Is Technology Enabling or Disabling for Diverse Learners Studying Online

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Abstract

Two ways in which 21st century higher education is substantially different are in the prevalence of online learning and increased student diversity, including students with disabling conditions. This chapter poses the question - Have online technologies levelled the playing field for students with disabling conditions or has the growing complexity of technology meant that more students have been shutout of education? This chapter argues that there are both metaphorical *snakes* and *ladders* at the intersection of technology and disability in the context of higher education. In other words, there are current forces that propel students with disabling conditions forward and there are slippery slopes that see students falling downwards and sometimes right out of the education system. The main contribution of this chapter to the literature is a *Framework of Enabling and Disabling Effects of Technology for Diverse Learners Studying Online*.

Introduction

Globally, the university learning experience has radically transformed between only two generations of students (Adams Becker, et al., 2017; Garrison & Anderson, 2003; Garrison, Anderson, & Archer, 2000; Kinash, 2017). Grandparents of today's university students spent most of their time in tiered-theatre seats listening to lectures. A high proportion of today's students are enrolled in online campuses and even those who are formally registered as on-campus students mostly engage online through learning management systems (LMS) that accompany their lectures and labs. Many campuses now resemble ghost towns, as after the first few classes, a high-proportion of on-campus students figure-out that they can learn at-home in their pyjamas or at a local coffee shop with friends if they watch the lecture recordings through their computers (Kinash, Knight, & Mclean, 2015). In other words, online learning or distance education, is the lived-experience of most contemporary university students whether they are officially registered as on-campus students or not. The shift from on-campus to online learning (or bricks to clicks) has also re-shaped the activities students *do* as part of their learning, which authors such as Biggs (1999) describe as the essence of the

educational experience. A list of student actions and activities provided by Lebenicnik, Pitt and Starcic (2015) serve as an operational definition of *online learning*.

> This may include watching educational videos and video lectures, reading e-books, online articles, slides, online text and documents, and blogs, and listening to podcasts … [and] playing educational games, using virtual environments for learning, … using ICT for self-assessment, [and] using ICT for planning the learning process. (p. 99-100)

Fabian and MacLean (2014) add five additional tasks to the list, including "use of multimedia tools, use of apps, creation and use of a bespoke app, multimedia manipulation and sharing, and creation of an online e-portfolio" (p. 1). The introduction of online learning has transformed *how* students learn from three perspectives: shifting their modality from on-campus to online; changing the very nature of their learning activities; and advancing their achievement and retention (Carle, Jaffee, & Miller, 2009; Kinash, Brand, & Mathew, 2012).

Another major change in the context of universities is the increased diversity of the student population (Devlin & McKay, 2016; Wood, Scutter, & Viljoen, 2017). Returning to the grandparents of today's university students, most of the students who enrolled in university were the high-achievers in secondary school and they tended to leave school, mostly at eighteen years of age, and go right onto university. Males mostly studied engineering and science and females mostly enrolled in nursing and education. In countries such as the United States of America (USA) and Australia, almost all of the students were Anglo-Saxon Caucasians. There was a noticeable lack of cultural diversity. In the Australian context, this meant that there were almost no First Peoples, or in other words, Australians from Aboriginal and Torres Strait Islander descent. Notably, while participation of Australian First Peoples in university has improved, the situation remains dire (Behrendt, Larkin, Griew & Kelly, 2012; Oliver, Rochecourte, & Grote, 2013). Furthermore, an ethnographer of the past would be hard-pressed to find a student in a wheelchair or using a cane. The age range of *today's* university students are diverse and many learners enrol after gaining substantive skills and experience in the workforce (Baxter & Britton, 2001; Heagney & Benson, 2017). The entry scores and prior academic achievement of enrolled university students also widely vary. There are now more female than male students and even though there are still gender biases across many disciplines, the profile is mixed (Universities Australia, 2017). Country of origin is of little consequence, and neither is race, colour or religion in the student profile (Heagney & Benson, 2017; Universities Australia, 2017). Finally, while the percentage of people with disabling conditions with a university education is still depressingly lower than the percentage of people without, the overall diversity of students, including those with a wide range of disabling conditions, is far more redeeming than in the past (Seale, 2006).

