Barriers to e-Learning During Crisis: A Capital Theory Perspective on Academic Adversity

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ABSTRACT

The unprecedented coronavirus pandemic (COVID-19) presented new, daunting academic adversities to college students, especially those from underserved communities. This study provides a nuanced understanding of underserved students' adversities in online distance education, based on an in-depth analysis of narratives of 220 students from a minority-serving institution in the United States. Informed by the capital theory, the study revealed six major barriers to e-learning: technical, cultural, environmental, balance, social, and financial barriers, and identified new underlying dimensions. Moreover, the study found that technical barriers are often coupled with other types of barriers and underserved students are more likely to experience multiple learning barriers. A variance model of influencing factors was proposed for e-learning outcomes. The paper highlights new digital divide in e-learning and provides practical implications for educational institutions to support underserved students in overcoming academic adversities and building educational resilience.

Keywords: e-Learning, Underserved students, Academic adversity, Learning barriers, Capital theory, COVID-19

1. INTRODUCTION

Information and communication technology (ICT) has been used to support core teaching and learning activities in distance education (Saw et al., 2008). As such, the learning process supported and enabled by ICT is referred to technology-mediated learning (TML) that consists of delivery of course instruction, communication among students and instructors, and execution of learning tasks (Alavi & Leidner, 2001). TML has been considered as a major breakthrough in teaching and learning because it allows both synchronous and asynchronous deliveries of information to learners who could not attend classes in person (Appana, 2008). Referring TML as electronic learning (e-learning), information systems researchers examined the success factors for e-learning outcomes (Hayashi et al., 2004). However, TML also creates obstacles for higher education institutions. For example, Cho and Berge (2002) conducted a content analysis of 32 cases of organizations using TML and revealed a major barrier related to technical expertise, support, and infrastructure of the institutions.

The coronavirus pandemic (COVID-19) has forced higher education institutions around the world to adopt the TML and given rise to new academic adversities to learners in the online learning environment. Adversity refers to the negative contexts and experiences that can potentially disrupt or challenge adaptive functioning and development of individuals (Obradović et al., 2012). In the academic context, adversity is considered a critical inhibitor to student success in higher

education. COVID-19 has imposed sudden, new adversities to college students in the middle of the spring 2020 semester: face-to-face education was disrupted as colleges and universities moved in-person classes to distance education to contain the outbreak. In this context, the adversities were acute, due to the sudden, unprecedented outbreaks of the deadly virus. Moreover, the adversities affected multiple levels and settings simultaneously because COVID-19 has negatively impacted the healthcare system, economy, and social activities globally. The interplay of the acute nature and multi-level scope of the adversities exacerbated the COVID-19 related adversities in education.

Among the population of college students, underserved students were hit the hardest. Underserved students are students who do not receive equitable educational and career planning opportunities and resources as other students in the academic pipeline (ACT Report, 2014). They possess at least one of the following characteristics: (1) racial/ethnic minority; (2) low household income; or (3) first generation in college (i.e., highest parental education level is high school or less) (ACT Report, 2014). Underserved students have experienced economic and financial barriers in their college retention and graduation. According to Kyte (2017), approximately one third of surveyed universities and colleges failed to provide resources to help underserved students balance the demands between employment for earning income and academic study in college.

On top of the existing barriers that underserved students already face, COVID-19 has posed more and new risks to the

underserved students, hindering their academic progresses. As reported by the U.S. Centers for Disease Control and Prevention (2020), African American and Hispanic/Latino minority communities experienced disproportionly high health risk in COVID-19. Meanwhile, they suffered from higher levels of unemployment, at a rate of 16.6% and 18.2% respectively in April 2020, compared to 12.8% for Whites and 13.7% for Asian Americans (Couch et al., 2020). How underserved students adapted and persevered in this unprecedented global crisis has emerged as an urgent and important question. Thus, this study addresses the following research questions:

1) What are the major barriers for e-learning of underserved college students?
2) How do these barriers interact with each other influencing e-learning?
3) Do these learning barriers differ for underserved students compared to their counterparts?

The study draws upon literature on e-learning and academic adversity as well as adopts the capital theory by Bourdieu (1986) as a sensitizing framework to guide our data coding and analysis. A survey of 220 students from a four-year minority-serving university was conducted in late March of 2020. The sample represents underserved college students, including 155 (70.4%) Black or Hispanic students, 128 (58.2%) students with household income less than the median income of the region, and 138 (62.7%) first-generation students (FGS). FGS are a disadvantaged population of students who enroll in postsecondary education and whose parents do not have any postsecondary education experience (Redford & Hoyer, 2017).

Our qualitative analysis shows that six major learning barriers emerged during the sudden transition to distance education: technical, cultural, social, financial, environmental, and balance, of which, environmental and balance barriers are newly discovered barriers that have not been addressed in previous research. Moreover, technical barriers are found to interact with other types of barriers influencing student e-learning. In addition, our supplemental data analysis shows that underserved students are more likely to encounter multiple barriers to e-learning, compared to their peers.

Focusing on the underserved student population, this study contributes to the literature in two ways. First, it incorporates the capital theory perspective to enrich the conceptualization of academic adversity. Second, it develops a variance model for future quantitative research to test e-learning outcomes – positive responses to academic adversity – in different educational settings. Furthermore, the study has important practical implications. Understanding the academic adversities of underserved students during COVID-19 provides useful and timely insights into designing and implementing programs to support their continuing success under national or global crises.

The reminder of the paper is organized as follows: Section 2 reviews literature on e-learning, academic adversity, and capital theory; Section 3 describes the methods used for data collection and analysis; Section 4 reports research findings; Section 5 discusses the results and proposes a variance model; Section 6 indicates policy implications and offers suggestions for future research; and Section 7 concludes with a call for shared responsibilities in building educational resilience of underserved students.

2. LITERATURE REVIEW

2.1 e-Learning

In this paper, we consider TML as e-learning (Hayashi et al., 2004). Consistent with prior research (e.g., Andres & Shipps, 2010), this paper draws upon the affordance lens on e-learning. A key concept of affordance refers to the action potential that an object offers (Gibson, 1986). In the information systems context, technology affords actional potentials (Majchrzak & Markus, 2013). The relationship between a user and technology initiates an affordance, yet it can provide more than one type of affordance. For example, Treem and Leonardi (2012) identified four affordances of social networking technology (i.e., social media) – persistence, association, editability, and visibility – and suggested that the same or similar technology may provide a set of different affordances to different users in different contexts.

