The Persistent Digital Divide: The Case Study of a Minority Serving Institution

Brandis Phillips Ph.D., CPA
North Carolina A&T, bphillip@ncat.edu

Belinda Shipps PhD
North Carolina A & T, bpshipps@ncat.edu

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Cover Page Footnote

ABSTRACT

The COVID-19 pandemic has laid bare the persistent digital divide between those that have access to technology and those that do not. As such, we conducted a case study that consisted of interviews and a survey of students along with interviews of administrators and faculty at a minority serving institution. The institution is used along with resources and appropriations theory as a lens to further understand the digital divide and how technology access and use have manifested during the pandemic. The results suggest that students perceived difficulty with access to and use of information communication technologies (such as hardware and software), which interfered with their engagement with learning. At the institution under investigation, the pre-pandemic lack of access to technological resources was eliminated during the pandemic thanks to additional funding. Nevertheless, the communication problems between the administration and students limited students' access to the resources available.

Keywords: digital divide, technology acceptance, inequality, socio-technical

INTRODUCTION

According to the Federal Communications Commission (Commission 2021), nearly 30 million people in the U.S. do not have access to a high-speed fixed broadband service. Almost 17 million school children have no access to broadband at home, leading to a homework gap (Commisssion 2021). The digital divide refers to the gap between those who have access to technology and those that do not (Castells 2002). Although access to technology appears ubiquitous due to the proliferation of smartphones, COVID-19 has exposed the fissures in the notion of this ubiquity. While access is possible in less affluent communities, it is not of the same quality as that in more affluent households. Where quality is characterized as internet speed and device capabilities such as the amount of random-access memory, this disparity can be described as concerning the availability of devices in the household (including computers and Wi-Fi access points), the speed of access available in the community, and the price of access. During the pandemic, the digital divide has been most obvious in rural and low income areas across the U.S. (Fitzgerald 2020). For instance, in Hudson, NY, people without broadband service pull up in their cars or sit outside the library to access its internet service after hours (Milstein 2021). As a result of COVID-19, many people are struggling with virtual work and access to the internet for schooling (Mahyoob 2020; Sunasee 2020). Digital access is critical to education, employment, and economic success. Pre-pandemic, there were already vast differences in the level of access to the internet and devices in households of varying income levels across the U.S. This digital divide has been exacerbated by COVID-19's disproportionate impact on lower income families. Individuals that live in neighborhoods with less access also do not have sufficient disposable income to purchase devices that enable higher levels of throughput (in the form of Wi-Fi) or desktops or laptops that allow users to access the internet effectively and efficiently to fully participate in school or work. As such, we suggest that the digital divide is not only still present given the ubiquity of internet connected devices but is accelerating in some areas due to gaps in income and access that prevent school and college-age students from fully participating in their educational pursuits. What does this mean for students? As the virtual learning environment has become the new normal for university students, they are struggling to access and complete their work in a COVID-19-mandated virtual environment.

The aim of this research is to understand what the current barriers are to bridging the digital divide during the COVID-19 pandemic and how the pandemic and its effect on the digital divide has impacted students. The research will discuss the digital divide in the context of the pandemic, provide theoretical frameworks, and discuss the results of focus groups and a survey to gain an understanding of the broad themes of the digital divide during the COVID-19 pandemic.

The Digital Divide and the Pandemic

The digital divide is of special concern given the onset of the COVID-19 pandemic and the related mandated social distancing and move from face-to-face interactions to remote, online interactions for working, learning, shopping, and socializing. This switch to online learning was sudden and created a great deal of uncertainty for instructors and students (Liguori and Winkler 2020). This was a challenge for both instructors and students who were unfamiliar with online teaching and learning (Sunasee 2020).

Many instructors, who were used to face-to-face classroom interactions, were forced to teach in an unfamiliar online environment (Liguori and Winkler 2020). In this study, the research site was a university environment where most courses were taught in the traditional, face-to-face manner. Students and instructors faced many challenges including technology use, usability, social interaction, emotional intelligence around awareness of resources, emotional support, technical help, and management of stressful situations. In many cases, technology failings led to the unavailability of technology resources such as lost or spotty connectivity, failing laptops, missed assignments, and difficulty navigating courses (Sunasee 2020).

