University Students with Disabilities Experience the COVID-19 Induced Shift to Remote Instruction

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Abstract: *Given the acute nature of the impacts of the COVID-19 pandemic on education, limited research is available on the experiences of post-secondary students with disabilities who navigated the abrupt shift from face-to-face to remote instruction in the spring of 2020. Research does show that students with disabilities are often faced with accessibility challenges in the context of online instruction. In addition, educators have expressed concerns about the quality of instruction in an online environment. This retrospective pretest survey study investigated the experiences university students with disabilities before and after the shift to remote instruction. Results showed that accessibility to some accommodations became more difficult, and that some elements of quality of instruction also become poorer. However, a few elements of accessibility and quality of instruction significantly improved after the transition. Suggestions for future research to understand these results more deeply conclude this report.*

Key Words: accessibility, quality of instruction, post-secondary, disabilities, COVID

Recent research on disabilities and the current pandemic focuses more on K-12 students, and the affective experiences of students and parents, over accessibility and academic outcomes. Scholarly literature on the experiences of post-secondary students with disabilities enrolled in remote instruction, not related to the current pandemic, is more available. These studies can provide some guidance with respect to what issues warrant investigation as instruction was forced to online formats during the spring 2020 onset of the COVID pandemic. One of the issues that arises out of remote instruction for these students is accessibility.

Some studies have found that accessibility is a global problem for students with specific categories of disabilities. For example, research shows that students with visual impairments have problems with accessibility to massive open online courses (MOOCs) (Park, 2019). Students with visual impairment have also reported problems with access to learning environments relying on virtual reality applications (Lannan, 2019b), and information and communication support technology (Eligi, 2017). Broader reviews of e-learning and websites in general for students with

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visual impairments have also identified problems with accessibility (Foley, 2011; Kharade & Peese, 2012). Accessibility issues have also been identified for the online learning experiences of students who are deaf or hard of hearing (Batanero, de-Marcos, Holvikivi, Hilera, & Otón, 2019; Ferreiro-Lago & Osuna-Acedo, 2017).

More generally, students with a variety of disabilities report preferring online learning (Ilgaz & Gulbahar, 2017; Kent, Ellis, & Giles, 2018). However, international analyses of online learning accessibility in general hves found learning materials and sites wanting (Alsalem, 2018; Boateng, 2016; Carvajal, Piqueras, & Mérida, 2018; Massengale & Vasquez III, 2016). The experiences of parents of K-12 students with a variety of disabilities, also indicates problems with access to instructional technology related to the shift to online instruction in Scotland due to the pandemic (Couper-Kenney & Riddell, 2021).

In addition to problems with accessibility for students with disabilities, questions have arisen about the quality and inclusiveness of online instruction, for all students. Universal Design for Learning (UDL) is an approach to instructional design intended to create learning experiences that are inclusive of a wide range of learners, including learners with disabilities. UDL is based on three broad guidelines (CAST, 2021). The first is to design learning experiences with multiple types of Engagement. The second is to provide learning experiences with multiple ways of presenting the content through Representation. The third is to provide learning experiences with multiple means of Action and Expression.

While recent reviews and meta-analyses have concluded that UDL is effective in face-to-face settings (Al-Azawei, Serenelli, & Lundqvist, 2016; Capp, 2017), evidence to support the use of UDL for online education is more limited. Scholars have recommended applying UDL to online instruction (Catalano, 2014; Pittman & Heiselt 2014). However, faculty report challenges to implementing UDL guidelines in online courses, including comfort with technology, pedagogical competencies, time, and faculty resistance (Singleton, Evmenova, Jerome, & Clark, 2019). For example, online university courses may do better at including comprehension and Expression elements of UDL than Action elements (Westine, 2019).

Nevertheless, there is some evidence that incorporating UDL guidelines into online course improves the quality of instruction. For example, students reported better communication about expectations and other course information when UDL was applied to the redesign of an undergraduate course (Rao & Tanners, 2011). Middle school students had greater increases in reading comprehension in a reading program based on UDL guidelines when their progress was monitored online, rather than traditional paper-pencil format, and these differences were greater for students with learning disabilities (Hall, 2015). The pandemic may provide a unique opportunity for education reform through implementation of UDL principles to benefit all students, and particularly students with diverse needs related to learning disabilities (Basham, Blackorby, & Marino, 2020).