The statistics, in the USA and in Australia (where the chapter authors live), and indeed globally, provide evidence to support all of the above trends. There has been a notable increase in the proportion of students with disabling conditions within the university sector, in both Australia and the USA (Hollins & Foley, 2013; Lersilp, 2016). This has been tracked and documented within the Australian context, with a marked 94 per cent increase in students with disabilities from 2008 to 2015 (Universities Australia, 2017). Whilst not as stark, there has also been an increase in the proportion of American students with disabling conditions within the postsecondary context, increasing from 10.9 per cent in 2007-2008 to 11.1 per cent

in 2011-2012 (United States Department of Education, National Center for Education Statistics, 2016a). These statistics highlight the ensuing diversification of the twenty-first century student cohort.

Parallel to this increase in student diversity, has been the increase of online education. Whilst the figures are murky, due to classifications such as *multi-modal* (both *online* and *on-campus*) and entirely *online*, there is no doubt that there has been a steady increase in the number of students either studying wholly online, or part thereof. In the USA, it was found by the Babson Survey Research Group (2015) that at least 28 per cent of students are studying at least one course (otherwise referred to as unit of study) online. Furthermore, it was found by the United States Department of Education, National Center for Education Statistics (2016b), that between 14 to 14.5 per cent of American students are studying completely online. This proportion of online students is congruent with Australian statistics, with the Australian Bureau of Statistics (2012) asserting that in 2010, 12 per cent of students studying in Australia were completing their studies online. In summary, as the statistics highlight above, more students are studying online, with the university sector becoming more diverse with an expansion of enrolments by students with disabling conditions.

The key question addressed by this chapter is - how do these two trends interact? Have online technologies levelled the playing field for students with disabling conditions? Or has the growing complexity of technology meant that more students have been shut-out of education? Are online students with disabling conditions engaging and succeeding in ways that they would not on-campus? Or is the opposite the case?

In 2004, the first author's team review of 2000-2003 literature at the intersection of online learning and disability was published (Kinash, Crichton, & Kim-Rupnow). The authors' overall interpretation of the review was that "improving accessibility of online learning for students with disabilities will promote best practices in online learning for all students" (p. 5). Through a comprehensive search, the authors found only 43 published documents that had *disability*, *online learning* and *higher education*, or close synonyms, as keywords. Of these, only five presented findings from empirical research studies. This trend has dramatically changed, in that in 2018, there are a plethora of empirical studies researching how to design for, and support, online learners with disabling conditions in higher education. A large number of these studies are reported in this chapter.

This chapter uses the definition of students with disabling conditions as provided by Seale, Georgeson, Mamas and Swain (2015), including, "any student who has a sensory, cognitive, physical or psychological impairment and who may benefit from using technological tools and related services to support and promote access to equitable educational experiences and outcomes" (p. 118). Notably, this chapter intentionally uses person-first language in writing, *students with disabling conditions* as opposed to *disabled students* (Brown, Bayer, & MacFarlane, 1989). This use of language has a long and well-informed history in *Disability Studies* (Bishop, 1994; Longmore, 2003; Marks, 1999; Seale, 2006; Shapiro, 1994) and there are three rationales for this form of expression. First, stating the *student* role prior to *disability* (i.e. students with disabling conditions) indicates that particularly in the context of this chapter, the role of *student* is more paramount to that of the person's connection to disability. In other words, *disability* is only one facet of the student's identity, just as are his or her race, religion, height or hair colour. Second, and closely connected to the first

rationale, using language in this manner sends a strong message that the student's *being*, consideration and/or relationship with others is not to be over-shadowed by the facet of disability. Third, the expressed language is *student with a disabling condition*, as opposed to *student with a disability* because a person cannot *have* a disability (Longmore, 2003; Marks, 1999; Seale, 2006; Shapiro, 1994). If the environment (including that of online learning) were entirely user-friendly and accessible, disability ceases to exist. The student's characteristics (including cognitive and/or physical attributes) are disabled when the environment does not support his or her full and equitable participation. For example, a student in a wheelchair is not disabled until there is no ramp to access the building. In the online environment, the blind student is likewise not disabled until the course design does not allow him or her to use screen-reading software to hear the course content (Vaughn & Omvig, 2005). When quoted authors have not used person-first language (i.e. *disabled students*) this language has been retained in this chapter, but when the chapter authors refer to students, the respectful language will most often be *students with disabling conditions.* There are exceptions, such as the use of *deaf students* and *blind students* because this language use is the explicit preference of the respective self-advocacy organisations, and thereby part of situated cultures (Shapiro, 1994; Vaughn & Omvig, 2005).

