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The Use of Videoconferencing in Higher Education

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Abstract

This chapter will explore the impact of the COVID-19 pandemic on the higher education industry. Specifically, there will be a discussion of the exponential growth of videoconferencing tools for higher education purposes. The effects of the communication technology tool on the college classroom will be explored, including how faculty and students experience the synchronous, virtual classroom. Parts of the communication process and how they differ in face-to-face and video-conference class will be outlined. The concept of Zoom fatigue will be defined and examined, in relation to the communication process. Recommendations for effective use of videoconferencing in the college classroom will be provided.

Keywords: Zoom, videoconferencing, higher education, Zoom fatigue

1. Introduction

Mandatory societal lockdowns and social distancing measures necessitated by a global health pandemic in 2020 rapidly transformed how people worked and learned. Individuals instinctively turned to synchronous online video communication technologies in unprecedented numbers as a substitute for face-to-face interactions. Videoconferencing platforms, such as Zoom and Microsoft Teams, quickly became a considerable part of many people's everyday activities. While videoconferencing closely simulated face-to-face instruction, many reported using the tools was "exhausting," prompting journalists in the popular press to label this new phenomenon "Zoom fatigue" [1, 2].

The use of videoconferencing platforms exploded in spring 2020. Zoom, one of the most popular of the videoconferencing platforms, increased thirtyfold as the use of its service from December 2019 to March 2020 jumped from 10 million daily users to 300 million daily users [3, 4]. In higher education, professors rapidly transitioned their previously face-to-face courses to fully online instruction in a matter of days, and the majority used videoconferencing to continue to lecture to their classes [5, 6]. Whereas web videoconferencing platforms had fulfilled niche needs for remote meetings prior to the pandemic, the technology's use abruptly became normalized as a way for people to work, learn, and socialize during the widespread lockdowns caused by the pandemic, and users began spending extended hours communicating on the videoconferencing tools.

The coronavirus pandemic dramatically changed day-to-day life, as individuals and families lived primarily in isolation while local, state, and national lockdown mandates were enacted, and communication technologies provided a way for individuals to stay connected in a socially distant world. Remote working became

routine during the crisis with 42% of people working from home [7]. Distance education also gained widespread acceptance as more than 90% of students of all ages (K-12 and postsecondary) turned to online learning [8]. Experts predict remote working will retain a significant influence in the workplace as estimates predict 25–30% of employees will be working remotely multiple days a week [9]. Online learning is also predicted to remain in high demand as college and universities struggle to find the most efficient and affordable ways to deliver educational content [10]. Meanwhile, students, who are now accustomed to online learning, are planning to include online education in their future educational plans, with 22% of 2021 high school seniors prioritizing colleges with online classes [11]. Remote working and online education seem likely to be relevant and widespread in the future, so the extensive presence of videoconferencing in everyday life will likely continue [4].

Driven by the need for remote working and learning, videoconferencing is now an integral part of everyday life, helping users navigate the challenges of social distancing, remote work, and online learning [12]. When face-to-face communication is not possible, videoconferencing intuitively feels like a logical substitution due to its media richness [13] and similarities to in-person interactions. Videoconferencing simulates face-to-face encounters because users can see and hear others simultaneously, in real-time [1]. Traditionally, videoconferencing was used in business and educational contexts as a supplemental method of interacting with people across geographic distances. The technology was not designed to serve as the dominate form of communication for educational purposes. As videoconferencing became more prevalent, concerns about its implementation developed.

The massive pivot to online instruction and exponential growth of videoconferencing quickly presented new challenges for its users [14]. About 80% of faculty members used videoconferencing tools in their courses during spring 2020 [6]; however, early into the transition to online learning, both faculty and students described Zoom as exhausting [2]. For all videoconferencing's benefits, the increased use of video calls in people's daily lives also led to intense feelings of tiredness. The mediated alternative to face-to-face interactions drained users because communicating through videoconferencing takes more effort and energy than in-person communication [1, 15, 16]. A new phenomenon that emerged from the overuse of videoconferencing platforms is commonly known as "Zoom fatigue," although the same feeling occurs with other such platforms, including Microsoft Teams and Skype [1, 3, 4, 15, 17, 18]. Zoom fatigue posed previously unknown complications for videoconferencing users to understand and address.