The research on access to online instruction specifically related to the pandemic and for students with disabilities is more limited to date. Most of that existing research examines access and instruction for K-12 students. For example, during the pandemic, lack of funding and basic resources made access to online education particularly difficult for Native American students with disabilities (Running Bear, Terrill, Frates, Peterson, & Ulrich, 2021). A comparison of two cohorts of students with attention deficit hyperactivity disorder (ADHD) found that there were no differences in academic achievement gains before and after the beginning of the pandemic, and that teachers used a wide range of approaches for teaching and assessment (Lupas et al., 2021). However, these results may depend on types of disability, and/or location. For example, Ressa (2021) found that for students with disabilities in general in Kenya, both access and academic

progress were hindered by the switch to remote instruction. Poorer access has also been reported for K-12 students with disabilities in Turkey (Yazcayir & Gurgur, 2021). A survey of more than 400 service providers in the United States working with K-12 students with hearing impairment also found that access to services was poorer for those students after the pandemic shift to online instruction (Schafer, Dunn, & Lavi, 2021). A study of post-secondary students with visual impairments at a university in Ghana also found problems with access to course materials and accommodations related to the move to online instruction (Amponsah, 2021). This result echoes the results of studies cited above for online instruction and students with visual impairments. A more general review of research on this topic in the United States found that evidence was limited, but the existing evidence indicated that K-12 students with disabilities have been disproportionately disadvantaged with respect to access to instruction and services, and efforts to keep pace with learning goals, as a result of the move to online instruction caused by the pandemic (Morando-Rhim & Ekin, 2021). University students at an R1 university in the United States reported reduced access to course resources after the shift to online instruction in spring of 2020. These same students reported as large reductions in Engagement, and moderate reductions in Action and Expression, based on the UDL model. However, they reported a small but significant improvement in the application of the Representation principle of UDL by instructors (Ives, 2021). A study of post-secondary students with disabilities across seven institutions in the United States found that these students reported difficulties with access to the course materials, and access to approved accommodations (Gin, Guerrero, Brownell, & Cooper, 2021). Generally, these studies tend to support the conclusion that students with disabilities experienced poorer access to instructional materials at the K-12 level as a result of the shift to online instruction in the fall of 2020 due to the pandemic. Evidence for changes in academic outcomes for students with disabilities is limited. Similarly, the evidence for these outcomes at the post-secondary level is sparse.

Given the abrupt pandemic-prompted shift from face-to-face to remote instruction in university courses, concerns about accessibility for online course in general, concerns about the quality of instruction in online courses, and the lack of a research base examining the relationship between these three issues, I posed the following research questions:

- What significant changes in access to accommodations did students with disabilities experience related to the transition to remote instruction due to the pandemic?
- What significant changes in quality of instruction did students with disabilities experience related to the transition to remote instruction due to the pandemic?

METHODS

For this study I implemented a retrospective pretest-posttest approach using self-reported survey data, after the Institutional Review Board of my home university determined that this research qualifies for an Exempt finding.

RETROSPECTIVE PRETEST-POSTTEST

While randomized controlled trials (RCT) are the recognized standard research design for making causal inferences, RCTs do have some limitations. One is that response shift bias poses a threat to internal validity for RTCs (Howard & Dailey, 1979; Howard et al., 1979). Response shift bias occurs when the standards participants use for responding to self-report measures changes over time. For example, responses about remote instruction may be influenced by the experience of shifting from face-to-face to remote instruction, so that responses before the shift are based on

different expectations from responses after the shift. Response shift bias may apply to any research design that involves repeated measures over time. In addition, RCTs, by definition, cannot be applied in situations where the researcher does not have control over the predictor variable. Similarly, RCTs cannot be applied in situations where participants cannot be randomly assigned to different conditions, for practical or ethical reasons.

Given the circumstances surrounding the shift from face-to-face to remote instruction in higher education, related to the COVID-19 pandemic, RCTs would not be practical for examining the effects of this shift on student experiences. In these situations, a retrospective pretest, or retrospective pretest-posttest, design can be more appropriate (Pelfrey & Pelfrey, 2009). The retrospective pretest-posttest design "involves asking participants at the time of the posttest to retrospectively respond to questionnaire items thinking back to a specified pretest period. In effect, participants rate each item twice within a single sitting ("then" and "now") to measure self-perceptions of change" (Little et al., 2020, p. 175). Although arguably underutilized, retrospective pretest-posttest designs have been used in the field of education to examine the effectiveness of academic instruction (Coulter, 2012), professional development (Sullivan & Haley, 2009), and teacher efficacy beliefs (Cantrell, 2003), among other outcomes.