This chapter argues that within higher education there exist both metaphorical *snakes* and *ladders* at the intersection of technology and disability. In other words, there are current forces that propel students with disabling conditions forward and there are adverse challenges that see students falling downwards and sometimes right out of the education system. According to Konur (2007),

> The increasing use of computer-assisted teaching and assessment in higher education courses has brought both opportunities (inclusion of disabled students in computer-assisted courses with suitable disability adjustments) and threats ('digital divide' – exclusion of disabled students from computer-assisted courses without suitable disability adjustments) for disabled students. (p. 209)

Figure 1 (below) is a *Framework of Enabling and Disabling Effects of Technology for Diverse Learners Studying Online*. Figure 1 will now be fully described in text for three reasons (Sapp, 2009). First, in keeping with an important philosophy of *nothing about us without us*, it would be ludicrous for a chapter about students with disabling conditions' success in university to be inaccessible (and thus unreadable) by students with vision impairments. Second, readers who are new to designing education for full participation by students with disabling conditions can use this text description as an example. Third, some readers who do or do not have disabling conditions, may achieve heightened clarity regarding the intent of the image through reading the text description (and thus the authors' explanation).

INSERT FIGURE 1 HERE

Description embedded language for framework

The image is loosely fashioned after the board game *Snakes and Ladders* which is played with a game board, game pieces and dice. The goal is to be the first player to reach the final square on the game board. When the shake of dice results in a player landing on the start of a ladder, the player skips ahead on the game board to the top of the ladder and plays-on from

there. Conversely, when the shake of dice results in a player landing on one end of a snake, the player goes backward on the game board to the end of the snake that is lower down on the game board. Thus, ladders are metaphors for advantageous life elements and snakes are metaphors for deterrents. This image is not a full game board. There are only twelve game board squares and only the first and final three are labelled. The first three are: 1) Pre-university, 2) First Year and 3) During University and the final three are: 1) Final Year, 2) Graduation and 3) Post-University. There are four snakes and five ladders shown on the image, each of which are described in the next two paragraphs.

As shown in Figure 1, there are two stand-alone *ladders* that foster student success during university and post-university into the workforce. Respectively, these ladders are *assistive technologies* (the specialised tools, devices and software that allow students to access university curriculum, such as text-to-speech software for blind students) and *digital capital and cultural capital* (functional proficiency in working with technologies, with people from diverse backgrounds and with diverse beliefs. For example, deaf students understanding block-chain and the nuances of deaf culture). Likewise, there are two *snakes* starting long before, and often preventing students from, attending university and which can create barriers long into university and thereafter. These two snakes are *hegemony and entrenched stigma* (which means that people with disabling conditions are often judged and identified only by their disability and furthermore that limits and ceilings are imposed upon them) and *stigma of assistive technologies* (in that many people with disabling conditions sometimes refuse to use the tools, devices and software that could make education accessible because the use will identify them as disabled and result in stigma and hegemony). There is another factor, which is both an enabler and a disabler, and Figure 1 therefore shows a *snake* lying over a *ladder*. This factor is *development of educational technology*. As will be detailed in the pages below, the hardware and software used within universities has evolved such that in some instances, circumstances, and for students with certain disabling conditions, there is full inclusion and participation without barriers. At the same time, other digital advancements have created new barriers and steepened the playing field like never before.

There are three more factors that are embedded in the university process and thereby commence after the students are in first year and beyond. The first *ladder* is *digitally enhanced pedagogy*, which can assist students with disabling conditions right through to graduation. This means that universities have designed learning and teaching such that curriculum and assessment takes full-advantage of the affordances introduced by modern technologies. The next *ladder*, which takes effect during university and continues to the final year, is *universal design for learning*. A consequence that often surprises university academics is that when they make changes in course design for a student with a disabling condition, accessibility, engagement and learning improves for many other students without disabling conditions. Finally, there is a *snake* lurking beyond university. This *snake* can often occur once the student with disabling conditions has graduated and joined the workforce. While most universities are now making efforts to greater address the needs of students with disabling conditions, some graduates do not find this same effort with their new employers, and thus the *snake* of, *unaccommodating workforce technologies.* This snake can slide the graduates out of the workforce and sometimes back into the university for further education.