LITERATURE REVIEW

The digital divide has been defined in many ways. One definition categorizes the digital divide as consisting of three stages: economic divide, usability divide, and empowerment divide (Nielsen 2006). Another definition defines the digital divide as inequalities regarding access to and use of information and communication technologies (ICTs) (Castells 2002). Here, inequalities refer to the disparities in access to broadband in many lower income urban and rural areas as well as differences in household income that prevent lower income households from purchasing computer hardware and internet service. Many researchers have argued that digital divides are more comprehensive and multidimensional and include not only technical skills but also outcomes and consequences (Fuchs 2009; Selwyn 2004; Van Dijk 2005). This contrasts with earlier more unilaterally focused research. In this study, we take a multilateral approach as we study the digital divide in relation to the COVID-19 pandemic and its many associated challenges that make it difficult for students to access and use technology. That is, we examine the digital divide in terms of both technical and social aspects.

Theoretical Frameworks

Accessibility – Resources and Appropriation Theory

We argue that when resources are not accessible for use in an online learning environment, this can contribute to the widening of the digital divide, which can potentially lead to students not gaining the necessary knowledge, skills, and abilities (KSA) (van Deursen et al. 2021; Van Dijk 2005). In this research, our focus is on the digital divide between students and the challenges they face in accessing the online teaching environment. We use the resources and appropriation theory to help understand these challenges as they relate to the digital divide and thus to those students who experienced challenges with access to and use of the online environment and those who did not. In this research, we refer to appropriate access and use as the ability of students to effectively engage and interact with the online environment by successfully gaining online access to and use of their online assignments and communications to complete their course requirements.

We use this theory to help us understand the possible contributing factors and potential impact of having or not having access to the resources necessary for students and appropriated by them to help them increase their knowledge level. The health concerns associated with COVID-19 led to a rapid shift from in-person learning to virtual/online learning, which created many challenges (Adedoyin and Soykan 2020; Liguori and Winkler 2020). Many of these challenges involved issues regarding accessibility and the use of technological resources for faculty and students (Gillis and Krull 2020). Previous research demonstrates an association between the accessibility of technology and the digital divide (van Deursen et al. 2021). Based on previous research, we argue that the

individual's access to and use of ICTs can play a role in the use of technology and its association with the digital divide (van Deursen et al. 2021; Van Dijk 2005). During the pandemic, with the rapid and chaotic rush to virtual instruction, the online environment became more complex in terms of accessibility. This was due to the increase in online traffic and new programs, procedures, and applications as well as people being unfamiliar with how to access and use this newly expanded online environment (Mahyoob 2020; Sunasee 2020).

The resources and appropriation theory explains technology acceptance as a process called appropriation. The theory emphasizes that when a new technology emerges, it will be followed by a process involving the diffusion, acceptance, and adoption of the new technology (Van Dijk 2005). Van Dijk (2005) states that in an online, multimedia environment where technologies are complex, there may be the potential for access problems that can lead to digital inequity at different stages of access. For example, if a student cannot access the internet (physical access), they do not have access to a laptop or other equipment (material access), or they do not know how to access the technology (skills and knowledge), this can create a divide between them and those students who do have physical and material access and the skills and knowledge to access the online environment. The outcomes of this divide can impact people's level of participation in society in cultural, economic, social, political, and other areas (van Deursen et al. 2021).

Van Dijk (2005) applies the resources and appropriation theory to the digital divide by arguing that there are several different personal and positional categories such as gender, sex, race, country, income, and educational level that can produce an unequal distribution of resources. This unequal distribution of resources can in turn lead to unequal access to digital technologies and unequal involvement in society.

We relate this concept to our research by exploring the question of whether the unequal distribution of resources among students can lead to unequal access to digital technologies and unequal participation in society. Our research addresses inequality through the lens of underrepresented students and their access to and use of digital technology. This access relates to both physical access and material access to resources. Physical access relates to access to the internet and communication devices. Examples of material resources include equipment, procedures, manuals, paper, ink, laptops, hardware, online learning management systems, and so on.

The rapid change to a new, massive, complex, learning environment was novel for many students as well as faculty and other staff (Sunasee 2020). Some of the potential challenges of this quick transition are increased internet traffic (more people accessing the online environment) and students and faculty who are new to online learning and online learning procedures. With university computer labs closed, some students may lack the resources such as equipment, hardware, and software needed to access the online learning environment. The access to and use of ICTs help explain the technical aspects of the digital divide; however, the combination of the technical and the social aspect of the digital divide provides a richer understanding of this phenomenon and its impact.

