of learners including students with learning disabilities. A state scan (CAST, 2020) indicated education systems that

supported more student centered learning at the core of their operations, such as those embracing UDL, had a more holistic and rapid response to COVID-19. For example, in the United States, twelve states identified UDL as a core operating or needed framework in their COVID-19 response plans (see CAST, 2020).

Understanding Universal Design for Learning

Founded by CAST in the late 1990s, UDL builds upon the work of Universal Design (UD; Mace, 1998) with a focus on learning (Meyer et al., 2014). As a design framework, UDL integrates research across neuroscience, the learning sciences, and education (Basham et al., 2016b). According to the Higher Education Opportunity Act (2008) UDL is defined as:

> a scientifically valid framework for guiding educational practice that — (A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (B) reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient.

Universal Design for Learning is a goal driven, student-centered, instructional framework leading to proactive and iterative design cycles. Each iteration includes evidence-based educational practices, targeted assessments, data-driven decision making, and continuous improvement (i.e., improvement science) contextualized across the learning environment (Basham & Blackorby, 2020; Basham et al., 2020). Research indicates UDL improves academic performance, especially in students with learning disabilities (Basham et al., 2016; Rappolt-Schlichtmann et al., 2012; Rappolt-Schlichtmann et al., 2013).

The framework is based on the premise learning barriers occur as an interaction between learners' strengths, challenges, and preferences. Thus, UDL overcomes the deficit-driven approach to education (Zhang et al., 2020), where students who struggle are viewed as the problem. However, the problem is not with the students, it is within the curriculum design. As shown in the UDL Guidelines (Figure 1), the framework considers curriculum design around three principles, nine guidelines, and 31 "checkpoints" (i.e., variables) (CAST, 2018). Rather than a design checklist, UDL is focused on ensuring learners can access the content, build understanding of knowledge and skills, and internalize behaviors to enhance expert learning (Basham et al., 2020). The UDL principles include:

- Multiple Means of Engagement, where the learning experience embeds a range of strategies (e.g., student choice) to engage the interests and maintain motivation of all students.
- Multiple Means of Representation, where information is presented and represented in ways and supported using instructional strategies/tools that account for learning variability of students.
- Multiple Means of Action and Expression, where students have multiple ways to access and demonstrate their knowledge and skill acquisition.

The UDL framework helps educators share the same focus, anticipate and reduce or eliminate unneeded barriers to learning by ensuring goals, methods, materials, and assessments are flexible (Meyer et al., 2014). Universal Design for Learning rests on principles and guidelines that can be embedded in virtually any learning environment or experience (e.g., physical, blended, online). It is content agnostic and supports a variety of instructional styles (Basham & Marino, 2013). Those wanting to learn more are encouraged to visit the field driven global platform (LearningDesigned.org). Readers will find materials for supporting conceptual understanding, technology-based tools, and resources for UDL implementation, along with the field's professional micro-credentials.

UDL in the Redesign Process During COVID-19

Since the inception of COVID-19, individuals and organizations across the UDL community have been called upon to help support the education system as learners move into emergency online, continuous learning, and remote learning experiences. Most recently, the focus has shifted toward design considerations for reopening and preparing for new school realities and learning environments.

Universal Design for Learning incorporates a proactive structure for addressing curriculum design, methods, and materials to support the needs of all learners. This is accomplished by considering learner variability at the outset establishing desired goals, across the educational operations (e.g., the adoption of online systems, acquisition of learning materials, pedagogical practices, and professional learning opportunities). The design framework can be utilized across a variety of content areas, learning environments, ages, and locations. While additional research is needed, preliminary research indicates UDL is useful in supporting both micro (e.g., single learning experience) and macro (e.g., state, district) level designs (Basham et al., 2020).

For instance, it has been used to support the design of efficacious video games for students with a variety of needs, including students with learning disabilities (Israel et al., 2016; Marino et al., 2014). In another example, Basham et al. (2011) used the framework as a basis for supporting the redesign of a failing urban school. Finally, Rappolt-Schlichtmann et al. (2013) found UDL provided significant gains for students during inquiry based science learning.

The framework has been implemented to support other global initiatives. For instance, UDL is used across the globe as a primary referenced framework in supporting UNESCO's Sustainable Development Goal (SDG 4) to develop inclusive, equitable, and quality lifelong learning opportunities for all (UNESCO Source Documents, 2020). Additionally, UDL has been adopted by USAID as a framework for supporting education system design, especially in supporting information communication technology (ICT) skills, literacy, and serving students with disabilities throughout the globe (USAID, 2018).