SURVEY

Content validity for the survey was derived from three sources. I began with a pre-existing instrument that the university's Office of Instructional Technology has used campus-wide to investigate the experiences of all students during the shift from face-to-face to remote instruction. Second, I collaborated with the university's Disability Resource Center (DRC) to identify accommodations that were consistently used by students who were eligible for services through the DRC. Third, I reviewed relevant research of student experiences with remote instruction to identify, or confirm, salient topics.

The survey was divided into three sections. The survey began with items asking about demographic characteristics, including academic standing, and academic unit (college or school), as well as prior experience with university-level online courses prior to the pandemic (Wang, 2014). In the second section of the survey, participants were asked to answer a series of 17 pairs of items about their access to accommodations approved for them by the DRC. Both items in each pair were identical except that one asked about student experiences *before* the shift to remote learning, and one asked about student experiences *after* the shift to remote learning. These items were all designed as 5-point Likert scales ranging from *Excellent* to *Terrible*, with an unscored additional option of *No experience*. The list of accommodations was provided by the DRC. The third section of the survey included similar paired items, except that the items in the third section addressed quality of instruction. This third section included two pairs of items on the frequency and helpfulness of communication with instructors (Wang, 2014), and three pairs of items asking about each of the three principles of Universal Design for Learning (Rao, Edelen-Smith, & Wailehua, 2015; Rao & Tanners, 2011; Singleton et al., 2019; Westine, 2019).

CONTEXT AND PARTICIPANTS

Data were collected from 153 students determined to be eligible for disability accommodations by the university's Disability Resource Center (DRC) at a Very High Research Activity (R1) university in the western part of the United States. Prior to the COVID-19 pandemic, While the large majority of courses at the university were taught in face-to-face classrooms prior to the COVID-19 pandemic. all classes shifted to a totally online format, in March of 2020, due to the pandemic, and that format continued through the early summer of 2021. Students were invited

to participate in the study on September 24, 2020, by email, with two follow-up reminders during the following four weeks. The survey was posted online, and made available for data collection for four weeks. In addition, staff at the DRC also send reminders encouraging students eligible for DRC services to complete the survey.

Table 1 shows the academic standing of the participants. A Graduate Special student is a student taking graduate credits, but not enrolled in a degree program. Representation is somewhat lower for first year students than for the other three undergraduate years. Combining the three graduate student groups yields representation comparable to that for each year of undergraduates.

Table 1
Academic Standing of Participants

Academic Standing	N
First Year	18
Sophomore	30
Junior	35
Senior	41
Masters	10
Doctoral	16
Graduate Special	3
Total	**153**

Table 2 shows the distribution of participants across units (colleges and schools) at the university. These data give a coarse indication of the fields of study for the participants. Given that there are 12 different categories across 153 participants, statistical comparisons across units lack the necessary power for statistical significance across the small groups. While every unit is represented by at least one participant, some units have better representation than others.

Table 3 shows the number of university-level online courses that participants had completed prior to the shift to all online instruction in the spring of 2020. About 30% of the 153 participants had never completed an online course prior to the pandemic, while over 40% had completed between one and five online courses prior to the pandemic.

Table 2
Fields of Study of Participants

Field of Study (Unit)	N
Agriculture, Biotechnology, and Natural Resources	19
Business	17
Education	13
Engineering	15
Liberal Arts	32
Science	35
Nursing	1
Community Health Sciences	10
Journalism	3
Medicine	3
Social Work	3
Undeclared	2
Total	**153**

Table 3
Online courses completed prior to the pandemic

Courses	N
0	46
1	26
2	11
3	13
4	9
5	5
6	3
7	2
8	1
9	1
10 or more	28
No response	5
Total	**153**

RESULTS

WHAT SIGNIFICANT CHANGES IN ACCESS TO ACCOMMODATIONS DID STUDENTS WITH DISABILITIES EXPERIENCE RELATED TO THE TRANSITION TO REMOTE INSTRUCTION DUE TO THE PANDEMIC?

To address this research question, I ran a series of paired-samples t-tests to determine if participants reported changes in their access to 17 accommodations authorized through the university's Disability Resources Center. In Table 4 I reported the number of students who responded to both items (N), the test statistic (t), the probability of a Type I error if the null hypothesis is rejected (p), and a standardized mean difference effect size (g^*) for the 17

accommodations included in the survey. Standardized effect size measures are independent of sample size, and thus offer a measure of the size of the effect independent of statistical significance (Ives, 2003). Noting that some of the samples were small, I chose to use Hedges g with a correction for inflation due to small sample size (Hedges & Olkin, 1985). Both Cohen's d and Hedges g are vulnerable to this small sample bias. Access to five of the accommodations was significantly worse after the shift to online instruction (applying a conventional alpha level of .05). For these five accommodations, two of the accommodations had large effect sizes (at least .80), two others had effect sizes in the medium range (at least .50), and one accommodation had a small effect size (at least .20). In addition, participants reported significantly improved access to audio recording of lectures, with a small effect size. There were no significant differences for the remaining 11 accommodations, although three of their effect sizes did reach the small range.