Social-Cognitive Theory – Empowerment Divide

Social cognitive theory (SCT) also helps us to better understand the digital divide and the interplay between the related technical, social, personal, and behavioral factors (Cherns 1976; Clegg 2000). Online learning environments (online courses) are socio-technical systems in that they are social environments that use ICTs. SCT asserts that there is a three-sided inter-relationship between personal attributes, environment, and behavior where social and personal factors impact behavior in the social environment. The online learning environment is an interactional, technical, and social environment shared by instructors, students, and others. Virtual interactions can impact behavior in different ways regarding continuous use and the individual's interaction within the online learning environment (Mahyoob 2020; Sunasee 2020). In terms of the digital divide, virtual interactions with professors for instruction may have a different value for students in terms of content delivery and the knowledge acquired (Liguori and Winkler 2020). We also suggest that social support is a factor in accessing an online environment using the internet. Van Dijk (2005) states that individuals with numerous social relationships are more prone to receive the

technology and support they need when they have technical difficulties. Individuals with fewer social support connections are less likely to participate in internet activity (Neves and Fonseca 2015).

Case Environment

The case study concerns a minority serving institution (MSI) in the southeastern U.S. with approximately 12,000 undergraduate and graduate students. The institution is a doctoral intensive campus with moderately high research funding. Demographically, approximately 90% of the MSI's students are African American. Approximately 65% of the undergraduate population receives a Pell Grant (an indicator of financial need, which is part of the digital divide) and over half are first generation college students. The university is primarily residential with over 40% of the undergraduate population residing on-campus and most of the remainder living within 10 miles of the campus.

In terms of virtual learning, the university had been moving slowly toward providing more distance learning opportunities. Before the COVID-19 pandemic, approximately 300 distance-learning courses were offered each semester out of approximately 2,000 courses in total. Moreover, 20 programs/majors were offered virtually out of over 150 offered across the university. Once the pandemic began, over 1,900 courses were conducted virtually. As a result of the pandemic, 5 additional distance learning programs in engineering are in development at the master's level along with a criminal justice/cybersecurity degree and 11 undergraduate concentrations. The pandemic also brought about an increase in the pace of change. Previously, it took four years to create 160 permanent distance learning courses yet during the pandemic, another 340 permanent distance learning courses were developed in just four months. In terms of faculty support for distance learning education, the university maintains three instructional designers for a faculty of approximately 1,000 campus-wide. During the pandemic, three additional temporary designers were hired. However, as the labor market for workers with technology skills has improved during the pandemic, four of the university's six instructional designers have left the university for better opportunities. Regarding faculty support for training, the university maintains a center for instructional training for both educational tools and innovation in content delivery. A variety of courses are offered including training on Blackboard, lecture software, how to conduct a flipped classroom, and more. Before the pandemic, there were usually one to two classes per week. At the beginning of the pandemic, some weekly courses were offered four to five times per week to ensure faculty had the skills they needed to deliver their courses remotely.

RESEARCH MODEL

We examine the digital divide through the lens of a MSI where the vast majority of the student population are vulnerable to technology access limitations. We develop a digital divide model using a multidimensional approach based on the aforementioned theoretical frameworks. We examine the digital divide as an antecedent to a) access, b) skills and knowledge content, and c) social interaction associated with the awareness and management of the learning environment (see Figure 1 below). In this model, physical access and material resources are the consequence of the presence of the digital divide, which acts as a barrier to proper engagement with technology. Individual actors find that it is harder to appropriate technology in a manner that will allow them to effectively utilize it. The social environment is characterized as the computer-mediated interactions between instructors and students representing virtual social interactions that manifest differently when the digital divide is present.