This chapter proceeds to elaborate on each of the *snakes* and *ladders* introduced above. The statistics and propositions of disablers and enablers are outlined. Furthermore, detailed

examples from empirical literature, and from the experiences of the authors, are provided. Finally, the chapter will conclude with recommendations for enabling, as opposed to disabling, the university experiences of diverse students through efficacious use and embedding of technology.

Digital capital and cultural capital

Capital is a relatively new concept borrowed from the banking context and applied to the higher education sector. Digital capital means "the resources and benefits that can be utilised by communities, from Internet infrastructure to online information, modes of communication and tools, to digital literacy and skills" (Roberts & Townsend, 2015, p. 202). Seale, Georgeson, Mamas and Swain (2015) identified five essential elements of *digital capital* that when planned, delivered and evaluated consistently, in partnership between the student, the institution and the student's wider support network, can assure success of students with disabling conditions in university. These elements are

> i. technological know-how;
> ii. informally investing time in self-improvement of technology skills and competencies;
> iii. influence of family and institution attended prior to higher education in offering early and sustained access and encouragement to use technology;
> iv. networks of face-to-face technological contacts; and
> v. networks of online technological contacts. (p. 120)

The authors further elaborate that purely denotative definitions of digital tools and resources provide only partial solutions for students with disabling conditions. Success can only be achieved if digital advancements are considered in the context of *cultural capital*. The authors define cultural capital as "the possession of cultural competencies and knowledge that enable people to be cultural consumers in ways that are valued and expected in society" (p. 119). A concrete example is the culture of blindness. Most blind people assert that they are ordinary human beings who happen not to be able to see (Kinash, 2006). This means that in order to fully function in society, the public-at-large (and in this case, university staff and students) need to embrace this culture and view obstacles as part of the environment (as opposed to inherent to the blind individual) and thus optimise efforts to remove these obstacles. This means that it is incumbent upon universities to design online learning such that *all* educational environments are accessible to, and promote the success of, *all* students, including those with disabling conditions.

Assistive technology

While the thoughtful and well-informed design of educational environments (including online learning) radically improves accessibility and participation of students with disabling conditions, design does not entirely replace the need for assistive technologies (Seale, 2006; Vaughn & Omvig, 2005). Assistive technologies are hardware and software solutions that can be used by people with disabling conditions to personalise and specialise approaches to addressing specific challenges. For example, blind students usually require screen-reading software, but this software only works effectively if the design of the course materials and overall interface support the use of this software. To follow this example further, screen-reading software reads text aloud from left to right, followed by top to bottom. If there are

tables or frames producing columns of text that make left to right reading incomprehensible, the software cannot work, no matter what version has been installed. Lersilp (2016) analysed surveys completed by 140 students with disabling conditions enrolled between six institutions in Northern Thailand. The survey queried provision, usage and needs of assistive technology. The researcher reported that the surveyed students indicated needing assistive technologies such as "screen magnification, dictation software, Braille, and screen readers, in order to use computers effectively" (p. 9). The researcher queried whether students with disabling conditions could experience success using the standard technological offerings (e.g. computers and LMS) provided that these technologies were designed in accordance with the propositions of universal design for learning (UDL). The research results indicated that most students with disabling students required *assistive*, as well as, *standard* technologies, and furthermore that universities are often negligent in the provision of these technologies.

Hegemony and entrenched stigma

Hegemony means that one dominant group of people controls another group of people (Bishop, 1994; Longmore, 2003; Marks, 1999; Seale, 2006; Shapiro, 1994). Obstructions and ceilings are placed in the way of the non-dominant group, which limits their success or progress. One does not have to look far for examples of ways in which members of society who do not have disabling conditions intentionally or unintentionally dominate over those people who do have disabling conditions. People with disabling conditions are the butt of insensitive *jokes* and insults such as – *how could you make that mistake; are you a retard; why did you cut me off in traffic, are you blind?; did you not hear what I said, what are you, deaf?* Media portrayals, such as blockbuster movies, unless designed to carry a message of enlightenment and advocacy, cast people with disabling conditions in undesirable and often fear-provoking roles. Design decisions are usually made by able-bodied people. When people with disabling conditions are given *seats* at influential *tables* they are usually tokenistic and their voices are not properly heard. People with disabling conditions are under-represented in higher education, government and the workforce (Bishop, 1994; Longmore, 2003; Marks, 1999; Seale, 2006; Shapiro, 1994; Vaughn & Omvig, 2005). Specific to higher education, many blind students who read braille wait until half-way through the semester (and the course is thus half-over) before they receive their accessible version of course texts, simply because educators and other university staff do not plan ahead to ensure that the course materials will be provided in a timely, equitable and reasonable manner (Kinash, 2006).