Table 4
Changes in access to accommodations before and after the shift to remote learning

Accommodation	N	t	p	g*
Significantly Poorer Access				
Extra Time on Tests	86	4.782	< .001	.59
Quiet/Private Testing Environment for Tests	101	5.553	< .001	.87
Text-to-Speech for Tests	23	2.577	.017	.61
Disability Resource Center Exam Processing	59	5.093	< .001	.83
Notetaking	42	2.524	.016	.45
Significantly Improved Access				
Audio Recording of Lectures	57	2.191	.033	.39
No Significant Difference				
Speech Recognition Software	25	.891	.382	.12
Word Processors for Essay Exams	38	.780	.440	.10
Readers for Tests	13	No difference		
Scribes for Tests	12	1.301	.220	.31
Oral Examinations	14	.898	.385	.20
E-Text for Tests	30	.441	.662	.05
Audio Files for Tests	24	1.163	.257	.13
Electronic Textbooks	100	.564	.574	.04
FM Systems	10	No Difference		
Roger Pens	14	1.455	.169	.36
TypeWell Transcription	17	No Difference		

WHAT SIGNIFICANT CHANGES IN QUALITY OF INSTRUCTION DID STUDENTS WITH DISABILITIES EXPERIENCE RELATED TO THE TRANSITION TO REMOTE INSTRUCTION DUE TO THE PANDEMIC?

Five pairs of items in the survey were related to quality of instruction. Two of these pairs addressed instructor communication, and three addressed principles of Universal design for Learning. Table 5 reports the results for paired-sample t-tests for each of these pairs of items.

Table 5

Changes in elements of instructional quality before and after the shift to remote learning

	N	t	p	g*
Significant Decrease				
Frequency of Instructor Communication	135	6.799	< .001	.61
Helpfulness of Instructor Communication	134	5.885	< .001	.54
Assessment Through Multiple Approaches	134	3.869	< .001	.27
Engagement	133	8.710	< .001	1.06
Significant Increase				
Content Through Multiple Approaches	134	3.631	< .001	.36

Communication from instructors was reported to be both significantly less frequent and less helpful, with medium effect sizes. Assessment was also significantly less likely to be done through multiple approaches under remote instruction, with a small effect size. Students' Engagement was reported to be significantly poorer under remote instruction, with a large effect size. Of note, students reported that instructors used a significantly wider range of approaches for presenting content under remote instruction, with a small effect size.

Given that participants reported a wide range of prior experience with university-level online courses, I also examined the possibility that students who had never taken an online course before might have experienced a greater loss of instructional quality related to the shift to all online instruction. I calculated gain scores for the reported scores on each of the five quality of instruction items by subtracting the retrospective pretest scores from the posttest scores for each student. I then ran a series of five independent samples t-tests to check for significant differences in mean gain scores between students who reported no prior experience with university-level online courses, and those who reported having taken at least one online course before the pandemic. None of the five t-tests approached statistical significance (*p*-values ranged from .234 to .744). In addition, all of the corrected Hedges g effect sizes were below the small range (.039 to .157).

DISCUSSION

Given that there is little pre-existing research on the experiences of university students with disabilities during a transition from face-to-face learning, to remote learning, this study raises many questions. First, the generalizability of the results should be addressed through systematic replication. While it may be plausible to predict similar results for similar university settings and populations, it is less clear if these results would be replicated in other colleges, community colleges, professional schools, trade schools, or other adults learning contexts, much less for K-12 settings.

Note also that I ran 17 statistical tests related to accessibility, and 10 more related to quality of instruction. Running more tests increases the risk of Type I error inflation for the overall study. It is likely that one or more of the significant findings are Type I errors, particularly those with significance levels closer to the alpha level of .05.