However, while UDL provides a foundation of educational design across multiple environments and experiences, its implementation is focused on understanding effective inclusive design rather than a specific practice. Thus, it is focused on an iterative design cycle focused on goal setting, design, implementation, and measurement (Basham & Marino, 2013). This process requires a shift in understanding the variables associated with the design of learning environments and experiences.

Additionally, research on the implementation of UDL as well as improvements to the framework itself is continuous (Basham et al., 2020). Combined these considerations support a challenge to the current education system.

What This Might Mean for Students with LD

What could a learning experience look like during COVID-19? Consider Timara, a seventeen-year-old female with dyslexia enrolled in an online AP biology II course. She has just begun a unit on mendelian inheritance, which contains essential crosscutting concepts for future understanding of genetics, mutation, and adaptation. Her course has been organized using the UDL framework. As such, she is provided with varied resources ranging from traditional text with text-to-speech assistive technology, to videos, annotated PowerPoint presentations, simulations (see http://star.mit.edu/genetics/index.html), and other simulated lab experiences (see https://www.labster.com/simulations/animal-genetics/). She has access to digital graphic dictionaries, advanced content organizers, and step-by-step instruction protocols. These assist her with deficits in background knowledge, planning, and organization.

Timara needs social interaction to engage with the content. Her teacher assigns her to a virtual breakout room with a group of three peers. Together they complete the Labster simulation linked above. This social interaction helps her with task initiation and persistence. One of Timara's teammates, who has strong executive function skills, is charged with monitoring the group's on-task behavior. Discussions stemming from questions in the lab lead to extensive conversations about the topic content and potential problems and solutions. The group also has access to their teacher, who can be accessed on demand via text messages or the group can choose to proceed with the lab, knowing the teacher is making virtual rounds on the breakout groups. Timara uses a dictation tool in Microsoft Word to record their interactions and take notes, which she can later copy and paste into her lab report.

Compare this to a situation where Timara received a paper and pencil packet. The packet is thick and heavy. She opens it and finds a pile of loose papers and a textbook. The directions say read chapters 13 - 15 and complete the lab. As she pulls out the book loose papers also fall out onto the floor. She cannot figure out how they were organized. She opens the book to chapter 13. The content is largely inaccessible because of her dyslexia. She looks out the window and becomes distracted. Five minutes later she closes the book and turns on the television. The lab is never completed.

What might a near future online learning experience look like? If Timara's younger sister took the same class a few years from now, it could integrate virtual reality. An area with outstanding potential for future development in education is virtual reality (Parsons et al., 2017). This medium, which to date is feasible but has not seen wide-scale adoption at the K-12 level, enables learners to become completely immersed in the learning environment. Currently VR is widely used in military and medical training fields. The hardware and software is now below $500.00 for untethered VR headsets. These allow the user to be completely immersed in scenarios addressing real world problems and challenges (see https://www.youtube.com/watch?v=IIGFGF1hQmw).

Virtual environments allow a sequence of actions that lead to specific observable behaviors in real-world contexts. This approach is considered function-led,

as opposed to construct-driven (Burgess et al., 1998). Parsons (2011) argued this approach enhances ecological validity while offering customizable user interface features, which participants can use to circumvent barriers encountered during assessment. Examples include individuals with specific learning disabilities, such as those with dyslexia, who could choose to have text read aloud by selecting a setting at the outset of the assessment.

Parsons et al. (2017) noted the importance of developing scenario generation systems in order to account for the rapid development cycles associated with emerging technology. In addition, Parsons (2011) advocated for four principles during the development of new environments. (1) Correspondence: Tasks should correspond with real-world scenarios. (2) Representativeness: Tasks should accurately represent the people performing the task (e.g., the participant) and associated outcome measures. (3) Expedience: Tasks should reflect and predict real-world consequences. (4) Relevance: Tasks must be relevant to both neurocognitive domains and the real world.