Stigma is closely related to hegemony. Stigma means that groups of people are negatively judged and stereotyped based on a single characteristic (Goffman, 1959; Goffman, 1963). In the context of this chapter, that single characteristic is a disabling condition. All blind students, all deaf students, all students in wheelchairs, etc. are lumped-together in those groupings and summed-up by others based on the one facet of having a disabling condition. Therefore, *all* blind students are considered to be the same, as opposed to diverse people who happen to be blind. Furthermore, people with disabling conditions are positioned as *others* and considered to be more different than having as much in common, or similar. It is therefore understandable that students with disabling conditions often prefer the de-identified and partially invisible nature of online learning. For many students, they can feel that online interaction is nearly sanctimonious, as compared to face-to-face. When the first author completed her doctoral research on *blind online learners*, she heard this perspective multiple times (Kinash, 2006). Students explained that they sometimes chose to tell only the *educator*

that they were blind and asked those educators not to share this information with their student peers (all of whom were sighted). They explained that it came as a relief to be judged on the same basis as their student peers (e.g. on how well they argued their point on the discussion forum) versus through the stigmatising cloud of being *that blind person*.

Stigma of assistive technologies

It is therefore no wonder that students choose not to use assistive technologies that would otherwise help them because this could very well mark them as disabled and therefore trigger hegemony and stigma (Grimes, Scevak, Southgate & Buchanan, 2017). This is particularly the case when disabling conditions are 'invisible' such as learning disabilities. Students will often go to great lengths to keep these disabilities hidden, thus preferring *failing-out* to *coming-out.* This is particularly the case for on-campus students, who usually need to self-identify and register with the equivalent of the *Disability Office.* Rather than ensuring that all computers are loaded with accessibility software and easily switched settings, many universities continue to have a *special lab* that has the only accessible computers on-campus. This *lab* is often placed in an undesirable part of campus with shabby furnishings and low-light indicating that students with disabling conditions are less deserving than other students. Once again, online learning can be less stigmatising than on-campus because the student can use assistive technologies, away from the watchful (and judgmental) eyes of peers and appear *normal* to others (Heiman, & Shemesh, 2011). It is incumbent upon the university, then, to make the online environment as accessible as possible and to ensure that the student is supported with access to the additional assistive technologies that he or she requires.

Development of educational technology

One of the technological advancements that can be readily applied to educational contexts, and particularly online learning, is that of broadband. Smyth's (2005) research confirmed that using broadband videoconferencing (as opposed to synchronous web-conferencing using desktop computers) facilitates natural communication without distracting time lags in audio and/or video. One of the explicit advantages Smyth (2005) included was that broadband videoconferencing enables universities to "become more inclusive for students with disabilities or limiting geographical / familial circumstances" (p. 817). She provided a specific example of a distance student who was on a life-support system. She wrote that he, "interacted constantly with peers and effectively led one group because he could observe his fellow students in the lecture theatre, see the internet sites that the teacher was demonstrating, and respond to questions in real time" (p. 814). The author went on to describe peer connections (between this student and the other students) made through this online learning experience that became extended outside of the broadband.

As stated above, development of educational technology can be an enabler / ladder or a disabler / snake. One of the key findings from Hollins and Foley's (2013) research into the user experiences of sixteen university students with learning disabilities provides an illustrative example of the deleterious consequences of development of educational technology across higher education. As the technology has become more readily available, universities are applying electronic / automated help features with pre-recorded messages and text-based process sheets to numerous online sites. One example is using digital rather than human help on library pages, to assist users in finding source texts. Many of the students in Hollins and Foley's study said that the resultant decline in human services impedes their

learning. These students with learning disabilities reported that past experiences of reading electronic help over-and-over without understanding / arriving at solutions means that they no longer try to use these technologies and go without help.