Digital Divide Model
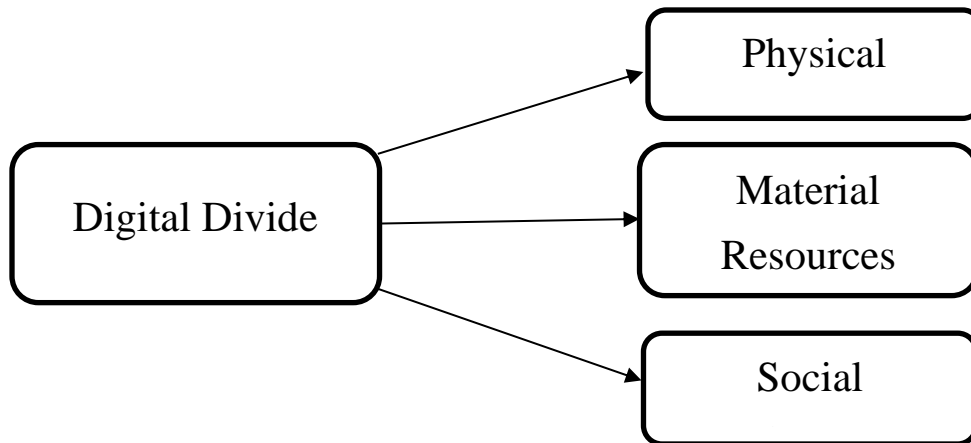
Figure 1

Methods

A mixed methods approach is utilized to gain a better understanding of the impact of the pandemic on access to and use of technology. First, interviews were conducted with two focus groups of students. These interviews were followed by a survey of students in introductory business technology courses. Both the interviews and survey were solicited from business majors at the case study site. The student interviews were conducted during the 2020 fall semester. Participants were solicited through an email invitation from the Assistant Dean's office at the College of Business. A $10 gift card was given in exchange for completing the interview. Open-ended questions (see Appendix A) were asked regarding the students' perceptions of how the institution has adapted to teaching and operating virtually. Students were also asked about their level of engagement with and ability to learn in a virtual environment. Given the results of the focus groups, a quantitative survey was created to collect variables on perceptions of institutional effectiveness during the pandemic, technology acceptance, and student engagement. The quantitative survey was conducted in the final week of the 2021 spring semester. Student respondents were solicited from introductory information systems courses and given extra credit as an inducement to participate. Follow-up interviews were conducted during the 2021 fall semester with administrators and faculty to more thoroughly understand the impact of the pandemic on teaching efficiency and institutional effectiveness.

Case Study Results

The abrupt shift to an emergency online teaching environment was challenging for both students and faculty (Gillis and Krull 2020). We evaluate these challenges in relation to the digital inequities between students and the possible impact of these inequities on their education. Many students experienced numerous challenges such as accessibility, anxiety and stress working in limited, shared workspaces, and distractions from others in the home.

Qualitative Focus Group Interviews

Two hour-long focus groups were conducted with minority undergraduate and MBA students at the case study site. See Table 1 for the sample characteristics of the interviewees.

Table 1. *Sample Characteristics*

Race	Participants	Classification	Participants	Age	Participants
African American	6	Undergraduates	4	18-24	5
Caucasian	1	Graduates - MBA	4	25-35	3
Hispanic	1				

Technology Access (Physical and Material), Technology Use, and the Digital Divide

Our interviews with students reveal that many students were frustrated with the online learning environment due to problems with the quality of internet access, the lack of material resources such as laptops, and communication concerns. Also of primary concern was the use of productivity tools such as Microsoft Office. Many students who would normally go to the library or to campus labs to do their work did not have this access during the pandemic as the university campus was closed. This created problems with access to equipment and materials such as software, which were needed to access the online environment. Many students at the university, who were forced to switch to online learning, had never taken online courses before and were unfamiliar with working in an online environment. Research by Gillis and Krull (2020) supports the argument that there is still a large population of students that have not taken virtual courses. Also, as described by Fish and Wickersham (2009), many students who take online courses are not tech savvy. Finally, although many of the students interviewed had laptops, compared with their wealthier peers, laptop ownership was notably low and access to devices at home was limited or non-existent.

The students mentioned that they had to quickly return home to continue their classes remotely in an online environment. This created frustration and anxiety for some students who did not have computers or tablets and/or sufficient internet connection. Also, some students' computers stopped working when the pandemic lockdown began, leaving them in need of a laptop to finish the semester. Furthermore, some students live in rural areas where internet connections are very weak or spotty. Other students indicated that the university's learning system (Blackboard) was sometimes inaccessible or lost connection while they were taking tests. Technological problems and failures dented students' confidence in the online systems and discouraged their use of these systems. Furthermore, students increased their use of Google G Suite due to their lack of access to Microsoft Office. For some students, Google G Suite was always preferred over Microsoft Office.

Many of the focus group respondents commented on technology use problems such as "spotty or weak connections," "lack of fully functioning devices," and "inaccessible and/or poorly functioning Blackboard learning management systems during testing."