2. Background

While videoconferencing technology has existed for about 50 years, its integration into educational contexts occurred much later. Early distance education research considered televised broadcasts and large videoconference systems that required site-to-site operation, but over time, technology advanced and distance educators used broadcast media less and integrated computer-mediated instruction more. Likewise, researchers concentrated their consideration more on distance learning through computer-based instruction and online education, rather than videoconferencing [19]. More recently, affordable, convenient web videoconferencing platforms renewed instructors' interest in videoconferencing as a method to increase presence and engagement in their online courses. The global pandemic of 2020 further solidified videoconferencing's use in online education.

2.1 History of videoconferencing

The ability to transmit visual and verbal communication simultaneously over long distances was dreamt about for years before science made it a reality. Soon after the introduction of the telephone in the late nineteenth century, the idea of a videophone was first imagined [20]. The desire of businesses to better collaborate and communicate over long distances primarily fueled the development of the technology throughout the 20th century, but mass adoption of the technology occurred in the 21st century after computers and networks advanced to become more accessible and affordable for consumers. The availability of current user-friendly videoconferencing platforms is primarily due to the convergence of videoconferencing, computer, and networking technologies that developed over time, leading to the affordability of the necessary hardware, software, and bandwidth [21]. According to [20], “Today, the act of placing a video call is as simple as pressing a button. However, the systems we know and use have evolved after about a century of research in the field” [p. 1]. As is the case with many technologies, the initial scientific innovation to bring videoconferencing to a screen took extensive time as did the adoption of its use to a mass audience.

Videoconferencing technology was the culmination of decades of innovative scientific research by the Bell System’s Lab. The first functioning ikonophone was built in 1927 and used a television signal broadcast over a telephone line, but that technology was not scalable, meaning it was not feasible to implement it to a mass audience [20, 22]. Decades later, the public was awed by the introduction of the Bell System’s experimental “picturephone” at the 1963 World’s Fair in Queens, NY [22, 23]. Afterwards, three picturephone booths were placed in Washington, D.C., New York, and Chicago, but the devices could only communicate with each other and for a steep price. In 1970, the Bell System launched the first commercial picturephone service in Pittsburgh. Few businesses nationwide adopted the expensive service, but it paved the way for future videoconferencing technology and use by businesses, education institutions, and consumers [24].

Videoconferencing evolved during the 1970s and 1980s as a result of corporate demand. Business organizations recognized the benefits of videoconferencing to collaborate and communicate over geographic distances, saving travel time and costs while enabling organizational members to conduct efficient meetings in dispersed locations [21, 23]. The significant expenses required to use the technology restricted the extent of videoconferencing’s adoption. Costly equipment and specialized systems reserved the use of the technology to the wealthiest of companies and their upper-level executives and stakeholders [23].

As technology advanced and costs decreased somewhat in the 1990s, videoconferencing gained momentum within organizations who adopted the technology to enable virtual meetings that included visual and verbal communication through computer conferencing. Although substantial cost and effort were still required, with systems costing \$70,000–\$90,000 [21], more organizations, including higher education institutions began to implement videoconferencing by the late 1990s [23]. During this time, the emergence of the Web also spurred consumer interest in videoconferences, but the average computer system with its dial-up modem and internet service could not yet handle the technical demands. Prohibitive high costs did not allow for widespread adoption of videoconferencing until the availability of broadband internet and competitively priced devices flooded the marketplace [21, 23].

Technological advances spurred the growth of videoconferencing services in the late 1990s and early 2000s, expanding the industry’s focus to include individual consumers. The development of the webcam in 1998 and increased internet transmission speeds led to consumer-based videoconferencing products and services,

such as Skype in 2003, a pioneer in desktop computer-based videoconferencing [21]. Consumer demand soon drove technological progress. The impact of widespread videoconferencing can be traced to the introduction of 3G technology and smartphones as they made synchronous and immediate video sharing possible for consumers worldwide [23]. Further, Apple played a major role in the proliferation of videoconferencing with its introduction of FaceTime in 2010. These advancements caused a major shift in focus from business-centered products and services to consumer-centered videoconferencing [21].

Today, continued technological enhancements allow individuals to connect on video calls and videoconferences through a variety of platforms and personal devices, providing a rich communicative experience. The advent of cloud computing makes the organizational infrastructure required to utilize videoconferencing more affordable because large capital expenses are no longer necessary. The current technical focus is on improving the quality, convenience, and ease of videoconferencing for organizations and individuals. Videoconferencing has become an expectation in many settings as more and more people apply videoconferences in business, health, and educational settings [21]. Telemedical visits and virtual job interviews were becoming more prevalent even before the pandemic of 2020.