What do these principles mean for individuals seeking educational software to assist students with learning disabilities? First, these principles have been espoused for nearly 20 years, albeit not in the immersive world of virtual reality. Marino (2010) in a review of technology-enhanced science literature for students with and without learning disabilities noted a high degree of similarity across general education and special education disciplines, although the terms used in each discipline did not directly align. For example, Kesidou and Roseman (2002) called for simulations allowing students to interact with new materials in relevant and meaningful ways, similar to the correspondence and representativeness principles of Parsons' (2011) research. McNamara and Shapiro (2005) described how simulations could enhance the cohesion and coherence of curricular materials, similar to Parsons "Expedience" principle. Finally, Ketelhut (2007) along with Barab et al. (2005) noted how tasks embedded in simulation provided authentic social and academically meaningful tasks for students similar to Parsons' "Relevance" principle.

Conclusion

COVID-19 has killed hundreds of thousands and changed the face of the global education system. The education of 1.6 billion learners (91% of the global student population) were impacted by the pandemic as schools in 194 countries ceased normal face-to-face operations. This global crisis has uncovered both expected and unexpected consequences across the education system. While much of the devastation left in the wake of the pandemic will be negative, it is also an opportunity for us to ask hard questions about how the education system operates, its underlying assumptions, and what we would like it to be for the next generation.

Similarly, the field of special education has struggled for years to make incremental improvements for students with learning disabilities. Issues associated with an essential redesign are further reaching and more complex than can be discussed in a single article. There is not currently or will there be a 'silver bullet' that will 'fix' long-standing problems. However, UDL is a flexible design framework that encourages proactive anticipation of learner variability. In the most ideal situation, global

education leaders will envision a future education system that is equitable, beneficial, and meaningful for all learners.

Considering the redesign of an education system focused on overcoming the pre- and post-pandemic barriers inherent in the education of all learners, requires the initial recognition that design is directly associated with outcomes. The initial step in the redesign of education is to identify and prioritize the goals of the system. If the goal is to produce different outcomes, then there is a need to consider how to proactively approach this redesign. The UDL framework supports the most viable foundation for beginning this redesign process.

This process will be difficult, requiring substantial investment of time and resources. Mistakes will be inevitable during the iterative design process. However, if all of us, regardless of our specific roles, ask the right questions, take action, and learn from our mistakes, we can transform this opportunity into a robust UDL supported and technology-enhanced educational system. This novel learning environment has the potential to provide individual analysis, recommendations, and suggested learning pathways to maximize the success of students with LD.

References

Barab, S., Thomas, M., Dodge, T., Carteaux, R., & Tuzun, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Education Technology Research and Development, 53*, 86–107. https://doi.org/10.1007/BF02504859

Basham, J. D., & Blackorby, J. (2020). UDL Next: The future of the framework. In K. Lowrey, (Ed.), *Critical issues in Universal Design for Learning.* Knowledge by Design.

Basham, J. D., & Marino, M. (2013). Understanding STEM education and supporting students with universal design for learning. *Teaching Exceptional Children, 45*, 8–15. https://doi.org/10.1177/004005991304500401

Basham, J. D., Gardner, J. E., & Smith, S. J. (2020). Measuring the implementation of UDL in classrooms and schools: Initial field test results. *Remedial and Special Education.* https://doi.org/10.1177/0741932520908015

Basham, J. D., Hall, T. E., Carter, R. A., Jr., & Stahl, W. M. (2016a). An operationalized understanding of personalized learning. *Journal of Special Education Technology, 31*, 126–136. https://doi.org/10.1177/0162643416660835

Basham, J. D., Koehler, C., & Israel, M. (2011). Creating a "STEM for all" environment. In C. Johnson (Ed.), *Secondary STEM education reform: secondary education in the changing world* (pp. 1–25). Palgrave Macmillan. https://doi.org/10.1057/9781137002228_1

Basham, J. D., Smith, S. J., & Satter, A. L. (2016b). Universal Design for Learning: Scanning for alignment in K–12 blended and fully online learning materials. *Journal of Special Education Technology*, *31*, 147–155. https://doi.org/10.1177/0162643416660836

Basham, J. D., Stahl, S., Hall, T., & Carter Jr, R. A. (2017). Establishing a student-centered environment to support all learners. In C. M. Curran, & A. J. Petersen (Eds.), *Handbook of research on classroom diversity and inclusive education practice* (pp. 155–182). IGI Global. https://doi.org/10.4018/978-1-5225-2520-2.ch007