There may be multiple reasons for finding statistically significant differences for some of these accommodations, or indeed for failing to find statistically significant differences. For example, 1) when fewer students are using an accommodation, fewer students respond to these items, which reduces the power of the statistic to detect a significant difference, 2) changes may

be too small to be statistically significant, 3) the need for some accommodations may have changed when the mode of instruction changed, and 4) to the extent that students see face-to-face instruction as preferable to remote instruction, they may rate their experiences with remote instruction more negatively in general. For example, instructors may have some control over giving Extra Time on Tests, but problems with Quiet/Private Testing Environment for Tests may be related to the home situations of some students. Efforts to support these students more effectively should be based on a clearer understanding of the circumstances that contribute to these reported losses in accessibility.

Participants reported significant reductions in accessibility of some resources. These results are consistent with pre-pandemic studies that found problems with accessibility for students with various disabilities (e.g. Batanero et al., 2019; Eligi, 2017; Foley, 2011; Lannan, 2019a; Park, 2019), and these problems were likely exacerbated by the pandemic (e.g. Couper-Kenney & Riddell, 2021; Ressa, 2021; Running Bear et al., 2021; Schafer et al., 2021; Yazcayir & Gurgur, 2021). However, the reasons for these reductions are not addressed in the study. Most of these accommodations rely on having others support the students directly by taking notes, providing extra time for tests, or preserving a quiet environment for studying. There may be steps that resource centers for students can take to improve access to these accommodations through better access to support personnel who would provide these accommodations.

Audio Recording of Lectures actually yielded a significant improvement in access, according to the participants. Again, further investigation is warranted to understand why. For example, it may be that because classes were moved to online presentation, more instructors began recording their lectures and posting those recordings for all students to access.

It is encouraging to find that students did not report a significant drop in accessibility for the majority of the accommodations. Most of the accommodations in this list involve specific assistive technology and software, such as speech recognition software, word processors, FM systems, and Roger pens. However, a few are more related to having others support the students directly. These include readers, scribes, and oral exams.

With respect to quality of instruction, participants reported moderate drops in both the frequency and usefulness of communication from instructors. These results are consistent with prior research finding that students with disabilities may face challenges with communication (Bastedo, Sugar, Swenson, & Vargas, 2013a; Eligi, 2017), although evidence of problems with communication specifically related to the pandemic is lacking. Frequency of communication may be relatively easily addressed once instructors are aware of the problem. Helpfulness of communication may be more of a challenge, although there is some evidence that implementation of UDL in course design can improve communication (Bastedo, Sugar, Swenson, & Vargas, 2013b; Rao & Tanners, 2011).

Participants also reported a small drop in the range of approaches to assessment they experienced after the shift to remote instruction. A wider range of approaches to assessment is associated with more inclusive teaching practices. This element of instruction relates to the UDL guideline of providing learning experiences with multiple means of Action and Expression (CAST, 2021). An even bigger concern is the large drop in Engagement reported by students after the shift. This element of instruction relates to the UDL guideline of designing learning experiences with multiple types of Engagement (CAST, 2021). This large shift suggests that instructors, and in turn their students, might benefit from some professional development related to tools and techniques for improving students' Engagement in online environments.

Finally, participants reported a significant improvement in their experiences with content being accessible through multiple approaches. This element of instruction relates to the UDL

guideline of providing learning experiences with multiple ways of presenting the content - Representation (CAST, 2021). Perhaps when instructors were compelled to shift to online instruction, they were also compelled to be more flexible about the ways in which they presented content. However, these results for all three principles of UDL replicate the results on a larger sample of university students at one university (Ives, 2021). That is, the larger sample also reported a large drop in Engagement, a moderate drop in Action and Expression, and a small improvement in Representation following the shift to online instruction in the fall of 2020. This is another topic for further investigation.

The results of this study demonstrate that the shift from face-to-face to remote instruction had a significant impact on both the accessibility and the quality of instruction for students with disabilities. Next steps should include more research to gain a greater understanding of these changes, concerted effort to mitigate the losses related to the shift, and an appreciation of lessons that can be learned from the gains related to the shift.

Given the inevitability of future pandemics (Auld, Bernstein, Cashore, & Levin, 2021), and other possible abrupt disruptions to education, these results have implications facing those challenges. Accessibility to online academic resources was a worldwide problem for students with disabilities long before the onset of this pandemic. This problem was exacerbated by the pandemic. Educators and administrators need to plan to provide individual supports, including training and equipment, as well as infrastructure improvements, to facilitate the transition to online instruction when needed, as well as to improve accessibility once the transition has taken place. In addition, maintaining, or even improving, the quality of instruction through a UDL model during these disruptive circumstances means focusing particularly on the supports needed to strengthen Engagement of students, perhaps even more so than supports for the Action and Expression principle if UDL.

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