The context of TML and collaboration may provide a set of different affordances. Kirschner and colleagues (2004) examined collaborative learning mediated by technology and suggested that the effectiveness of such collaborative learning depends on the presence of three types of affordances – the technological, educational (or learning), and social affordances – in the task environment. According to Kirschner et al. (2004), technological affordances refer to the presence of specific tools and artifacts such as videoconferencing or workgroup support system that supports collaborative tasks. In particular, technologies afford the accomplishment of learning goals by facilitating and maintaining member participation, information exchanges, and interactions to the team learning process.

Although technology use can afford actions for positive outcomes, the interaction between the user and technology can afford actions that provide hindrances in other ways (Leidner et al., 2018). For example, Andres and Shipps (2010) examined a team's collaboration mode (collocated vs. non-collocated and videoconferencing supported) and its impact on team performance. They found that compared with face-to-face collaboration mode, teams using technology-mediated collaboration experienced greater instances of communication breakdowns, misunderstandings, and difficulty moving forward with task execution.

In the e-learning environment, individual learners' behavior is also important. Patterns of interactions between instructors and learners and among learners themselves have been found useful to explain the behavior of learners. Chou (2002) compared student interactions in different learning environments and found that a higher percentage of social-emotional interactions occurred in synchronous mode, while task-oriented interactions were more frequently observed in asynchronous discussions. In addition to technology and individual behavior, factors and experiences related to academic adversity have potential, negative effects on student learning outcomes.

2.2 Academic Adversity

Academic adversity refers to the contexts and experiences that have the potential of negatively affecting a student's adaptive functioning and development in an academic setting (Obradović et al., 2012). Adversities may be classified by its temporal impact or effect scope. A chronic adversity such as poverty or racism has long term effects, while an acute adversity results from tragic events such as a sudden loss of a

loved one or being a victim of an armed robbery (Yates et al., 2015). Moreover, adversities may affect systems within an individual, such as a virus that attacks the immune system of a person. They may also affect systems at multiple levels and settings simultaneously, as in the case of a natural disaster that affects individual systems of stress, beliefs, and behavior, as well as broader systems of family, school, health care, and agriculture (Yates et al., 2015). Further, adversities may be part of everyday academic life or pose a major threat to a student's long-term educational development (Martin, 2013). During COVID-19, the adversities are acute, affecting multiple levels and settings simultaneously, and potentially threatening students' long-term learning.

To operationalize the concept of academic adversity, Martin (2013) developed an academic adversity index named the Academic Risk and Resilience Scale (ARRS), which consisted of factors such as failing a grade, school suspension, and a learning disability. Subsequently, Cassidy (2016) proposed a 30-item Academic Resilience Scale (AR-30) to capture college student's specific adaptive cognitive-affective and behavioral responses to academic adversity. The AR-30 measure highlights the importance of internal factors such as self-efficacy and self-regulation in overcoming academic challenges. On the other hand, using a sample of 249 individuals aged between 16 and 20 years from high-needs communities in Australia, Collie et al. (2017) emphasized the importance of external factors such as social and academic support in determining the learning outcomes of students who experienced academic adversity. Regardless of the specific measures used, research has shown that academic adversity is negatively associated with student engagement and academic achievement (Martin, 2014; McLeod et al., 2012; Wang & Peck, 2013).

2.3 Capital Theory

The literature outlined above implies that social, economic, and cultural factors are conducive to the persistence and academic performance of college students, especially those who come from underserved communities. These factors can be viewed as various forms of capital. From an economics perspective, capital consists of assets that can enhance one's power to perform economically useful activities. These assets can take several forms. In this qualitative study, we employ the capital theory by Bourdieu (1986) as a sensitizing framework for understanding the learning barriers of underserved college students.

According to Bourdieu (1986, 2002), capital can present itself in five fundamental forms: economic, cultural, social, symbolic, and technical. Economic capital refers to monetary resources. Cultural capital includes shared, cultural signals such as attitudes, preferences, behavior, and educational qualifications. "Educational credentials become a kind of surrogate measure of quality or ability" (Cai, 2013, p. 459) and can signal an ability to perform in the workplace, thus influencing labor market outcomes. Social capital is comprised of social obligations or connections, and encompasses individual's socio-economic status, social networks, and the social status/standing of their connections. Symbolic capital refers to an individual's accumulated wealth in a symbolic form, such as authority, knowledge, prestige, reputation, or academic degrees. Technical capital captures the technology-related skills that a person develops using computing

equipment. All these capitals are critical for an individual to succeed in a society.

Bourdieu's capital theory has only recently begun to appear in the information systems education literature. For example, Joshi et al. (2016) found that African American men succeed in information technology careers by accumulating the five forms of capital. In our study, we consider missing (or lack of) each capital as an indication of barrier. For example, lacking technical capital is viewed as encountering a technical barrier. In sum, the existing literature on e-learning and academic adversity are helpful in building our basic understanding of the challenges to higher education brought by COVID-19. Yet, we have limited knowledge about the multifaceted nature and massive magnitude of adversities in e-learning during such a global crisis. To address the research gap, this study adopts the capital theory lens to guide our investigation of students' learning barriers during COVID-19.

3. RESEARCH METHOD

Our research goal is to develop an analytical generalization regarding barriers that hinder academic continuity during the global crisis. To address the first two research questions, we analyze data using qualitative research methods (e.g., open coding, analytical categories informed by prior research, data display matrices) as articulated by Miles and Huberman (1994). To address the third research question, we supplement our qualitative analysis with chi-square tests for quantitative data.

3.1 Research Site and Data Collection

We collected data through an online questionnaire distributed to undergraduate and graduate students of a four-year urban, public university in the United States. The university is known as a minority-serving institution with 60% of students being Hispanic or Latino, 15% Black or African American, 11% White, 11% Asian, and others. Consistent with the definition by U.S. Department of Education (2021), we consider minority-serving institutions as institutions of higher education that enroll a high percentage of minority students such as African American, American Indian, Hispanic/Latino, and Pacific Islander. In addition, 54% of the students in this university are FGS; 64% are Pell-eligible (eligible to apply for U.S. Federal Pell Grants targeted at undergraduate students with exceptional financial needs); 74% are employed full-time; 64% are female; and 86% are undergraduates. In comparison, among four-year public universities in the U.S., 56% of undergraduate students are White, 20% Hispanic, 12% Black, and 8% Asian; among all postbaccalaureate degree programs, 63% of the students are White, 14% Black, 11% Hispanic, and 8% Asian (NCES, 2020). Given the diversity of the student body, this university is an ideal research site for us to study underserved college students' learning barriers and academic adversity during COVID-19.