Basham, J. D., Stahl, S., Ortiz, K., Rice, M. F., & Smith, S. (2015). *Equity matters: Digital & online learning for students with disabilities.* Center on Online Learning and Students with Disabilities. https://kuscholarworks.ku.edu/bitstream/handle/1808/22627/2015_COLSD_Annual-Publication_FULL.pdf?sequence=1

Benner, A. D., Boyle, A. E., & Sadler, S. (2016). Parental involvement and adolescents' educational success: The roles of prior achievement and socioeconomic status. *Journal of Youth and Adolescence, 45*, 1053–1064. https://doi.org/10.1007/s10964-016-0431-4

Bowie, L. (2020, April). Tens of thousands of Maryland students have missed lessons since schools closed for coronavirus. https://www.baltimoresun.com/coronavirus/bs-md-students-not-learning-20200423-227kclee6jdtpg3eafcgivw5w4-story.html

Bryk, A. S. (2009). Support a science of performance improvement. *Phi Delta Kappan, 90*, 597–600. https://doi.org/10.1177/003172170909000815

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2015). *Learning to improve: How America's schools can get better at getting better*. Cambridge, MA: Harvard Education Press.

Burgess, P. W., Alderman, N., Evans, J., Emslie, H., & Wilson, B. A. (1998). The ecological validity of tests of executive function. *The Journal of the International Neuropsychological Society, 4*, 547–558. https://doi.org/10.1017/S1355617798466037 https://www.ncbi.nlm.nih.gov/pubmed/10050359

Burnette, D. (2020, May 8). *Devastated budgets and widening inequities: How the Coronavirus collapse will impact schools.* Education Week. https://www.edweek.org/ew/articles/2020/05/09/devastated-budgets-and-widening-inequities-how-the.html

California Department of Education. (2019). *State Accountability Report Card.* https://www.cde.ca.gov/ta/ac/sa/

Carter, R. A., Jr., & Rice, M. (2016). Administrator work in leveraging technologies for students with disabilities in online coursework. *Journal of Special Education Technology*, *31*, 137–146. https://doi.org/10.1177/0162643416660838

Carter, R. A., Jr., Basham, J., & Rice, M. (2016). Helping special education teachers' transition to online learning. In K. Graziano & S. Bryans-Bongey (Eds.) *Online education: Issues, methods, and best practices for K-12 educators.* USA: Information Today, Inc.

Casey, A., & Fernendez-Rio, J. (2019). Cooperative learning and the affective domain. *Journal of Physical Education, Recreation & Dance, 90*, 12–17. https://doi.org/10.1080/07303084.2019.1559671

CAST. (2020). *Scan of COVID plans.* https://docs.google.com/spreadsheets/d/1BI9K0yWW4U630hbXMbk28jhK723tVg8t0Pe1L821CfE/edit#gid=0

Center on Online Learning and Students with Disabilities. (2016). E*quity matters: Digital & online learning for students with disabilities.* Author. http://centerononlinelearning.org/publications/equity-mat-ters-2016/

Christenson, C. M. (2016). *The Clayton M. Christenson reader.* Harvard Business Review.

Christensen, C. M., Johnson, C. W., & Horn, M. B. (2010). *Disrupting class.* New York, NY: McGraw-Hill.

Coleman, J. S. (1966). *Equality of Educational Opportunity* (Vol. 38001). US Department of Health, Education, and Welfare, Office of Education. https://files.eric.ed.gov/fulltext/ED012275.pdf

Darlington, T., & Darlington, A. (2018). *Booze and vinyl: A spirited guide to great music and mixed drinks.* Hachette Book Group.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Dolmans, D. H. J. M., Loyens, S. M. M., Marcq, H., & Gijbels, D. (2016). Deep and surface learning in problem-based learning: A review of the literature. *Advances in Health Science Education, 21*, 1087–1112. https://doi.org/10.1007/s10459-015-9645-6

Dorn, E., Hancock, B. M., Sarakatsannis, J., & Viruleg, E. (2020). *COVID-19 and student learning in the United States: The hurt could last a lifetime.* McKinsey & Company. https://www.mckinsey.com/industries/public-sector/our-insights/covid-19-and-student-learning-in-the-united-states-the-hurt-could-last-a-lifetime

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*, 1087–1101. https://doi.org/10.1037/0022-3514.92.6.1087

Dweck, C. S. (2006). *Mindset: The new psychology of success.* New York, NY: Random House.