As video technology advanced, its use in educational settings also expanded. 23 explained, “In a society saturated with the visual image and in which digital video is penetrating the personal mobile market, the future of videoconferencing as a medium of communication in both commerce and schooling would seem to be assured” [p. 296]. In 2020, the use of videoconferences for synchronous online instruction became commonplace, and its extensive use drew concerns from both faculty and students.

3. Videoconferencing and higher education

While videoconferencing technology had played a role in educational settings for years, college faculty turned to the technology in record numbers to teach because they sought to closely simulate the in-person classroom environment. Furthermore, existing research demonstrated that synchronous communication in online college courses led to increased student engagement and improved student outcomes [25, 26]. However, the technology, selected for its inherent media richness [13], came with disadvantages as well. Videoconference users reported intense feelings of exhaustion, which caused problems for college faculty and students who were seeking to connect throughout the day in an online learning environment [1–4, 15]. In fact, users faced several challenges in the mediated communication environment of the videoconference classroom.

3.1 Synchronous online learning

Much of the distance education research literature that compares synchronous and asynchronous instructional deliveries is based upon early site-to-site videoconferencing technology that required students to attend sessions together at remote locations and connect with instructors through videoconferences [27]. Today’s synchronous online learning sharply contrasts with the synchronous distance education of the past, and the expanded use of web videoconferencing has only recently encouraged researchers to compare asynchronous and synchronous course delivery modes in online learning [26, 28–30].

Often, videoconferencing appears in the distance learning literature in comparison to face-to-face instruction [28, 30–33] or in opposition to asynchronous online education [26, 29, 34, 35]. Comparing various instructional delivery modalities, research shows faculty and students prefer synchronous face-to-face instruction, asynchronous online instruction, and then, synchronous online videoconference instruction [30, 36]. In terms of student performance, synchronous online courses achieve the same student learning outcomes as face-to-face courses [28]; however, students rate synchronous online courses lower than face-to-face courses in terms of instructor presence, communication, and interaction [31, 33].

Synchronous videoconferencing is viewed as a method to increase the interaction, communication, collaboration, and presence in online courses, which higher education institutions assume will lead to improved online retention rates [26]. Synchronous media offer viable alternatives for online education that had predominantly relied on asynchronous communication, which include discussion boards, email, and use of recorded video [26, 35]. Online synchronous learning includes live-streamed videoconferences, with its defining characteristics being immediate, real-time, and allowing for instant feedback [26, 35]. While both asynchronous and synchronous learning environments can effectively engage students with course material [35], motivation is a determining factor in students' preferences [26, 29]. While one study found students prefer asynchronous learning to synchronous learning online [29], another study found students preferred synchronous online learning to asynchronous learning and that student performance improved in synchronous online environments [35]. Some studies found students' sense of connection increases in synchronous online learning compared to asynchronous online environments because there is instant feedback and interaction [28, 37]. However, other research found students did not report increased connection and community from synchronous online instruction [36]. Combining asynchronous and synchronous instruction in online courses may lead to greater engagement and retention [38].

Adding synchronous interactions to online education is a method for instructors to closely approximate face-to-face courses by including a real-time, verbal and non-verbal communication component with students in geographically dispersed locations [25, 28, 32, 39]. While outcomes are similar in online courses delivered through videoconferencing and face-to-face courses, students rate videoconferencing courses lower than in-person courses in presence, interaction, and communication [28, 33, 34, 36]. In comparing synchronous to asynchronous online courses, videoconferencing has been demonstrated to improve immediacy and social presence in some studies [25, 34, 40]. Other studies identified student motivation, interaction, and collaboration are encouraged by the implementation of videoconferences in online courses [34, 41, 42]. Diverging from these studies, other research did not find videoconferencing increased student satisfaction nor decreased transactional distance in online learning [36, 43]. In a case study of videoconferencing use in college courses, students reported they felt hidden in their videoconference class sessions because instructors either ask them to turn off their video and audio feeds to preserve bandwidth and limit distractions, or there are so many students in a course that the instructor cannot see everyone on screen at one time [36]. Students also felt deterred from participating in synchronous class sessions because the structure of the videoconference made them feel as if they asked questions, they would interrupt the instructor or talk over other students [36].