Prior to COVID-19, majority of students at this university were enrolled in in-person classes and used "Blackboard" as the main web-based course management system. Due to COVID-19, the university suspended all in-person classes in the middle of spring semester in 2020 and migrated all classes to alternative instruction (virtual, distance education).

We collected data via an online survey from late March to early April of 2020. The survey included 18 questions and took 15 minutes on average to complete. Specifically, the survey

asked about student's concerns with COVID-19 (1-4 points scale) and views about technology readiness (1-4 points scale). It also included an open-ended question about students' learning barriers: "What are the major barriers for you to continue the college classes via the alternative instruction mode during the remaining weeks of the semester, and how are you handling the barriers? Please provide an example, if possible." Other survey questions asked the study participants' individual and demographic background (including age, gender, employment, ethnic background, FGS status, household income, etc.).

Due to the limited time frame, we were not able to conduct a pilot study. We first solicited instructors from the same college who agreed to disseminate the survey to their students. We then asked these instructors to share the survey link to their students. A total of 450 students received the survey, among which, 220 completed it, resulting in a response rate of 48.9%. Female accounted for 51.8% of the total responses, and FGS accounted for 62.7%. Table 1 summarizes the data sample.

	Frequency	Percent
By Gender		
Female	114	51.8%
Male	106	48.2%
By First-Generation Student Status		
FGS	138	62.7%
Non-FGS	82	37.3%
By Household Income		
Less than $20,000	47	21.4%
$20,000 to $34,999	42	19.1%
$35,000 to $49,999	39	17.7%
$50,000 to $74,999	42	19.1%
$75,000 to $99,999	25	11.4%
$100,000 or More	25	11.4%
By Employment Status		
Employed full-time	87	39.5%
Employed part-time	63	28.6%
Not employed	70	31.8%
By Ethnicity		
Asian or Pacific Islander	34	15.5%
Black or African American	24	10.9%
Hispanic or Latino	131	59.5%
White or Caucasian	21	9.5%
Other	10	4.5%
Grand Total	220	100.0%

Table 1. Sample Characteristics

In addition, 75.5% of the respondents indicated that they were "concerned" or "very concerned" about the risks of COVID-19, followed by 23.2% indicating "somewhat concerned" and 1.4% "not concerned at all."

3.2 Data Coding and Analysis
In the initial data coding, we analyzed respondents' narratives to identify major obstacles they encountered in learning. Our initial coding scheme was informed by the capital theory. For example, social barrier is defined as lacking social capital such

as social obligations or connections, social networks, and the social status/standing of their connections.

Following Miles and Huberman's (1994) coding strategy, we performed the data coding manually in multiple steps. First, the two researchers determined the coding scheme of barrier categories based on prior studies on academic adversity (Obradović et al., 2012; Yates et al., 2015) and capital forms (Bourdieu, 1986, 2002). This process resulted in four learning barriers corresponding to four types of capital respectively (with the exception of symbolic capital). Using this initial coding scheme, we performed a pilot coding on 10 sample responses. New categories emerged or existing categories were modified. We discussed the pilot coding results and refined the coding scheme, such as adding the barrier types of "balance" and "environmental" and classifying "lack of study space" as an environmental barrier in distance education. Next, we independently coded 75 responses (38.6% of the sample), discussed the coding, and resolved any coding disagreements. Then, one coder followed the agreed coding scheme and completed coding of the remaining data. The inter-rater reliability of coding has a Cohen's Kappa Index of 0.903, suggesting a high level of agreement between the two coders (Ryan & Bernard, 2000). Table 2 provides coding examples and summarizes the coding scheme consisting of barrier categories and sub-categories (concepts).

As shown in Table 2, the raw count of each barrier (in Column 1) represents the number of respondents who reported that barrier, and the percentage value represents the percent of total 179 respondents who reported barriers. As each respondent's statement may have more than one coded barrier category assigned, the sum of the percentages exceeds 100%.

In total, 81.4% (179 out of 220) of the respondents reported at least one learning barrier during the first transition week, while 18.6% (41 out of 220) reported no barrier. We assigned between one and four barriers to a respondent's statements. Among all 179 respondents who reported at least one barrier, 32.4% reported multiple barriers simultaneously (i.e., two or more barriers).

4. FINDINGS

The participants in our study expressed six major barriers associated with their learning experience as they adapted to, and engaged in, the alternative mode of instruction in online learning environment. Below we elaborate our findings in three subsections, each subsection addressing each of the three research questions accordingly.

4.1 Six Categories of Barriers
4.1.1 Technical Barrier. Technical barrier refers to obstacles associated with the technical component of the distance education environment, including the platform, hardware, software, Internet, and online learning modality. This barrier emerged as a dominant obstacle hindering students' academic work: 48% of the 179 respondents reported such barrier. However, the underlying causes of technical barrier varied. One major cause is *lack of technical equipment*, including insufficient Internet access and computer equipment (hardware, software). In some cases, students did not have Internet access at home, and others lacked the software required for class. One respondent elaborated on the Internet access problem:

Barrier Category	Sub-category	Coding Example
(1) Technical Barrier (86; 48%) Lacking technology-related skills and computing resources *(Modified from Bourdieu, 1986)*	Lack of technical equipment: Lack of adequate equipment and tools for achieve tasks and goals in distance learning (i.e., computer software and hardware, Internet) *(Derived from the study)*	*"I don't have internet connection at home so I have to be using my mobile hotspot to connect with my computer."*
	Lack of digital skills: Lack of exposure to or previous experience with familiarity with using computing hardware, software, and the platform to accomplish tasks and goals in distance learning *(Modified from Bourdieu, 1986)*	*"I am not fully known to zoom so it is hard for me to understand how it work."*
	Complexity of online modality: User frustration resulted from the complexity of online learning, such as unexpected multiple classes online, technical problems with the platform, hardware, software, etc. *(Derived from the study)*	*"Now that all classes are online it makes it hard to remember due dates and what assignments need to be done."*
(2) Cultural Barrier (57; 31.8%) Lacking cultural capital, including shared, cultural signals such as attitudes, preferences, and behaviors, as well as educational qualifications. *(Modified from Bourdieu, 1986)*	Lack of focus: Lacking the embodied state incorporated in mind and body, such as lack of focus, difficulty to concentrate, being distracted from academic work *(Modified from Bourdieu, 1986)*	*"It's hard to concentrate on hw, papers, projects, exams when you aren't even sure if you have the virus causing this pandemic."*
	Lack of online learning capability: Lacking strong capability for online instruction *(Derived from the study)*	*"My major barriers are the overall class instruction itself. My personal ways of learning require me to be in a classroom setting. The classroom is where I succeed, not on-line."*
(3) Environmental Barrier (56; 31.3%) Lacking suitable environment to support learning activities in distance education *(Modified from Swarbrick, 2006)*	Learning space inadequacy: Lack of spacious and quiet environment to support learning activities in distance education (i.e., study space, desk) *(Derived from the study)*	*"I lack solitary study space. There are always people at my house and it's hard to get away with COVID-19 closing libraries, and coffee shops."*
(4) Balance Barrier (30; 16.8%) The challenge of meeting the demands from employment, family and education all at once during the crisis time. *(Derived from the study)*	Work-life balance struggle: Difficulty in allocating time and efforts to meeting demands from employment, family and college education *(Derived from the study)*	*"Barriers are having my kids at home, working from home and completing my courses now online."*
(5) Social Barrier (23; 12.8%) Lacking social capital, i.e., social obligations or connections, social networks, interaction with other key stakeholders in the distance education environment, including instructors, tutors, classmates and project team *(Modified from Bourdieu, 1986)*	Insufficient student-teacher interaction: Lack of access to and interaction to relationships with others (i.e., Instructors, tutors) knowledgeable about the subjects of study *(Modified from Bourdieu, 1986)*	*"Some major barriers would include the lack of teacher-student interaction, ability to ask questions in person"*
	Insufficient student peer interaction: Lack of access to and interaction with relationships with peers (i.e., classmates, members of project teams) to share knowledge and collaborate on course work *(Derived from the study)*	*"My major barrier is not having the chance to interact with my fellow group from my class to get a better understanding of each topic that is being discussed in class."*
(6) Financial Barrier (4; 2.2%) Lacking economic capital such as monetary resources and can be expressed as money or property. *(Modified from Bourdieu, 1986)*	Financial insecurity: Lacking financial resources to procure IT equipment and tools needed for online education *(Modified from Bourdieu, 1986)*	*"One barrier is not being sure I'll have access to the internet for the rest of the semester since family is not working at the moment."*

Table 2. Coding of e-Learning Barriers in Crisis

Some of the major barriers for me are slow internet. There are 3 students in my home so our internet tends to be really slow while we are doing our homework. I am trying to handle that barrier by having an assigned time we each get to work on our most important assignments in which we need faster internet and try to stay off the internet while the other one works on homework.

The second cause of technical barrier is students' **lack of digital skills**. Online classes relied on the content management system of Blackboard and the videoconferencing tool Zoom, but some students struggled with using these technologies. As one respondent explained, "*A lot of students had never done an online class before and don't know how to navigate on video call services.*"

The third cause of technical barrier is the **complexity of online modality**. When multiple classes were offered online during the same time period, students encountered more technical problems with computer hardware and software. This is reflected below:

I am used to online classes but having all my classes online can get overwhelmed. The main barrier I have faced is when instructors want to have a mandatory live Zoom session. We are in uncharted territory and facing an unprecedented situation so having to attend an online session can be difficult.

As shown above, the respondents' problems with adequate Internet access, or lacking software programs or hardware for their course work were partly resulted from the shutdown of campus facilities. Our respondents have found temporary solutions to cope with some barriers, but not others. For example, to overcome the technical barrier of slow Internet, some respondents asked family members "to turn off all devices to speed up Wi-Fi" or agreed upon "assigned time" for Internet access. However, for technical barriers associated with lacking digital skills and multiple online classes, no effective solutions were readily available. In the long run, enhancing digital skills is essential for e-learning success, because students' digital literacy can enhance their self-efficacy, which in turn has a positive, significant effect on online learning behavior (Prior et al., 2016).

4.1.2 Cultural Barrier. Cultural barrier refers to the difficulty to concentrate on, or lacking the capability for, academic study using online learning platform. Respondents frequently expressed their problems with **lack of focus** for course work when they were surrounded by the escalation of the virus outbreak and overwhelmed by the concerns of their family's health. This type of barrier is revealed in the following remark:

It has been very hard to fully focus on school because of the uncertainty that we are facing during this pandemic. Many people are stressing out because they are losing their jobs and, in some instances, loved ones to this virus.

Another underlying dimension of the cultural barrier is **lack of capability for online modality**. Respondents frequently expressed their struggle with online modality and stated that they performed better in in-person instructions. In some instances, students found it difficult to understand a topic without in-person instructions from professors, as they explained below:

Trying to learn through zoom, or posted presentations

is somewhat of a challenge for me. It just isn't the same as having an instructor right there to repeat/explain an example.

I feel that learning specific topics is just very difficult to a point where you start giving up. An example for me would be Statistics, I was doing really well on campus but now I feel like I can't grasp the lectures which is discouraging me.

Unlike the students who encountered technical barriers and found solution by allocating Internet use time to maintain stable connections, the students facing cultural barriers did not have solutions available for them to cope with the "distraction" challenges.

4.1.3 Environmental Barrier. Environment barrier refers to lack of spacious, quiet environment to support learning activities in distance education. This is a new category of learning barrier emerging during the pandemic. This construct is inspired by the wellness research that highlights environment as one of the eight dimensions to focus on for individuals to optimize health and wellness (Swarbrick, 2006). For e-learning, it is important for students to have an appropriate study space to concentrate on learning tasks. However, this has become one major challenge for college students in the spring of 2020, as illustrated in the following remarks:

The major barrier is lack of study space. I'm renting a room and have limited and comfortable space in my room to study. I have to sit in the bed which hurts my back and my lightning in my room isn't that bright.

A barrier for me would be a lack of study space because everyone is at home during the same time. I am handling that by choosing a space in the house and letting everyone know that, that specific place is for me at a specific time.

As shown above, whether renting a room or staying with family members at home, the respondents lacked a stimulating environment for their online classes. In some cases, they were able to cope with the barriers by setting up family rules for sharing study space in the household. However, in other cases when the living space was very limited and uncomfortable, it became more difficult for them to perform their learning activities.

4.1.4 Balance Barrier. Like the environmental barrier, balance barrier emerged as another new learning obstacle during the pandemic. Balance barrier refers to the challenge of meeting the demands from employment, school, and family all at once during the crisis. Some students had to take care of family members (especially children and the elderly) while others tried to balance academic work and increasing workload from their employers. Two students elaborated on this challenge below:

In my case, I don't have an impact with slow internet or study space, the only thing I need to manage is the time with my kids which I'm providing care for and time to do their academic work while I try to complete mine.

For me, the biggest challenge is my job because of the high number of shifts I have to cover due to the virus and call-offs of work. Gives me little to no time to get homework done.