Education Week. (2020, May 6). *Map: Coronavirus and school closures.* Education Week. https://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html

Every Student Succeeds Act, 20 U.S.C. § 6301 (2015). https://www.congress.gov/114/plaws/publ95/PLAW-114publ95.pdf

Flannery, A. J., Luebbe, A. M., & Becker, S. P. (2017). Sluggish cognitive tempo is associated with poorer study skills, more executive functioning deficits, and greater impairment in college students. *Journal of Clinical Psychology, 73*, 1091–1113. https://doi.org/10.1002/jclp.22406

Fuchs, D., Deshler, D. D., & Reschly, D. J. (2004). National Research Center on Learning Disabilities: Multimethod studies of identification and classification issues. *Learning Disability Quarterly*, *27*, 189–195. https://doi.org/10.2307/1593672

Fuchs, L. S., Fuchs, D., Hammlett, C. L., Phillips, N. D., Karns, K., & Dutka, S. (1997). Enhancing students helping behavior during peer mediated instruction with conceptual mathematical explanations. *The Elementary School Journal, 97*, 223–249. https://doi.org/10.1086/461863

Freire, P. (1974). *Education for critical consciousness.* New York, NY: Seabury Press.

Gallagher, R., & Egger, H. L. (2020). *School's out: A parents' guide for meeting the challenge during the COVID-19 pandemic.* NYU Langone Health. https://nyulangone.org/news/schools-out-parents-guide-meeting-challenge-during-covid-19-pandemic

Garland, K. V., Vasquez, E., III., & Pearl, C. (2012). Efficacy of individualized clinical coaching in a virtual reality classroom for increasing teachers' fidelity of implementation of discrete trial teaching. *Education and Training in Autism and Developmental Disabilities Journal, 47*, 502–515.

Goldstein, D., Popescu, A., & Hannah-Jones, N. (2020, April 6). *As school moves online, many students stay logged out.* The New York Times. https://www.nytimes.com/2020/04/06/us/coronavirus-schools-attendance-absent.html

Hall, C. W., & Webster, R. E. (2008). Metacognitive and affective factors of college students with and without learning disabilities. *Journal of Postsecondary Education and Disability, 21*, 32–41.

Hammond, L., & Moore, W. M. (2018). Teachers taking up explicit instruction: The impact of a professional development and directive instructional coaching model. *Australian Journal of Teacher Education, 43*, 110–133. https://doi.org/10.14221/ajte.2018v43n7.7

Herold, B., & Kurtz, H. Y. (2020, May 11). *Teachers work an hour less per day during COVID-19: 8 key EdWeek survey findings.* Education Week. https://www.edweek.org/ew/articles/2020/05/11/teachers-work-an-hour-less-per-day.html

Higher Education Opportunity Act (Public Law 110-315). (2008). http://www2.ed.gov/policy/highered/ leg/hea08/index.html

Hill, F. (2020, April 18). *The pandemic is a crisis for students with special needs.* The Atlantic. https://www.theatlantic.com/education/archive/2020/04/special-education-goes-remote-covid-19-pandemic/610231/

Hill, N. E., Castellino, D. R., Lansford, J. E., Nowlin, P., Dodge, K. A., Bates, J. E., & Pettit, G. S. (2004). Parent academic involvement as related to school behavior, achievement, and aspirations: Demographic variations across adolescence. *Child development, 75*, 1491–1509. https://doi.org/10.1111/j.1467-8624.2004.00753.x

Hochanadel, A., & Finamore, D. (2015). Fixed and growth mindset in education and how grit helps students persist in the face of adversity. *Journal of International Education Research (JIER), 11*, 47–50. https://doi.org/10.19030/jier.v11i1.9099

Hussey, J. M., Chang, J. J., & Kotch, J. B. (2006). Child maltreatment in the United States: Prevalence, risk factors, and adolescent health consequences. *Pediatrics, 118*, 933–942. https://doi.org/10.1542/peds.2005-2452

Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).