3.2 Teaching through videoconferencing

While videoconferencing can be transformative for online education, instructors must tailor their teaching to use the tool effectively [44]. Re-envisioning pedagogy requires significant time commitment on the part of faculty as well as institutional support through training [36, 39, 44–46]. Videoconferencing is merely a delivery tool for instruction, and its successful implementation requires instructors to be innovative and creative in their course design [36, 41, 44]. Scholars have suggested a variety of pedagogical structures to increase student satisfaction in online courses through videoconferences, including the use of break-out groups, virtual poster sessions, show-and-tell, whole group discussions, polling features, chat, virtual hand raising, and small group meetings [36, 37, 45]. Conversely, long lectures do not transition well to videoconferences [36–39]. While instructors instinctively apply the same teaching methods in the new media rich, videoconference environment, this practice is not pedagogically sound [39, 44, 46]. Other researchers recommend instructors increase their presence during videoconference instruction through specific immediacy behaviors, including the use of more gestures, vocal variety, eye contact, smiles, informal speech, humor, self-disclosure, present tense verbs, and inclusive pronouns [33, 47]. Through careful, planned course design and implementation, instructors can use videoconferences to better engage students in their online courses, yet it is imperative colleges and universities must support these efforts through relevant training and infrastructure.

4. Videoconferencing and fatigue

In 2020, remote workers and learners experienced a significant, abrupt paradigmatic escalation in the use of videoconferences, driven by the COVID-19 global pandemic. Forced into home lockdowns by local, state, and national policies, people suddenly flocked to videoconferencing platforms as a substitute for face-to-face experiences. Videoconferences became a routine part of many people's day. The massive pivot to online instruction and exponential growth of videoconferencing quickly presented new challenges for its users, namely an intense feeling of exhaustion after videoconferences that the popular press dubbed Zoom fatigue [1, 3, 4, 15, 17, 18]. It is essential videoconferencing platform companies and those organization who use them better understand Zoom fatigue.

4.1 Fatigue

Fatigue is approached differently by various disciplines, such as psychology, medicine, occupational health, and information technology [15, 48]. The problem with much of the fatigue research is that the concept is often studied without defining it [48]. "In practice, there are no medical criteria for fatigue," criticized ([48], p. 196). Further complicating the study of fatigue is whether fatigue is a chronic condition or a temporary state [48]. Health professionals also differentiate between subjective physical fatigue, subjective mental fatigue, physical fatigability, and mental fatigability, with fatigability referring to difficulty in maintaining preferred levels of activity [48]. Overall, most literature considering fatigue considers issues related to mental and physical effects. Physical fatigue includes such concerns as muscle and eye strains, while mental fatigue includes psychological impacts, such as tiredness, stress, and burnout [49, 50].

Existing research on fatigue and new technologies has found both physical and psychological effects. For instance, the type of VR display technology does not

affect visual fatigue, but time was significantly associated with visual fatigue [51]. Fatigue is also a component of technostress in describing technostress, maintaining that fatigue is a common negative psychological experience from using communication technologies [52].

4.2 Social media fatigue

Zoom fatigue is also related to recent research about the use of online social networking tools and their association with feelings of fatigue [15, 49, 50]. Social media fatigue is defined as a form of fatigue that is marked by “the mental exhaustion after experiencing various technological, informative and communicative overloads” ([49], p. 141) through participation and interaction on various social media platforms. Other research has determined social media fatigue can lead to both physical and psychological effects [15]. Social media fatigue can be described as “a subjective, self-evaluated feeling of tiredness and an outcome of stress” ([15], p. 52). Social media fatigue leads some users to refrain from social media use either temporarily or permanently because they feel overwhelmed by information overload [53]. While social media fatigue is weariness related to the voluntary use of social media for entertainment and leisure purposes, Zoom fatigue is different because it is the result of the required use of videoconferencing for work and educational purposes. Whereas users may unplug and refrain from the information overload associated with social media fatigue by refraining from social media for a time period, that solution is not viable for videoconference users who are mandated to participate in the platforms for school or work.