As shown above, adult students during the pandemic found themselves struggling with fulfilling responsibilities in multiple roles: employee, family caregiver, and college student. Due to COVID-19, they not only felt more work pressure from their employers but also picked up new jobs as home-school teachers for their children while exploring the new territory of taking all classes online. Social interactions with and support from their professors and peers would be needed to help them get through the sudden change of instruction modality and shelter-in-place orders. Yet, these much-needed social support turned out to be inadequate as they experienced the social barrier.

4.1.5 Social Barrier. Social barrier refers to lack of access to and interaction with other key stakeholders in the distance education environment, including instructors, tutors, classmates, and project team members. One major challenge for online learning is ***insufficient student-instructor interaction***. One respondent explained:

> *The major barriers for college classes online are having better communication to the professors and the content they prove as some information is lost within the mode they teach on-screen. Whether it is a small number of questions or in a discussion of certain topics.*

Another type of social barrier is ***insufficient student-peer interaction***. Some respondents expressed their frustration about lacking interactions with their classmates and project team members in the online learning environment. This insufficiency affected their learning motivations, especially when they were expected to collaborate on a project, as shown in the following remark:

> *One challenge would be like group projects that were assigned in class, we kind of have to do everything differently. We've handled them by constantly being in contact using text messaging to communicate.*

4.1.6 Financial Barrier. The final category of barrier is financial barrier, which refers to lack of financial resources to support student's college education in the online environment, such as purchasing a computer and upgrading the Internet connection speed. Although this type of barrier has the least number of occurrences, it is worth noting that lack of financial resource would impact one's college education negatively. One respondent explained why his biggest barrier is financial, "My wife lost her job due to COVID-19 and we are struggling to make ends meet."

In summary, the COVID-19 pandemic has given rise to new barriers in e-learning. Meanwhile, for those barriers suggested in prior literature, new dimensions (i.e., sub-categories) were identified. For example, among the three sub-categories of technical barrier, lack of technical equipment and complexity of online modality were newly derived from this study.

4.2 Interplay between Technical Barriers and Other Barriers

A closer examination of the data reveals that students often experienced more than one type of barriers in their e-learning during the crisis. Among all 179 respondents, 56 of them (32.4%) reported multiple barriers simultaneously. Table 3 summarizes the co-occurrence of two or more barriers.

4.2.1 Technical and Environmental Barriers Co-occurred Frequently. It is not surprising as lack of study space is a common environmental obstacle for distance learning when the shelter-in-place order was enforced during the outbreak. Meanwhile, having most, if not all, members of the household, access online for work and/or learning gave rise to technical barriers. Among the 56 respondents who reported environmental barrier, 17 (30.4%) also experienced technical barrier. This coupling of technical and environmental barriers is reflected in the remark below:

> *My room is right next to the living room where the TV is. Sometimes when I'm trying to work on assignments or study or take tests it can be hard to concentrate. Also the Internet is slow, with many devices accessing to the Internet at the same room.*

4.2.2 Technical and Social Barriers Co-occurred. 35.7% technical barriers (10 out of 28) were related to social barriers. For example, lacking stable Internet connection was found to have a negative effect on execution of learning tasks (such as disruption in an online test). Such technical barrier was also associated with the insufficient communication with peers and instructors online. This coupling of barriers is illustrated below:

> *I am not tech savvy, and already hate sitting in front of a screen. Like many other students I learn better in interactive environments. Classes via the alternative instruction mode takes the fun out of learning which deteriorates my determination to learn subjects that I am actually interested in.*

4.2.3 Technical and Cultural Barriers. Our study participants expressed their experience with technical and cultural barriers simultaneously. This is reflected in the remark:

> *Now that my siblings are all home at the same time we're all trying to do our homework but it slows down the internet. Also now that all classes are online it makes it hard to remember due dates and what assignments need to be done.*

4.2.4 Technical and Balance Barriers. Majority of the study participants (68%) worked full-time or part-time while attending college. They frequently mentioned the challenges in balancing work, family, and study. The balancing barrier was coupled with technical barrier in their e-learning during COVID-19. A student illustrated the dual challenges of obtaining Internet access and balancing work and study at home:

> *I worry about my internet access lasting during this time period because I do not have internet at home and instead use a mobile hotspot to work on homework and work materials. I also work from home, which requires even more internet, so I fear that my connection will get slow and prevent me from easily completing assignments and work materials.*

The above examples revealed the association between technical barrier and other types of barriers. In addition, it is interesting to note the frequent coupling of environmental and cultural barriers; among the 56 respondents who reported environmental barrier, 44.6% of them also reported cultural barrier (see Table 3).

Barrier Category	Technical	Cultural	Balance	Social	Financial	Total
Environmental	17	25	7	6	1	56
Technical		9	7	10	2	28
Cultural			9	1	1	11
Balance				3	0	3
Social					0	0

Table 3. Occurrences of One Barrier Coupled with Another

4.3 Interplay Between Learning Barriers and Underserved Student Status

As mentioned previously, underserved students possess at least one of the following characteristics: (1) racial/ethnic minority; (2) low household income; or (3) first generation in college. Because over 80% of our sample are minority students, we look at the other two characteristics of underserved students and examine whether their learning barriers differ from those of non-underserved students.

4.3.1 Difference in the Learning Barriers - by Household Income. The experience of multiple barriers varied by the respondent's household income. According to the U.S. Census Bureau (2020), the median household income in the county where the university under study is located is about $64,000. For the purpose of this study, we categorize the household income below $50,000 as low income. As shown in Table 4, 38.1% of students from low-income households experienced multiple learning barriers compared to 25.7% of non-low-income students.

This difference by low-income household is statistically significant at the 0.10 level according to the Chi-square test. The remark of a low-income student illustrated the dual challenges of obtaining Internet access and balancing work and study at home:

I worry about my internet access lasting during this

time period because I do not have internet at home and instead use a mobile hotspot to work on homework and work materials. I also work from home, which requires even more internet, so I fear that my connection will get slow and prevent me from easily completing assignments and work materials.

4.3.2 Difference in the Learning Barriers: by FGS Status. The experience of multiple barriers varied between FGS and non-FGS. Table 5 details the distribution of the multi-barrier respondents by student's FGS status. Chi-square test shows that FGS are more likely to experience multiple learning barriers than their counterpart.

The result is not surprising as FGS tends to juggle with multiple responsibilities including employment, caregiving, and college study. The following is a statement of an FGS who encountered both balance and social barriers:

We are ALL working overtime due to these unforeseen circumstances Please keep in mind many students are dealing with one to three Full/Part-time jobs and have kids that are also affected by the COVID-19 situation. Not being able to be in class for lecture also makes learning more difficult and adds many more hours studying/reading course textbooks and lecture slides.