Israel, M., Wang, S., & Marino, M. T. (2016). A multilevel analysis of diverse learners playing life science video games: Interactions between game content, learning disability status, reading proficiency, and gender. *The Journal of Research on Science Teaching, 53*, 324–345. https://doi.org/10.1002/tea.21273

Iwata, B. A., Wallace, M. D., Kahng, S., Lindberg, J. S., Roscoe, E. M., Conners, J., Conners, J., Hanley, G. P., Thompson, R. H., & Worsdell, A. S. (2000). Skill acquisition in the implementation of functional analysis methodology. *Journal of Applied Behavior Analysis, 33*, 181–194. https://doi.org/10.1901/jaba.2000.33-181

Izvorski, I., Mahajan, S., Moorty, L., & Vincelette, G. A. (2020, April 20). *A policy framework for mitigating the economic impact of COVID-19*. Brookings. https://www.brookings.edu/blog/future-development/2020/04/20/a-policy-framework-for-mitigating-the-economic-impact-of-covid-19/

Jenkins, J. R. (1987). Similarities in the achievement levels of learning disabled and remedial students. *Counterpoint, 7*, 16.

Jingrong, X., Basham, J. D., Marino, M. T., & Rice, M. (2018). Reviewing research on mobile learning for students with and without disabilities in k-12 educational settings. *Journal of Special Education Technology, 33*, 27–39. https://doi.org/10.1177/0162643417732292

Kesidou, S., & Roseman, J. E., (2002). How well do middle school science programs measure up? Findings from project 2061's curriculum review. *Journal of Research in Science Teaching, 39*, 522–549. https://doi.org/10.1002/tea.10035

Ketelhut, D. J. (2007). The impact of student self-efficacy on scientific inquiry skills: An exploratory study of River City, a multi-user virtual environment. *Journal of Science Education and Technology, 16*, 99–111. https://doi.org/10.1007/s10956-006-9038-y

Lewis, C. (2015). What is improvement science? Do we need it in education? *Educational Researcher, 44*, 54–61. https://doi.org/10.3102/0013189X15570388

Lorenzo, G., Pomares, J., & Lledo, A. (2013). Inclusion of immersive virtual learning environments and visual control systems to support the learning of students with Asperger syndrome. *Computers in Education, 62*, 88–101. https://doi.org/10.1016/j.compedu.2012.10.028

Lumbreras, M. A., de Lourdes, M., & Ariel, S. (2018). Augmented reality in mobile devices for the learning of children with ASD. In R. Ruiz, G. Hermandez, & H. Marisol (Eds.), *Augmented reality for enhanced learning environments* (pp. 142–170). IGI Global. https://doi.org/10.4018/978-1-5225-5243-7.ch006

Mace, R. L. (1998). Universal design in housing. *Assistive Technology, 10*, 21–28. https://doi.org/10.1080/10400435.1998.10131957

Marino, M. T., (2010). Defining a technology research agenda for elementary and secondary students with learning and other high incidence disabilities in inclusive science classrooms. *Journal of Special Education Technology 25*, 1–28. https://doi.org/10.1177/016264341002500101

Marino, M. T., Becht, K., Vasquez III, E., Gallup, J., Basham, J. D., & Gallegos, B. (2014). Enhancing secondary science content accessibility with video games. *Teaching Exceptional Children, 47*, 27–34. https://doi.org/10.1177/0040059914542762

Marino, M. T., Israel, M., Beecher, C. C., & Basham, J. D. (2013). Students' and teachers' perceptions of using video games to enhance science instruction. *Journal of Science Education and Technology, 22*, 667–680. https://doi.org/10.1007/s10956-012-9421-9

McNamara, D. S., & Shapiro, A. M. (2005). Multimedia and hypermedia solutions for promoting metacognitive engagement, coherence, and learning. *Journal of Educational Computing Research, 33*, 1–29. https://doi.org/10.2190/7N6R-PCJL-UMHK-RYPJ

Meotto, K. (2019, May 2). *Still separate, still unequal: Teaching about school segregation and educational inequality.* The New York Times. https://www.nytimes.com/2019/05/02/learning/lesson-plans/still-separate-still-unequal-teaching-about-school-segregation-and-educational-inequality.html

Mervosh, S. (2019, February 27). *How much wealthier are white school districts than non-white ones? $23 billion, report says.* The New York Times. https://www.nytimes.com/2019/02/27/education/school-districts-funding-white-minorities.html

Meyer, A., Rose, D. H., & Gordon, D. T. (2014). *Universal Design for Learning: Theory and practice.* CAST Professional Publishing.