4.3 Zoom fatigue

Attempts to explain Zoom fatigue have primarily been reported in the popular press and discuss the communication problems with videoconferencing from a psychological perspective that emphasizes the increased cognitive load associated with videoconferences. Fatigue may be explained from a neuropsychological perspective, claiming the fatigue is related to reward assessment and how the brain responds to costs and rewards [15]. Other scholars asserted the fatigue is attributable to the increased mental and emotional effort it takes to participate in online meetings due to several factors [1, 16, 18]. It takes more effort to process nonverbal communication cues on video than it does in person because even small delays in transmission create dissonance for viewers to interpret [1, 54, 55]. An emphasis on facial cues [1, 18, 56] and the ability to see oneself, at a hyper-awareness level, further increase the stress-level and cognitive fatigue [1, 3, 17–18, 56]. It's easier to lose focus in video meetings due to the constant barrage of visual cues and distractions [17]. One proposed a theoretical argument for Zoom fatigue that attributes the phenomenon to prolonged eye gaze, cognitive load, mirror feedback, and reduced mobility [1]. Zoom fatigue appears to be a multi-dimensional phenomenon that requires a communication perspective to understand.

While psychologists explain Zoom fatigue through a consideration of cognitive load, many of the problems are founded within the distinct differences in how the communication process operates through videoconferences compared to in-person communication. Videoconferencing is viewed as a substitute for face-to-face interactions, but the two media are not the same. Although videoconferences offer both verbal and nonverbal information in real-time, those cues are mediated, and the time is not, in fact, real; there are slight delays in transmission [57]. Even short delays of 1.2 seconds produce negative perceptions of individuals on videoconferences, causing viewers to perceive them as less friendly or focused [55].

These seemingly minor differences from videoconference environments and in-person environments create some intense interpersonal challenges for videoconference users to overcome [57, 58]. Little nonverbal and real-time feedback prevents seamless communication [57]. Videoconference presents itself as an alternative to face-to-face communication, but the interpersonal communication behaviors exhibited through videoconferences are unnatural and disconcerting for many users [1, 36]. The technology that allows for synchronous verbal and nonverbal communication also impedes that communication through its channel transmission.

The mediated communication through videoconferences is different than face-to-face interactions. Cognitively, it is easier to process in-person verbal and nonverbal cues because they aren't being filtered through low-quality cameras or intermittent internet connections. 3 explained, "We can't see people well enough to discern such information as easily as we could if they were sitting across a table from us, but we can't help but try. Communicating is both more difficult and less successful" [p. 23]. The whole conversational framework is lost through the virtual channel. Psychologist Jocelyn Brewer maintained:

With video, we are monitoring for non-verbal cues and information with much less stimulus. We get tiny 2D thumbnails of faces, often at weird angles with people looking in different directions and not at the person speaking. So, the brain goes into "scanning mode," trying to fill in the gaps to get enough information to make sense of what's happening and receive the communication, ideas, or actions ([59], p. 50).

Many interpersonal communication behaviors are negatively affected through the mediated videoconferences. Listening is different on videoconferences than in face-to-face conversations because there is a need for constant gaze to demonstrate you are listening on video calls, which differs from listening in person, and the intense eye contact feels unnatural [1, 17]. The mediated technology makes it more difficult for communication partners to analyze pauses and facial expressions, disrupting the natural rhythm of conversational patterns [36, 54, 56–60]. Common conversational patterns, such as overlapping, are not practical on videoconferences [36, 60]. Silence presents another issue on videoconferences because silence creates anxiety about whether the technology is working [36, 54]. Videoconferences limit normal conversation patterns, resulting in more formality in interactions [16, 36, 60]. Interpersonal communication feels less natural when it is mediated through a videoconference [36].

The arrangement and features of the online videoconference display also produce challenges for users. Videoconferencing creates a simulated, mediated stage in which users perform for the others on the call, typically appearing as a square box that emphasizes the head and upper torso, increasing the salience of facial features compared to face-to-face interactions [16]. Users view a gallery of faces, including themselves, contributing to the mental and emotional exhaustion [1, 36, 59]. "It's this pressure to really be on and be responsive," according to Vaile Wright, the director of clinical research and quality for the American Psychological Association ([61], para. 6). This pressure results from the extreme closeness of people's faces presented on the screen. This up-close view is meant to permit users to better distinguish facial expressions and other nonverbal cues, but the unintended consequence is a scrutiny on faces, which is almost unnerving after a prolonged time. It is also difficult to maintain eye contact with a matrix of faces [1, 59].