	Low-Income (column %)	Others (column %)	Total (column %)
Single Barrier	65 (61.9%)	55 (74.3%)	120 (67%)
Multiple Barriers	40 (38.1%)	19 (25.7%)	59 (33%)
Total	105 (100%)	74 (100%)	179 (100%)
Chi^2 (1) = 3.03, p = 0.082; Cramér' V = 0.13; Gamma = 0.281			

Table 4. Multiple Barriers: By Household Income

	FGS (column %)	Non-FGS (column %)	Total (column %)
Single Barrier	65 (59.6%)	55 (78.6%)	120 (67.0%)
Multiple Barriers	44 (40.4%)	15 (21.4%)	59 (33.0%)
Total	109 (100%)	70 (100%)	179 (100%)
Chi^2 (1) = 7.797, p = 0.050; Cramér's V = 0.209; Gamma = 0.412			

Table 5. Multiple Barriers: By FGS Status

5. DISCUSSION

The objective of this study was to examine e-learning barriers due to the COVID-19 pandemic. Our data analysis reveals six major barriers during the global crisis in spring 2020. In particular, technical, cultural, and environmental barriers emerged as the top three barriers, followed by balance, social, and financial barriers. Although technical and cultural barriers resemble to some degree the lack of technical and cultural capital (Bourdieu, 1986, 2002), the constructs of the two barriers in our study were associated with new underlying dimensions. In addition, the two newly identified barriers, environment and balance barriers, are pertinent, especially for adult college students who often take dual or triple roles – employee, parent, and college student – in the context of the pandemic. In this regard, the environment and balance barriers exemplify the importance of external factors in influencing the learning of academically adverse students (Collie et al., 2017). Thus, with the discovery of new barriers and new dimensions of existing barriers to e-learning during COVID-19, this study expands the concept of academic adversity to a multifaceted one that goes beyond sole internal or external factors.

It is important to note that, among the 179 respondents who encountered barriers, about one third (32.4%) reported two or more barriers simultaneously. Further examination of the data shows that multiple learning barriers are more likely to occur within underserved students measured by both household income and student's FGS status. As prior research suggests, an educationally resilient student who has one or two risk factors is very different from a student who is extremely vulnerable to multiple high-risk behaviors (Waxman et al., 2003). As the number of at-risk factors increased, so did the demand on one's capability to overcome the obstacles to reach one's goals. Therefore, the ability of the underserved students in our study to overcome the barriers, especially multiple barriers, is essential for building their educational resilience, that is, succeeding at high levels in face of academic adversity.

Based on the six major barriers and sub-categories identified in the study, we propose a variance model on influencing factors of student learning outcomes (see Figure 1). The six-factor model could be empirically tested in a large-scale survey study to assess the performance effect of each factor. Moreover, underserved student status is predicted to moderate the effects of the contributing factors on students' college success. To be consistent with prior research on telecommute work (Neufeld & Fang, 2005), we rename the "environmental factor" as "situational distraction."

In summary, our study makes two theoretical contributions. First, it incorporates the capital perspective to enrich the conceptualization of academic adversity. Second, it develops a variance model for future quantitative research to test educational resilience in different educational settings. Focusing on the population of underserved students in a minority-serving institution helps address the research gap articulated by prior research (Khalaf, 2014).

6. IMPLICATIONS

The unprecedented coronavirus pandemic has tested the resilience of college students nationwide and around the world. Our analysis has uncovered a variety of hurdles that hindered the effective online learning of the underserved students. Existing research has called for interventions to build students' resilience, such as building close social bonds; encouraging supportive, low-criticism interactions; and ensuring that individuals had access to the resources required for their basic needs such as housing and health care (Martin, 2014). Extending this line of research, our study calls for attention to understanding the nature of the barriers to e-learning so that educational institutions can design and implement effective intervention programs. Moreover, our results suggest that adult students with multiple responsibilities (employment, parenting, and college study) are likely experiencing multiple barriers simultaneously; they are in urgent need of university support and services to cope with barriers and thrive in the times of crisis.
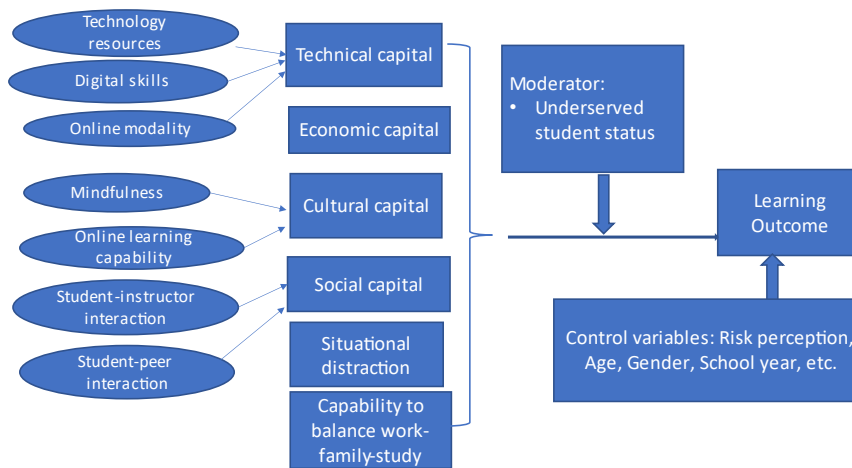

Figure 1. Model of Influencing Factors for Enhancing e-Learning in Crisis

In addition, our study highlights the importance of augmenting college students' technical resources and skills as critical success factor in e-learning. Our study revealed new digital divide in online learning: 48% of those reported barriers in the transition to online classes are related to lack of technology resources, such as slow or unstable Internet connection, lack of computing equipment, inadequate knowledge and skills about academic technologies. To help underserved students overcome the technical barriers in the short term, it is important for universities to allocate more resources to their laptop loaner and WiFi hotspot programs. In the long run, support by and involvement of private and public sectors are needed to remedy the digital barriers in distance education for the underserved student population.

The disruption to higher education due to COVID-19 exposed the digital inequality between underserved students and their peers. Researchers have suggested that equitable practices and policies in higher education should recognize and accommodate differences in students' aspirations, life circumstances, ways of engaging in learning and participating in college, and identities as learners and students (Witham et al., 2015). Therefore, our findings suggest the following equity-minded teaching practices:

Recommendation 1: Improve the frequency of instructor-student communication and effectiveness of online communications. Examples include specifying the expectations for instructor-student communications, accommodating individual and unexpected student needs for assistance, and keeping track of students' online learning progress more proactively.