Morris, R. D., Lovett, M. W., Wolf, M., Sevcik, R. A., Steinbach, K. A., Frijters, J. C., & Shapiro, M. B. (2012). Multiple-component remediation for developmental reading disabilities: IQ, socioeconomic status, and race as factors in remedial outcome. *Journal of Learning Disabilities, 45*, 99–127. https://doi.org/10.1177/0022219409355472

Myers, H. F., Wyatt, G. E., Ullman, J. B., Loeb, T. B., Chin, D., Prause, N., Zhang, M., Williams, J. K., Slavich, G. M., & Liu, H. (2015). Cumulative burden of lifetime adversities: Trauma and mental health in low-SES African Americans and Latino/as. *Psychological Trauma: Theory, Research, Practice and Policy, 7*, 243–251. https://doi.org/10.1037/a0039077

National Center on Education Statistics. (2019). *The nation's report card: Highlights on reading.* Author. https://www.nationsreportcard.gov/highlights/mathematics/2019/

National Disability Rights Network. (2020, April 21). *COVID-19 and education of students with disabilities resources.* https://www.ndrn.org/resource/covid-19-and-education-of-students-with-disabilities-resources/

Nguyen, L. T. C., & Gu, Y. (2013). Strategy-based instruction: A learner-focused approach to developing learner autonomy. *Language Teaching Research, 17*, 9–30. https://doi.org/10.1177/1362168812457528

Nomi, J. S., Gopal Vij, S., Dajani, D. R., Steimke, R., Damaraju, E., Rachakonda, S., Calhoun, V. D., & Uddin, L. Q. (2017). Chronnectomic patterns and neural flexibility underlie executive function. *NeuroImage, 147*, 861–871. https://doi.org/10.1016/j.neuroimage.2016.10.026

O'Connor, S. C., & Spreen, O. (1988). The relationship between parents' socioeconomic status and education level, and adult occupational and educational achievement of children with learning disabilities. *Journal of Learning Disabilities, 21*, 148–153. https://doi.org/10.1177/002221948802100305

Organization for Economic Cooperation and Development. (2019). *Programme for International Student Assessment (PISA): 2018 Results.* https://www.oecd.org/pisa/publications/pisa-2018-results.htm.

Parsons T. D. (2011). Neuropsychological Assessment Using Virtual Environments: Enhanced Assessment Technology for Improved Ecological Validity. In S. Brahnam & L. C. Jain (Eds.), *Advanced Computational Intelligence Paradigms in Healthcare 6. Virtual Reality in Psychotherapy, Rehabilitation, and Assessment. Studies in Computational Intelligence* (Vol. 337). Berlin, Heidelberg, Germany: Springer. https://doi.org/10.1007/978-3-642-17824-5_13

Parsons, T. D., Carlew, A. R., Magtoto, J., & Stonecipher, K. (2017). The potential of function-led virtual environments for ecologically valid measures of executive function in experimental and clinical neuropsychology. *Neuropsychological Rehabilitation, 37*, 777–807. https://doi.org/10.1080/ 09602011.2015.1109524

Rappolt-Schlichtmann, G., Daley, S. G., & Rose, L. T. (2012). *A research reader in Universal Design for Learning*. Cambridge, MA: Harvard Education Press.

Rappolt-Schlichtmann, G., Daley, S. G., Lim, S., Lapinski, S., Robinson, K. H., & Johnson, M. (2013). Universal Design for Learning and elementary school science: Exploring the efficacy, use, and perceptions of a web-based science notebook. *Journal of Educational Psychology*, *105*, 1210–1225. https://doi.org/10.1037/a0033217

Read, J. P., Ouimette, P., White, J., Colder, C., & Farrow, S. (2011). Rates of DSM-IV-TR Trauma Exposure and Posttraumatic Stress Disorder among newly matriculated college students. *Psychological Trauma: Theory, Research, Practice and Policy, 3*, 148–156. https://doi.org/10.1037/a0021260

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*, 155–169. https://doi.org/10.1007/BF01405730

Rose, T. (2016). *The end of average: How we succeed in a world that values sameness.* New York, NY: HarperOne.

Saadatzi, M. N., Pennington, R. C., & Welch, K. C. (2018). Effects of a robot peer on the acquisition and observational learning of sight words in young adults with autism spectrum disorder. *Journal of Special Education Technology*, *33*, 284–296. https://doi.org/10.1177/0162643418778506

Santiago, C. D., Kaltman, S., & Miranda, J. (2013). Poverty and mental health: How do low-income adults and children fare in psychotherapy? *Journal of Clinical Psychology, 69*, 115–126. https://doi.org/10.1002/jclp.21951

Scheflen, S. C., Freeman, S. F. N., & Paparella, T. (2012). Using video modeling to teach young children with autism developmentally appropriate play and connected speech. *Education and Training in Autism and Developmental Disabilities, 47*, 303–318.