Digitally enhanced pedagogy

One of the most notable contemporary advancements in digitally enhanced pedagogy is that of gamification. As argued by authors such as Villagrasa, Fonseca, Redondo and Duran (2014), gamification does not mean playing games in class. What it does mean is that the principles, affordances and advantages of online games are embedded with pedagogy. Some of the features of online gaming that make it particularly enjoyable, and often even addicting, are that: they are played with others; there are defined goals and objectives; there are strong elements of competition, players (e.g. students) receive immediate and specific feedback; they learn over time and with experience (e.g. formative assessment); and players often feel a sense of pride and accomplishment. Some of the ways that imaginative academics have applied these game principles to learning is by designing a clever game narrative that runs throughout the semester, with challenges, objectives and achievements in teams (groups). Students are awarded with experience points (XP) which they can track all-along and which are taken-into-consideration and thus aligned with their final grades. Gamification can work especially well in online learning because the mechanisms of the digital interface are amenable to the game playing and the environment feels ordinary and familiar to players / students. Furthermore, online students with disabling conditions can use their regular and familiar accessibility settings and assistive technologies to ensure full participation.

Universal design for learning

Universal design for learning (UDL) is the most common theme of research in the context of supporting the educational success of students with disabling conditions (Center for Applied Special Technology, 2011; Rose, Harbour, Johnston, Daley, & Abarbanell, 2006; Rose & Meyer, 2006). There are numerous empirical studies providing evidence of the value-add of UDL, particularly when used to design online learning. Watchorn, Larkin, Ang and Hitch (2013), for example, used UDL to design courses in the disciplines of architecture and occupational therapy and reported observational and self-reported gains in student learning outcomes. UDL is an extension of a concept originally conceptualised in the field of architecture (North Carolina State University, The Center for Universal Design, 1997). UD (without the L) meant that features of the built-environment were created such that they could be easily modified for use by consumers with highly differing needs. For example, by squeezing the low-resistance levers on the Varidesk (n.d.), office workers can choose to stand or sit while working. When applied to the educational context, this means that the needs of diverse students can be met by developing curriculum, assessment and interfaces that are flexible and easily customised. For example, in the specific context of online learning, the same content might be uploaded in three modes: video with captions, podcast and text-based transcript. Students with varying challenges and needs could then choose whether to access one, two or all three versions. Students with visual impairments are most likely to listen to the podcast and/or to the transcript through screen-reading software. Deaf students would read the transcript. Students from non-English speaking backgrounds may choose to listen to the podcast and then reinforce their learning by reading the transcript so that they can see the terminology spelled out. While there are still too few publications presenting empirical

investigations into UDL, those that have been conducted, confirm that whenever educators make changes for students with disabling conditions, many other students (without disabilities) view the alterations as improvements (Kinash, 2006; Kumar & Wideman, 2014). Authors such as Dell, Dell and Blackwell (2015) demonstrated that the propositions of UDL apply just as much, if not moreso, to online learning as to on-campus learning. For example, Kinash (2006) reported that when an educator changed the font to san-serif for an online student with a visual impairment, a number of other students (who did not know that their student peer had a visual impairment) provided unsolicited feedback that the curricular materials were easier to read. Further, when another educator improved the navigation of the discussion forum (again for an anonymous student with a visual impairment) again there were emails and thanks from numerous other students, all of whom were sighted (Kinash, 2006). This widespread positive impact of UDL is so paramount that the hallmark metaphor of UDL is the curb-cut. The slope easing the physical transition from sidewalks to street-level were designed for wheelchair users. However, they are more frequently used by parents pushing strollers, shoppers with carts and cyclists. When applied to the online interface, the term ‘electronic’ is added to making the metaphor – electronic curb-cut.

There are three key propositions that enable the impact of UDL on education (Rose & Meyer, 2006; Wood, Scutter, & Viljoen, 2017). The first proposition is multiple means of representation which means that the educator creates and provides access to the learning materials in diverse and complimentary forms. For example, the educator might triangulate the teaching of a single concept by posting an audio podcast, a screencast showing both slides and complimentary narration and a full text-based lecture transcript. The second proposition is multiple means of engagement, which recognises that diverse students are motivated in different ways and that even a single student needs different reinforcement at various points in his or her educational journey. This means that various mechanisms designed to elicit participation and enthusiasm are inter-mixed. Sometimes marks and grades are very motivating. Often, immediate and specific feedback can work wonders. Appealing to student curiosity and eliciting student questions which are directly responded to, also increase engagement. One of the multiple means of engagement that is often forgotten is explicitly telling students how the course-based knowledge, skills and attributes will specifically serve to make them more employable (Kinash, et al., 2015). The third UDL proposition is multiple means of expression. This means that students are supported to demonstrate their learning in ways that are meaningful and best represent that particular student’s capabilities. The first author often designs her online courses such that the expectations and marking criteria are clearly and explicitly posted alongside the assignment descriptions. As long as students meet these criteria, they are welcome to create their submission in whatever format they choose. It is far more interesting to mark a website, a video, and an essay than it is to mark paper after paper in the same format (Tobin, 2014). Experience shows that students put far more effort into assignments that they find meaningful and learn more when the student experience is co-constructed. Furthermore, employability is fostered because graduates can use these creative (and open) creations as portfolios or evidence of knowledge, skills and attributes as part of career applications and/or interviews and on digital professional portfolios such as LinkedIn (Jorre De St Jorre & Oliver, 2018; Oliver, 2015).