Recommendation 2: Invest in students' technical proficiency for academic technologies and increase technology resources for e-learning. Examples include implementing student trainings on academic content management systems and video conference tools; integrating synchronous and asynchronous communication technologies to provide complementary online learning materials; and posting frequently asked questions and answers.

Despite the promises, the study has several potential limitations. First, the findings are limited by a single research site. Given the data sample from a minority-serving institution, we could not compare underserved students with more privileged students during a pandemic. However, such a comparative study would offer additional insights and become an important topic for future research. Second, this is a qualitative study focusing on revealing major categories of barriers to e-learning in response to COVID-19. Future research is encouraged to provider further insights by empirically testing our proposed variance model by conducting large-scale surveys in boarder research contexts. Third, our study focuses on digital barriers associated with technology resources and skills in e-learning. A promising avenue for future research is to consider how media synchronicity theory (Dennis et al., 2008) applies to studies of communication effectiveness under different mode (synchronous vs. asynchronous) and co-location in student learning outcomes.

7. CONCLUSION

During a global health crisis, higher education institutions faced the challenge of maintaining students' academic continuity in the online environment. This challenge becomes greater for students coming from underserved communities that lack economic and financial resources. Our study of the underserved college students and their peers has shown the multifaceted nature of the learning obstacles, dominated by a variety of technical barriers. Moreover, technical barriers are found to interact with other types of barriers (social, cultural, environmental, balance) in influencing student e-learning. Compared to their peers, underserved students (low-income, FGS) are more likely to encounter multiple barriers to e-learning. We hope our study has offered useful, timely insights for higher education institutions to implement programs to build and sustain students' resilience during the pandemic and beyond. As Willems (2012) advocated, educational resilience is a shared responsibility of students, educators, institutions, and communities.

8. ACKNOWLEDGEMENTS

9. REFERENCES

ACT Report. (2014). Understanding the Underserved Learners: The Condition of STEM 2014. https://www.act.org/content/dam/act/unsecured/documents/STEM-Underserved-Learner.pdf

Alavi, M., & Leidner, D. E. (2001). Technology Mediated Learning: A Call for Greater Depth and Breadth of Research. *Information Systems Research*, 12(1), 1-10.

Andres, H. P., & Shipps, B. P. (2010). Team Learning in Technology-Mediated Distributed Teams. *Journal of Information Systems Education,* 21(2), 213-221.

Appana, S. (2008). A Review of Benefits and Limitations of Online Learning in the Context of the Student, the Instructor and the Tenured Faculty. *International Journal on E-learning*, 7(1), 5-22.

Bourdieu, P. (1986). The Forms of Capital. In J. Richardson (Ed.) *Handbook of Theory and Research for the Sociology of Education* (pp. 241-258). New York: Greenwood.

Bourdieu, P. (2002). *The Social Structure of the Economy*. NY: Polity.

Cai, Y. (2013). Graduate Employability: A Conceptual Framework for Understanding Employers' Perceptions. *Higher Education*, 65(4), 457-469.

Cassidy, S. (2016). The Academic Resilience Scale (ARS-30): A New Multidimensional Construct Measure. *Frontier Psychology*, 7, 1787. doi: 10.3389/fpsyg.2016.01787

Centers for Disease Control and Prevention. (2020, May 8). COVID-19 in Racial and Ethnic Minority Groups. https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/racial-ethnic-minorities.html

Cho, S. K., & Berge, Z. L. (2002). Overcoming Barriers to Distance Training and Education. *USDLA Journal,* 16(1), 16-34.

Chou, C. C. (2002). A Comparative Content Analysis of Student Interaction in Synchronous and Asynchronous

Learning Networks. In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences* (pp. 1795-1803). IEEE.

Collie, R. J., Martin, A. J., Bottrell, D., Armstrong, D., Ungar, M., & Liebenberg, L. (2017). Social Support, Academic Adversity and Academic Buoyancy: A Person-Centred Analysis and Implications for Academic Outcomes. *Educational Psychology,* 37(5), 550-564.

Couch, K. A., Fairlie, R. W., & Xu, H. (2020, May 18). The Impacts of COVID-19 on Minority Unemployment: First Evidence From April 2020 CPS Microdata. https://ssrn.com/abstract=3604814

Dennis, A. R., Fuller, R. M., & Valacich, J. S. (2008). Media, Tasks, and Communication Processes: A Theory of Media Synchronicity. *MIS Quarterly*, 32(3), 575-600.

Gibson, J. J. (1986). *The Ecological Approach to Visual Perception*. Lawrence Erlbaum Associates.

Hayashi, A., Chen, C., Ryan, T., & Wu, J. (2004). The Role of Social Presence and Moderating Role of Computer Self-Efficacy in Predicting the Continuance Usage of E-learning Systems. *Journal of Information Systems Education*, 15(2), 139-154.

Joshi, K. D., Kvasny, L., Unnikrishnan, P., & Trauth, E. (2016). How Do Black Men Succeed in IT Careers? The Effects of Capital. In *Proceeding of the 49th Hawaii International Conference on System Sciences* (pp. 4729-4738). IEEE.

Khalaf, M. A. (2014). Validity and Reliability of the Academic Resilience Scale in Egyptian Context. *US-China Education Review B*, 4(3), 202-210.

Kirschner, P., Strijbos, J., Kreijns, K., & Beers, P. J. (2004). Designing Electronic Collaborative Learning Environments. *Educational Technology Research & Development*, 52(3), 47-66.

Kyte, S. B. (2017). Equity in Working and Learning Among U.S. Adults: Are There Differences in Opportunities, Supports, and Returns? *Report of ACT Center for Equity in Learning*, Iowa, USA.

Leidner, D., Gonzalez, E., & Koch, H. (2018). An Affordance Perspective of Enterprise Social Media and Organizational Socialization. *Journal of Strategic Information Systems*, 27(2), 117-138.

Majchrzak, A., & Markus, L., (2013). Technology Affordances and Constraints in Management Information Systems (MIS). In E. Kessler (Eds.), *Encyclopedia of Management Theory* (pp. 832-836). Thousand Oaks, CA: Sage Publications Inc.

Martin, A. J. (2013). Academic Buoyancy and Academic Resilience: Exploring 'Everyday' and 'Classic' Resilience in the Face of Academic Adversity. *School Psychology International,* 34, 488-500.

Martin, A. J. (2014). The Role of ADHD in Academic Adversity: Disentangling ADHD Effects from Other Personal and Contextual Factors. *School Psychology Quarterly*, 29(4), 395-408.