The majority also stated that they "preferred face-to-face courses due to technology issues." Here, "issues" refers to students' frustration with using the technology and interacting with instructors that had problems delivering course content virtually. Also, they felt they "did not learn the material as well and that [their] grades suffered."

In relation to the digital divide and perceptions about technology access and use, students in the focus groups expressed a preference for face-to-face teaching because they felt that the online class environment was difficult to adapt to. Other structural issues included household issues caused in part by a lack of income. Wi-Fi networks within households were not robust enough to handle the increased traffic from more users. Families had to schedule Wi-Fi use in shifts to attend to work and school. When computers broke, arrangements had to be made to borrow devices. Regarding structural inequality, one MBA student was living in an apartment complex that was serviced

by a single local provider of a cable internet service that was slower than the services offered in more affluent areas nearby. In sum, the general feeling amongst the focus group respondents was that the classes worked in the end but not as well as traditional, in-person teaching.

Quantitative Survey

The resulting sample consisted of 99 responses, of which 96 were usable. The total population of potential respondents was approximately 210 students. Therefore, the response rate was 47%. One hundred percent of the respondents were African American of which 39 (41%) were male and 55 (57%) were female. To gain an understanding of the socioeconomic status of the interviewees, the students were asked if they had received a Pell Grant. Just over half of the respondents (53%) had received a Pell Grant, indicating that many of the students interviewed may have been experiencing economic hardship, which is a source of the digital divide. Given that the focus group participants expressed concerns regarding internet speeds, this issue was again raised in the survey. On a scale of 0 to 100, respondents found internet speeds to be below average with an average score of 48. The sample consisted of students who primarily resided on or near campus in the fall semester of 2020). Figure 2 below illustrates the students' perceptions of when the internet was slowest, specifically, afternoons between 12 PM and 4 PM and late evening from 8 PM to midnight. This corroborates the results of the interviews in which students described when they felt internet and application speeds were slowest. This may be primarily because many instructors set assignment deadlines for the end of the day, i.e., 11:59 PM. Before the pandemic, students routinely complained that internet speeds around the time when most assignments were due were slow. Nevertheless, according to the university, there was no documented evidence that higher levels of internet traffic at those times negatively impacted usage.
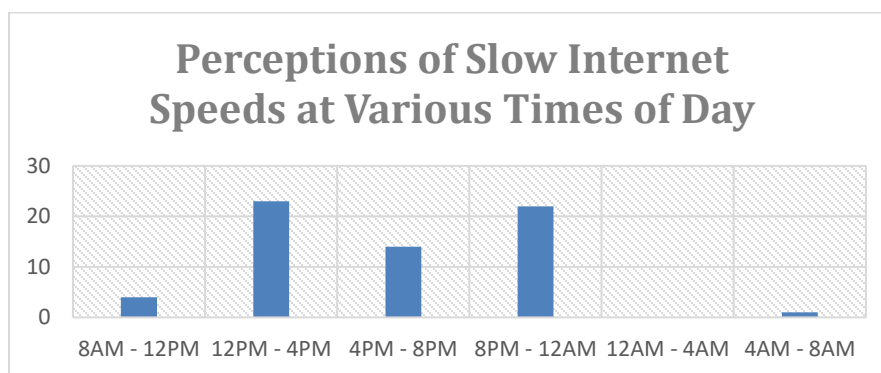
Note: the figures above do not equal the total respondents. As per the IRB, respondents cannot be obliged to answer all questions.

Preference for software was also an issue. Although Microsoft Office is the official tool of the university and students can access free licenses, students expressed a preference for Google G Suite due to its perceived ease of use and availability. Many students believed Microsoft Office was not available off-campus outside of the computer labs or library. Among the focus group respondents, some were unaware that Microsoft Office software was free and available to all students. Similarly, the quantitative survey responses indicate that 49 of the 96 respondents (49%) preferred to use Google G Suite and 43 (45%) preferred to use Microsoft Office. The students in the focus groups that understood they had access to Microsoft Office did not know how to download the software to their computers nor how to access Office 365 online. Even if the students could have used Office 365 online, some students still preferred Google G Suite. However, using the Google G Suite of tools created other problems in that students were unable to export their documents from Google in a format that was compatible with the course management system reducing their computer self-efficacy. For instance, text documents would have to be exported as pdfs or rich text files then uploaded to Blackboard. Spreadsheets would have to be exported as Excel or CSV files then uploaded to Blackboard.