Others discuss the stress from staring at oneself on the camera [1, 20, 36, 54, 57]. Marissa Shuffler, an associate professor at Clemson University who studies workplace wellbeing, stated, "When you're on a video conference, you know everybody's

looking at you; you are on stage, so there comes the social pressure and feeling like you need to perform” ([54], para. 6). The online display screen generates a hyper-awareness of the self.

Several issues may result from the intense focus on the self during videoconferences. The self-presentation feedback is a continuous loop, and this feedback increases self-consciousness, self-awareness, and may affect self-esteem [20]. The effect seems to be greatest at the start and end of video calls. Research demonstrated that participants look at themselves often during the beginning and end of videoconference sessions, but they gaze at themselves less when they are working on a task [22]. However, videoconference users reported they are concerned about their appearance, and this can lead to uncomfortable feelings and distractions, contributing to the sense of videoconferencing fatigue [20, 22, 36].

Many users participate in videoconferences at home, which causes a range of distractions [17, 36, 56, 59]. Potential environmental distractions and disruptions add to the emotional fatigue level. Students typically prefer to keep their professional (academic) spaces separate from their personal (social) spaces [62], but videoconferences often blend the two spaces. This blurring of the personal and professional realms contributes to students’ dissatisfaction with synchronous videoconference instruction [36]. Distracted by their environments, students in videoconference classes also reported they often turn off their video and microphone feeds during lectures to multi-task [36, 37]. Finally, a range of technical issues occur during videoconference meetings as users struggle with connection speeds, the mute button, camera angles, and lighting [36, 59]. A variety of environmental factors potentially contribute to feelings of Zoom fatigue.

5. Case study

To explore the effect of videoconferencing on faculty and students in higher education, a qualitative case study approach was employed that included document analysis, surveys, and in-depth interviews. This type of research is well suited to exploratory, interpretive studies that require close collaboration between the researcher and participants [36].

5.1 Methodology

The site of the case study was a small liberal arts university that is typical of other small, independent institutions. Document review involved the analysis of 1,358 narrative comments from students written as part of course evaluations, 103 completed online surveys from students and faculty, and 572 minutes of recorded faculty and student interviews. Data analysis included word frequency, sentiment, thematic analysis, and descriptive statistical analysis [36].

5.2 Findings

The findings from the case study present a complex, interesting story of how faculty and students experience videoconferencing in online courses. Document analysis revealed students primarily evaluated videoconferencing positively, often equating faculty’s use of videoconferencing with “caring” and “availability.” According to faculty surveys, faculty members used videoconferencing an average of 16.8 hours per week. Their reactions about the communication technology were mixed. They thought videoconferencing was a way of connecting to students in real time; however, students did not interact much on the videoconference sessions, and

many faculty and students experienced internet disruptions. All of the respondents admitted to feeling Zoom fatigue, and they described it as both mental and physical fatigue. A majority, 88%, of student survey respondents had participated in synchronous videoconferencing class sessions, and the majority of them had also experienced Zoom fatigue. The faculty and student interviews provided a deeper understanding of videoconferencing in college classes [36].

In interviews, faculty and students reported the media rich videoconferences were deficient in a number of ways, negatively affecting the communication technology's ability to facilitate natural conversation and interaction. Faculty and student experiences with videoconferences in courses greatly diverged, although both expressed frustration and dissatisfaction. Faculty members felt disappointed because many students did not interact on the videoconferences, with most students opting to keep their cameras off during the sessions. This produced an environment in which faculty were often teaching to a wall of black boxes and unable to coax students to engage with the material or them. Meanwhile, in an apparent contradiction, students reported feeling hidden and muted on videoconferences because the organizational structure of the mediated environment deterred their active participation. They cited instructor policies that required microphones be muted to prevent random external noises as creating an unintended outcome that discouraged direct feedback. Students felt uncomfortable with the process of muting and un-muting the microphone feature to ask or answer questions because they feared interrupting or overlapping. In short, videoconferencing complicates many of the dimensions of the communication process, including feedback and nonverbal communication. Stifled communication and disjointed videoconferences left faculty and students desiring more natural interaction. As one student explained, videoconference class sessions are "not genuine." The result was faculty members realized they were not reaching students, and students felt they were not learning [36].