Schwab, K., & Davis, N. (2018). *Shaping the future of the fourth industrial revolution.* World Economic Forum.

Shifrer, D., Muller, C., & Callahan, R. (2011). Disproportionality and learning disabilities: Parsing apart race, socioeconomic status, and language. *Journal of learning disabilities, 44*, 246–257. https://doi.org/10.1177/0022219410374236

Skrtic, T. (1991) The special education paradox: Equity as the way to excellence. *Harvard Educational Review, 61*, 148–207. https://doi.org/10.17763/haer.61.2.0q702751580h0617

Slavin, R. E. (1983). *Cooperative learning: Research on teaching monograph Series.* New York, NY: Longman. https://eric.ed.gov/?id=ED242707

Slavin, R. E. (1996). *Every child, every school: Success for all.* Thousand Oaks, CA: Corwin Press, Inc.

Slavin, R. E., (1990). General education under the regular education initiative: How must it change? *Remedial and Special Education, 11*, 40–50. https://doi.org/10.1177/074193259001100310

Smith, S. J., Basham, J., Rice, M. F., & Carter Jr, R. A. (2016). Preparing special educators for the K–12 online learning environment: A survey of teacher educators. *Journal of Special Education Technology*, *31*, 170–178. https://doi.org/10.1177/0162643416660834

U.S. Department of Education. (2019). *41st annual report to congress on the implementation of the individuals with disabilities education act, 2019.* https://www2.ed.gov/about/reports/annual/osep/2019/parts-b-c/41st-arc-for-idea.pdf

UNESCO. (2020). *COVID-19 educational disruption and response.* https://en.unesco.org/covid19/educationresponse

UNESCO Source document. (2020). *UNESDOC digital library*. https://unesdoc.unesco.org/permalink/P-4ee9996f-c121-4e3c-b7c0-f72f9e67b849

USAID. (2018). *Universal Design for Learning.* https://www.globalreadingnetwork.net/tags/universal-design-learning

Vasquez E., III., Nagendran, A., Welch, G. F., Marino, M. T., Hughes, D. E., Koch, A., & Delisio, L. (2015). Virtual learning environments for students with disabilities: A review and analysis of the empirical literature and two case studies. *Rural Special Education Quarterly, 34*, 26–32. https://doi.org/10.1177/875687051503400306

Walpole, M. (2003). Socioeconomic status and college: How SES affects college experiences and outcomes. *The review of higher education, 27*, 45–73. https://doi.org/10.1353/rhe.2003.0044

Wan, T. (2019, September 23). *US edtech investments peak again with $1.45 billion raised in 2018.* EdSurge. https://www.edsurge.com/news/2019-01-15-us-edtech-investments-peak-again-with-1-45-billion-raised-in-2018.

Weatherly, R., & Lipsky, M. (1977). Street-level bureaucrats and institutional innovation: Imple- menting special education reform. *Harvard Educational Review, 47*, 171–197. https://doi.org/10.17763/haer.47.2.v870r1v16786270x

Yeager, D. S. (2017). Social and emotional learning programs for adolescents. *The Future of Children, 27*, 73–94. https://doi.org/10.1353/foc.2017.0004

Zhang, L., Basham, J. D., & Lowrey, K. A. (2020). Foundations for reinventing the global education system: Personalized learning supported through Universal Design for Learning. In T. D. Neiman, & U. M. Stelson (Eds.), *Challenges and opportunities in global approaches to education* (pp. 146–163). IGI Global. https://doi.org/10.4018/978-1-5225-9775-9.ch008

Zhao, Y. (2018). *What works may hurt: Side effects in education.* Teachers College Press.

Zhao, Y., Wehmeyer, M., Basham, J., & Hansen, D. (2019). Tackling the wicked problem of measuring what matters: Framing the questions. *ECNU Review of Education, 2*, 262–278. https://doi.org/10.1177/2096531119878965

Acknowledgments

We would like to thank Sohyun Yang, Doctoral Student, University of Kansas for supporting the formatting.