Social Environment and the Digital Divide

From an organizational perspective, when the pandemic began, communication with students was inefficient. Although the institution provided laptops on a case-by-case basis, many students were initially unaware that if they did not have a laptop, the university could provide them with one. Also, regarding faculty, there was a lack of efficiency in virtual classrooms. Students in the focus group reported that "professors could not use Zoom well and when they did, there was distracting background noise," and "some professors did not use Zoom to interact...they claimed they did not have Zoom accounts."

The university had, however, provided all instructors with Zoom accounts. Many instructors either could not use the collaboration tool (Zoom) effectively or in a few cases would not use Zoom at all to conduct class. Some instructors appeared to be "technologically stunted," as described by a freshman accounting student, in their inability to use the tools available to them to deliver course content. Nevertheless, a sophomore accounting student did recognize that "there were a few professors that had an excellent command of the technology and delivered course content seamlessly."

Administrator Interviews

To fully understand the resources available to students both the Vice Provost of Distance Learning and the Associate Dean at the College of Business were interviewed. The results are as follows:

Vice Provost of Distance Learning

Before the pandemic, although the university saw the need for distance education, resources were limited and innovation was slow to materialize. As a result of the onset of the pandemic, several key initiatives were either created or expanded with the aid of CARES Act funding. For instance, a virtual undergraduate research symposium was created, the virtual campus computer lab was expanded from 20 to 125 machines, and the campus virtual learners' facilities on the course management system was expanded to aid virtual learning. Furthermore, a CARES Act website was developed to direct students to resources to aid virtual learning and personal well-being. Areas of concern were surprisingly limited with the notable exception of the incorrect coding of courses in the registration system necessary to accurately bill students. Before the pandemic, there was no coding available to properly reflect flex/hybrid courses and those held online synchronously. Other positive outcomes included changing faculty mindsets toward virtual education and additional training for faculty.

Regarding providing a measure of equity, the institution began a laptop loan program administered through the library. Internet hotspots near the campus were also offered to students. The laptop and hotspot programs were paid for using CARES Act funding. It is of note that the MSI examined in this research is part of a state system where its peers (i.e., similar-sized institutions) are predominately majority serving institutions and had established laptop borrowing programs pre-pandemic. The MSI investigated here was the only institution pre-pandemic without a laptop borrowing program.

Associate Dean, College of Business

In addition to the CARES Act funding provided through university administration, corporate giving was targeted directly at the College of Business. Resources were directed toward departments to engage with students and fulfill students' unmet technology needs, e.g., laptops, Wi-Fi hotspots, etc. Corroborating the sentiments of the Vice Provost for Distance Learning, administration and faculty in the business school now look more favorably on distance education and are more likely to embrace virtual learning. The students that appeared to be most engaged virtually, benefited from the additional resources provided, while those students that were not engaged did not take

advantage of additional resources. However, the Associate Dean observed that the additional resources could not satisfy the "reason many minority students attend an MSI," that is, "small classes, real-time interaction with faculty, and the ability for faculty and administrators to pick up on non-verbal cues. These things are not transferable to a virtual environment."

Faculty Member #1 (Department Chair Teaching One Course)

The Department Chair mentioned that their department was different from many others regarding online training and preparation as moving online did not pose a problem given that "instructors were well-versed in online teaching."

Over previous years, the Department Chair's department had focused on moving into online teaching and thus all staff in this department were able to teach effectively in a virtual environment. Harnessing their training, during COVID-19, they set up workshops and helped train other faculty. Importantly, the students in the department did not experience problems with accessing or using the virtual teaching environment and technology access more generally was not seen as a major problem. Nonetheless, from a social perspective, the students appeared to have difficulty with the mid-semester change to a virtual learning environment. For example, they experienced anxiety from the loss of jobs, lack of in-class structure, sharing space with siblings, sharing the internet with others in the home, and time management. The emotional and anxiety-related challenges were seen as contributing more to the digital divide than technology access and use problems in terms of its impact on the students' ability to acquire new knowledge.