Rao, Edelen-Smith and Wailehua (2015) demonstrated that educators can rigorously enact UDL ‘during the five phases of educational design (analysis, design, development,

implementation and evaluation)' (p. 35). Tobin (2014) converted the three UDL propositions into five key strategies for designing online learning environments.

1. *Start with text* (p. 15)
Tobin recommends scripting and drafting all curriculum resources, whether lectures, podcasts or videos to stay focussed and create an easily followed navigational thread.

2. *Create alternatives* (p. 15)
Identify the most-student-viewed documents and gradually build-up a posted resource set of alternative versions, such as demonstration-video tutorials, podcasts and screencasts.

3. *Let 'em do it their way* (p. 16)
Directly quoting Tobin, "instructors set the objectives; students define the method and medium" (p. 16).

4. *Go step by step* (p. 18)
Break everything (lectures, videos, assignment specifications) into chunks that are clearly labelled and sequenced.

5. *Set content free* (p. 18)
This strategy is based on the natural interaction between open educational practice and universal design for learning. Tobin wrote,

> Use tools that are accessible and easy for faculty and students to learn. A good example is creating a screen-capture video of a PowerPoint slideshow with your own voice-over, and then hosting the result on a file-streaming site like YouTube. Where before, students needed to have PowerPoint in order to get the file and use it, now all they need is an Internet browser. Students on phones and tablet devices can watch the video anywhere. Content is no longer tied to the clock, either: students can review and study at any time. (p. 18-19)

This quote illustrates that many educators are now striving for excellence in the student learning experience, but will the same level of care and support greet graduates as they enter the workforce?

Unaccommodating workforce technologies

While it has somewhat improved, there continues to be a relatively low participation of university graduates with disabling conditions in the workforce (Bishop, 1994; Longmore, 2003; Marks, 1999; Seale, 2006; Shapiro, 1994). It is therefore incumbent upon educators not only to pay attention to the technologies and technological skills that students will be using *within* the educational context, but also to support their transition into the workforce. Dailey (2006), a broadcast journalism Professor, explained how he made reasonable accommodations so that Steven, a student who used a motorized wheelchair, could fully participate in the learning experience. One of the first considered options was to create a special video camera, but Dailey discarded this route as it would set Steven up for failure upon graduation when he would be seeking a career as a journalist. Dailey (2006) wrote, "such a device would only exist in our department; therefore, this student could not reasonably expect to be hired at a TV station that had the same adaptive equipment" (p. 243). What Daily did instead stands as an exemplar because he found a simple solution that Steven

could easily replicate for full participation in his future workplace. They mounted a camera remote (which comes packed with even high-end cameras) to a board and strapped it to Steven's wheelchair. They then loaded off-the-shelf interactive software onto Steven's laptop. Dailey (2006) wrote, "his computer was his one equalizer, and he wielded it like a sword" (p. 246). Steven was able to fully participate in the course experience and excelled. These minimal, low-expense accommodations would also, no doubt, be considered worth-it to future employers. The installation of the interactive software is conceptually easy to bridge to the context of online education. Online environments often include access to site licences for students' use on their personal devices. The adaptation to the use of the video camera provides a link to an important caveat to online learning. Some institutions refer to students who purely study online as external students rather than online students because there are components of many programs which require offline experiences. The example described here of a broadcast journalism student completing a practical experience is a relevant example. When considering accessibility and equity of student learning, we need to consider the full experience and not just the online components (and these needs to extend post-graduation into the workforce).

Practical online learning course design recommendations

Catalano (2014) described challenges and solutions for university students with four types of disabling conditions. These passages have been reworded and arranged into the table below. The table format demonstrates an accessible design that screen-reading software can interpret.