McLeod, J. D., Uemura, R., & Rohrman, S. (2012). Adolescent Mental Health, Behavior Problems, and Academic Achievement. *Journal of Health and Social Behavior*, 53, 482-497.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook.* Sage.

NCES, Characteristics of Postsecondary Students. (2020, April). The National Center for Education Statistics (NCES) Annual Report, Washington, DC, USA. https://nces.ed.gov/programs/coe/indicator_csb.asp

Neufeld, D. J., & Fang, Y. (2005). Individual, Social and Situational Determinants of Telecommuter Productivity. *Information & Management*, 42(7), 1037-1049.

Obradović, J., Shaffer, A., & Masten, A. S. (2012). Risk and Adversity in Developmental Psychopathology: Progress and Future Directions. In L. C. Mayes & M. Lewis (Eds.), *The Cambridge Handbook of Environment in Human Development* (pp. 35-57). New York, NY: Cambridge University Press.

Prior, D. D., Mazanov, J., Meacheam, D., Heaslip, G., & Hanson, J. (2016). Attitude, Digital Literacy and Self-Efficacy: Flow-on Effects for Online Learning Behavior. *The Internet and Higher Education*, 29, 91-97.

Redford, J., & Hoyer, K. M. (2017). First-Generation and Continuing-Generation College Students: A Comparison of High School and Postsecondary Experiences*, NCES 2018-009.* U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Ryan, G. W., & Bernard, H. R. (2000). Data Management and Analysis Methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (2nd ed., pp. 769-802). Thousand Oaks, CA: Sage Publications Inc.

Saw, K. G., Majid, O., Abdul Ghani, N., Atan, H., Idrus, R. M., Rahman, Z. A., & Tan, K. E. (2008). The Videoconferencing Learning Environment: Technology, Interaction and Learning Intersect. *British Journal of Educational Technology*, 39(3), 475-485.

Swarbrick, M. (2006). A Wellness Approach. *Psychiatric Rehabilitation Journal*, 29(4), 311-314.

Treem, J. W., & Leonardi, P. M. (2012). Social Media Use in Organizations: Exploring the Affordances of Visibility, Editability, Persistence, and Association. *Communication Yearbook*, 36, 143-189.

US Census Bureau. (2020). QuickFacts. https://www.census.gov/quickfacts/fact/table/US/PST045219

US Department of Education. (2021). List of Postsecondary Institutions Enrolling Populations with Significant Percentages of Undergraduate Minority Students. https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html

Wang, M., & Peck, S. C. (2013). Adolescent Educational Success and Mental Health Vary Across School Engagement Profiles. *Developmental Psychology*, 49, 1266-1276.

Waxman, H. C., Gray, J. P., & Padron, Y. N. (2003). Review of Research on Educational Resilience. *UC Berkeley Research Reports.* https://escholarship.org/uc/item/7x695885

Willems, J. (2012). Educational Resilience as a Quadripartite Responsibility: Indigenous Peoples Participating in Higher Education via Distance Education. *Journal of Open, Flexible and Distance Learning*, 16(1), 14-27.

Witham, K., Malcom-Piqueux, L. E., Dowd, A.C., & Bensimon, E. M. (2015). *America's Unmet Promise: The Imperative for Equity in Higher Education.* Washington, DC: Association of American Colleges and Universities.

Yates, T. M., Tyrell, F. A., & Masten, A. S. (2015). Resilience Theory and the Practice of Positive Psychology From Individuals to Societies. In S. Joseph (Ed.), *Positive Psychology in Practice: Promoting Human Flourishing in*

Work, Health, Education, and Everyday Life (2nd ed., pp. 773-788). Hoboken, NJ: John Wiley & Sons, Inc.

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Xuefei "Nancy" Deng is a professor of information systems at California State University, Dominguez Hills. She received her Ph.D. in Information Systems from Carnegie Mellon University. Her research interests include crowdsourcing, digital and social media, IS workforce, fi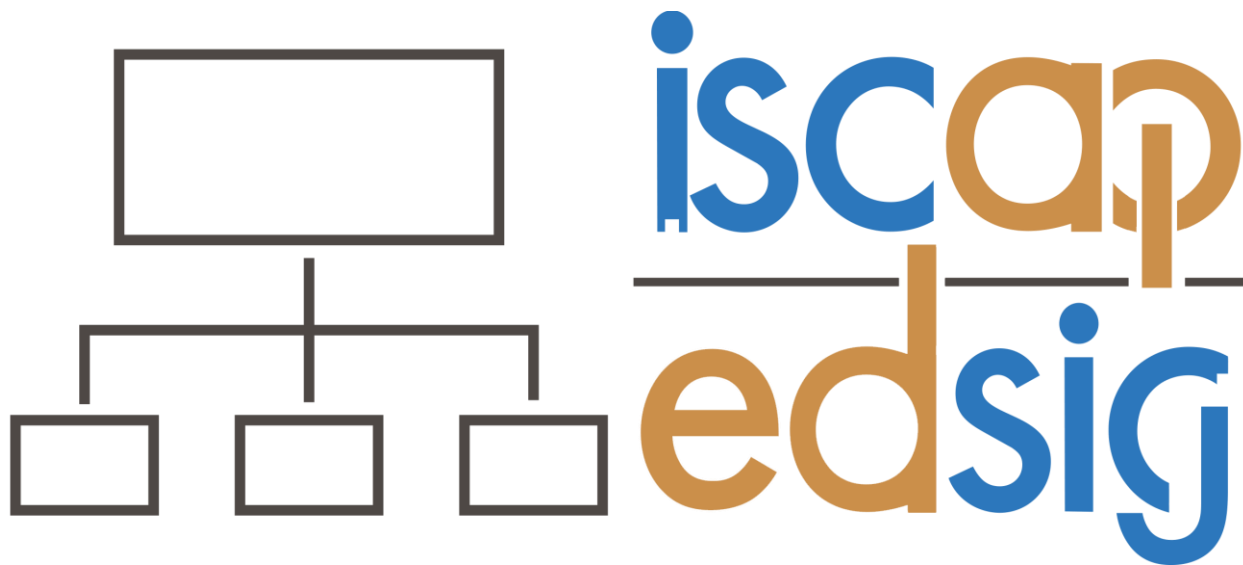rst-generation college students, and distance education. Her research has been published in *MIS Quarterly*, *Journal of Management Information Systems*, *Journal of the Association for Information Systems*, *Information Systems Journal*, *Information Technology & People*, and *Decision Support Systems*, among others.

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