Faculty Member #2 (Management Professor)

Some of the main issues identified concerned online training, online teaching, online testing, student anxiety, accessibility, students' interaction with peers and faculty, synchronous versus asynchronous learning, and converting face-to-face courses to online courses. Faculty member #2 stated that it was especially challenging to learn how to navigate the online environment when you were tasked with teaching three different, new, hastily created online courses without having any prior experience teaching in a virtual learning environment. It was also harder to convert classes devoted to experiential learning to a virtual format. In general, a lack of knowledge about online teaching could also contribute to the digital divide between students taking courses where faculty were not proficient in teaching in an online environment (and thus failed to motivate, interact with, and teach students effectively online) and those taking courses delivered by faculty experienced in online teaching.

The faculty member noted that many students were unprepared for the switch. Students taking online courses are not always technically literate and can struggle to understand how to use the technology (Fish and Wickersham, 2009). Faculty member #2 also mentioned that, along with online technical access and use difficulties, students experienced a multitude of problems including emotional stress, social anxiety, financial stress, illness, difficulty interacting in class, difficulty receiving feedback from instructors, difficulty managing additional work obligations, and working from home in crowded shared spaces including sharing slow internet and computer resources with others (i.e., roommates or family). COVID-19 helped aggravate the digital divide as students did not have alternative ways to access resources such as using campus computers or internet at the library, local bookstores, or coffee shops. Unequal access to technology between students can contribute to lower levels of digital literacy and can impact the level of knowledge and skills that students acquire (Hargittai 2003). The instructor also mentioned the challenges with synchronous versus asynchronous online courses for certain types of courses. Students appeared to be less engaged in the asynchronous courses.

Suggestions For Lessening the Digital Divide

The following lists the suggestions made by interviewees to improve course delivery at the institution level and concerning training for faculty and students and course-related priorities such as assessment, course objectives, and course development.

Institutional Opportunities for Improvement

- Make full library resources available to students that need to quarantine.
- Demand for distance learning is coming from all age groups.
- Continuously update the infrastructure. For example, with new software and security measures.
- Enlist creative ways to communicate with students using social media and smartphone apps. More input and feedback are needed from students to help them as learners.

Training

- Provide faculty with training delivered by faculty experienced in teaching virtually.
- Provide ongoing training - this must continue for faculty to keep up with the evolving nature of virtual education. The university should provide this training and require attendance.
- Provide students with training for completing courses virtually, including discussions on expectations, responsibilities, etc.

Assessment

- Consider virtual assessment methods: The virtual classroom is different from the face-to-face classroom. Therefore, online assessments should differ from offline assessments.
- Address cheating - Cheating should be addressed in virtual-specific assessments.

Course Objectives

- Consider how students interact with the course management system to shape objectives.
- Consider how objectives may differ in synchronous virtual versus asynchronous virtual courses.
- Think of creative ways to motivate and engage online learners. For example, create a summary of the chapters using a video guided tour of the chapter.

Course Development/Hybrid Learning

- Provide online templates that can be customized by faculty for their course and student audience.
- Mix online and face-to-face learning (i.e., hybrid courses). For example, maybe one synchronous virtual session per week and one face-to-face session per week.
- Allow face-to-face courses to go virtual when needed (e.g., if faculty need to be away for any reason, such as quarantine, conference attendance, etc.).

DISCUSSION AND CONCLUSION

This research is limited in that it examines one institution and surveys only a small number of students both quantitatively and qualitatively, which may limit the generalizability of the results. Nevertheless, the research provides another lens through which to further the literature on the digital divide.

The aim of this research is to understand what the current digital barriers are that not only maintain but have exacerbated the digital divide during the COVID-19 pandemic. The results provide insight into key areas of difficulty associated with the digital divide regarding structural inequality, organizational issues, and student income/family wealth. Structural inequality is exhibited by unequal access to housing that serves as a basis for

unequal internet access. From an organizational perspective, when the pandemic began, communication with students was inefficient. Although the institution provided laptops and hotspots, many students were initially unaware that these tools were available. This led to the key finding that the university is communicating in a way that is not adequately received by the students. Another organizational problem was that students had a significant number of instructors that were not well-prepared to deliver their courses virtually. Organizational resources were expanded to offer additional training but faculty did not take full advantage of these training opportunities. As such, the results suggest that closing the technology gap is based more on social factors than resource provision. The last major issue concerned less affluent households. In these homes, Wi-Fi networks and broadband within households were not robust enough to handle the increased traffic from more users.