Table 1: Challenges and solutions for online learners with disability conditions

Disability Condition	Challenges	Solutions
Visual impairment	Screen-reader limitations	- Provide clear text descriptors for all images - Format for screen-readers (left to right, top to bottom) - Provide skip-navigation options - Use clear, descriptive headings - Use san-serif font (e.g. Arial) that has no extra decoration (for low vision)
Hearing impairment	Low to no audio access	- Insert text captions on all videos and tutorials - Provide full lecture transcripts
Motor impairment	Sometimes inability	- Mail-out personalised devices such as mouth-stick - Make all parts of course accessible by keyboard (i.e. alternative to mouse) - Design navigation to be straight-forward and intuitive

		-Reduce number of online layers (i.e. few interlinked web-pages)
Learning disability	Cognitive challenges such as comprehension and retention	-Design LMS pages so that they are uncomplicated - Put most important information first - Use clear headings - Compile tasks and deadlines to provide in one place - Clearly differentiate between required and extra resources - Use plain language where possible - Provide examples of 'good' responses and assignments - Provide detailed assignment marking guides, criteria and expectations

In keeping with the propositions for UDL each of the solutions listed in the table above apply beyond the disability conditions with which they are specifically linked. It is not only students with visual impairments who benefit from clear, descriptive headings and san-serif font. Mature-age learners with multiple commitments such as dependent children and full-time careers often confine their studies to late evenings when they are tired and their eyes are sore. Text captions on videos are useful to many other students in addition to those with hearing impairments. Many people (first author included) never watch an on-demand video (e.g. Netflix) without captions turned-on. Most students are frustrated by playing digital hide-and-seek with online resources when they are provided many pages deep. This design-feature applied much more broadly than for students with motor impairments. Finally, international students (particular those from non-English speaking backgrounds NESB) request the very same solutions as students with learning disabilities. The first author had an online student from Burundi, East Africa who discovered halfway through the course that he had not found the resources read by his student peers because he had never before used a LMS and simply did not know the resources were there. Most internationals students (NESB) need to both hear and see new vocabulary before they can assimilate it. These applications across disabling conditions and other student diversity factors demonstrate the key strength of UDL, which is, when educators make changes for students with disabling conditions, the student learning experience improves for many, if not most, students (Kinash, 2006; Kumar & Wideman, 2014).

Recommendations for professional development of online educators

In the interests of developing quality, accessible online learning experiences for all learners (including those with disability conditions), it is fundamentally important that educators receive adequate professional development. He (2014) took a creative approach to empirically addressing this issue. He designed an online course in keeping with the propositions of UDL to teach future online teachers how to teach online. He administered a

pre and post-test to 24 students (future teachers) and also collected ongoing feedback. Results confirmed that the future online educators "not only enhanced their online learning self-efficacy and confidence in learning online through taking the online course, but also developed their confidence in their ability to teach online" (p. 291). He extended what was previously documented in the literature by adding key 'success indicators' of online learning from the perspective of future online educators, such as "including learner activity variety such as synchronous sessions, discussions, weekly announcement, group project and field experiences" and encouraging students' "voluntary use of tools such as BookBuilder, Photo Story, Voice Thread etc." (p. 294). Similarly, Hinshaw and Gumus (2013) shared a case study depicting five teachers studying online to learn more about teaching online. Data collection was through interviews and participant observations. Results clustered into three themes: online students (teachers) made a connection that extended beyond the parameters of the course; teachers extended their knowledge of teaching and became more efficacious; and they stepped beyond technologies that they used as learners (e.g. overhead projectors) to applying the affordances of online technologies (e.g. e-assessment). In the development of quality online learning, it is wise to remember that – staff ARE the university.

Conclusion

With the massification of the higher education sector and the shift to increasing online student enrolments, so too has the diversity of the student population multiplied. Enrolments of students with disabling conditions has markedly increased in both the Australian and American contexts, and whilst this chapter has not focussed on the cause for this, this chapter has sought to elucidate a number of challenges and strengths that technological advancements in online education have offered this diverse cohort. These challenges and strengths are outlined within the *Framework of Enabling and Disabling Effects of Technology for Diverse Learners Studying Online* developed by the authors. The authors provided a number of recommendations for educators to consider when designing and delivering online content to ensure it is more accessible and engaging for students. These recommendations support the finding that when educators improve content to enhance accessibility for students with disabling conditions, in turn students without disabling conditions also perceive the amendments as improvements.

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