This research can be helpful to educators and trainers who are developing and teaching online courses. It can provide insight into the impact of the digital divide on students and suggestions for boosting student motivation. Moreover, it can help to increase educator awareness of students, which may lead to higher levels of retention, student satisfaction, and course completion. Notably, the results support the need for broadband access. Finally, this research highlights the need for further study into the digital divide, its outcomes, and the barriers to overcoming the divide in specific areas and communities.

References

Adedoyin, O. B., and Soykan, E. 2020. "Covid-19 Pandemic and Online Learning: The Challenges and Opportunities," *Interactive Learning Environments*), pp. 1-13.

Castells, M. 2002. *The Internet Galaxy: Reflections on the Internet, Business, and Society*. Oxford University Press on Demand.

Cherns, A. 1976. "The Principles of Sociotechnical Design," *Human relations* (29:8), pp. 783-792.

Clegg, C. W. 2000. "Sociotechnical Principles for System Design," *Applied ergonomics* (31:5), pp. 463-477.

Commission, F. C. 2021. "Bridging the Digital Divide for All Americans."

Commisssion, F. C. 2021. "Homework Gap and Connectivity Divide."

Fish, W. W., and Wickersham, L. E. 2009. "Best Practices for Online Instructors: Reminders," *Quarterly Review of Distance Education* (10:3), p. 279.

Fitzgerald, D. 2020. "Broadband Internet Promises Are Left Unfulfilled in Many Rural Areas," in: *Wall Street Journal*.

Fuchs, C. 2009. "Information and Communication Technologies and Society: A Contribution to the Critique of the Political Economy of the Internet," *European journal of communication* (24:1), pp. 69-87.

Gillis, A., and Krull, L. M. 2020. "<? Covid19?> Covid-19 Remote Learning Transition in Spring 2020: Class Structures, Student Perceptions, and Inequality in College Courses," *Teaching Sociology* (48:4), pp. 283-299.

Hargittai, E. 2003. "The Digital Divide and What to Do About It," *New economy handbook* (2003), pp. 821-839.

Liguori, E., and Winkler, C. 2020. "From Offline to Online: Challenges and Opportunities for Entrepreneurship Education Following the Covid-19 Pandemic," *Entrepreneurship Education and Pedagogy* (3:4), pp. 346-351.

Mahyoob, M. 2020. "Challenges of E-Learning During the Covid-19 Pandemic Experienced by Efl Learners," *Arab World English Journal* (11:4).

Milstein, J. 2021. "New York's Digital Divide Is a Problem. Mandating Broadband Could Solve It," in: *USA Today*.

Neves, B. B., and Fonseca, J. 2015. "Latent Class Models in Action: Bridging Social Capital & Internet Usage," *Social science research* (50), pp. 15-30.

Nielsen, J. 2006. "Digital Divide: The Three Stages." from from https://www.nngroup.com/articles/digital-divide-the-three-stages/

Selwyn, N., 2004. "Reconsidering Political and Popular Understandings of the Digital Divide," *New media* (6:3), pp. 341-362.

Sunasee, R. 2020. "Challenges of Teaching Organic Chemistry During Covid-19 Pandemic at a Primarily Undergraduate Institution," *J Journal of Chemical Education* (97:9), pp. 3176-3181.

van Deursen, A., van der Zeeuw, A., de Boer, P., Jansen, G., and van Rompay, T. 2021. "Digital Inequalities in the Internet of Things: Differences in Attitudes, Material Access, Skills, and Usage," *Information, Communication Society* (24:2), pp. 258-276.

Van Dijk, J. 2005. *The Deepening Divide: Inequality in the Information Society*. Sage Publications.

APPENDIX A – INTERVIEW/SURVEY QUESTIONS

Student Questions

- To what degree were you negatively impacted regarding technology at the beginning of the pandemic?
- Hardware – adequately working on a computer.
- Software – applications used for class, any difficulty obtaining, downloading, or using software for class.
- Internet access – did you have broadband where you live?
- If you did not have broadband or if you had broadband but it was shared with multiple users in the household, was your connection adequate to allow you to complete your schoolwork?
- Before school went virtual (March 2020), what were your thoughts about virtual learning? Did those perceptions change after the spring semester and the beginning of the fall semester?
- To what degree do you believe faculty and administrators were prepared to be able to deliver courses virtually?

Faculty/Administrator Questions

- Describe the resources allocated to distance learning before and during the pandemic.
- Were any new programs devoted to distance learning proposed during the pandemic?
- How will teaching philosophies change as a result of the pandemic?