5.3 Model of Zoom fatigue

Since synchronous online interactions through videoconferencing is likely to remain a prevalent form of communication in higher education and other settings, it is imperative that more is known about the causes of Zoom fatigue. Through further analysis and interpretation of the case study data, a model of Zoom fatigue emerged [36]. Participants recognized multiple factors caused their feelings of tiredness. Further analysis and interpretation of survey and interview data led to a proposed theoretical model of Zoom fatigue that includes four key dimensions: situational factors, individual trait factors, environmental factors, and communication factors (see **Figure 1**).

These factors are outlined in **Table 1**. Situational factors are defined as aspects related to the specific conditions of a videoconference, such as the number of videoconferences scheduled a day, the size of the videoconference, the relationship among participants, the type of content shared in the videoconference, the level of participation (host or participant), and the amount of interaction during the videoconference. Individual trait factors include a participant's characteristics, which consist of personality type, anxiety level, motivation, self-awareness, and self-esteem. Environmental factors encompass those external elements, including background distractions, physical location, furniture, type of device, camera and microphone settings, and internet connectivity. Finally, communication factors emphasize the interaction components of verbal and nonverbal communication, which include conversation flow, lack of nonverbal cues, awkward silences, interruptions, overlapping, and feedback. The combination of these factors functions to

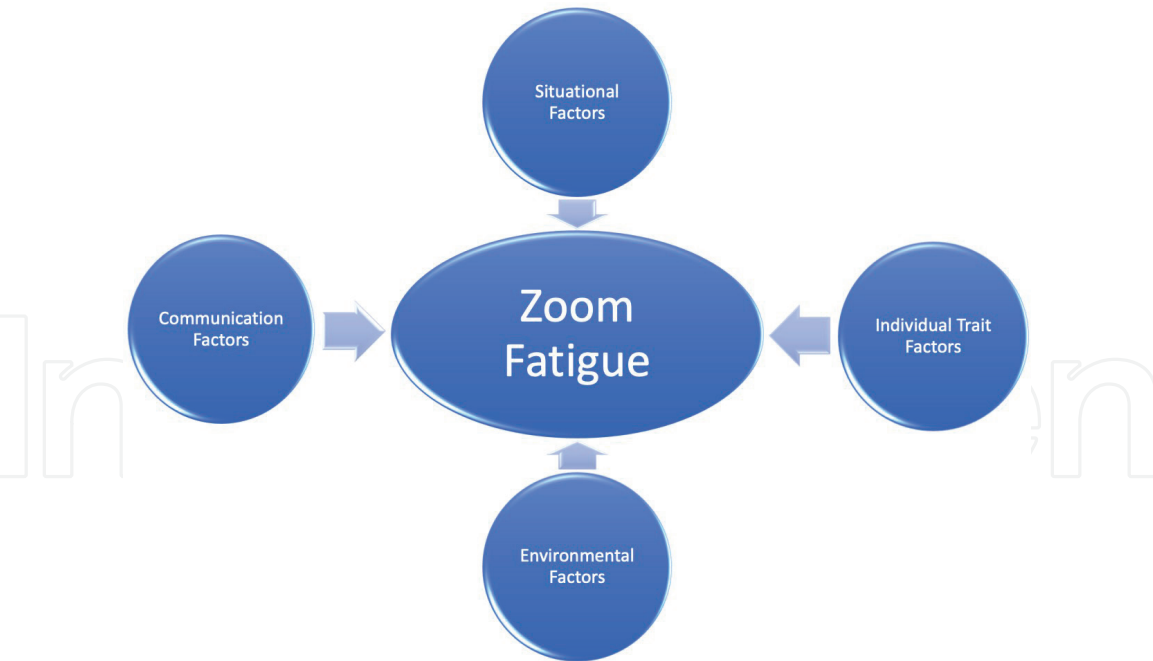


Figure 1.
Model of zoom fatigue (reprinted from [36]).

Situational	Individual Trait	Environmental	Communication
number	personality	background	gestures
size	anxiety level	physical location	facial expression
relationship	self-awareness	furniture	eye contact
content type	self-esteem	device accessibility	pauses
role		camera setting	interruptions
interaction		microphone setting	overlapping
		internet connectivity feedback	

Table 1.
Factors of zoom fatigue (reprinted from [36]).

impact the level of Zoom fatigue videoconferencing participants feel, according to survey and interview data [36].

Zoom fatigue is a multifaceted problem. To prevent Zoom fatigue, videoconference participants should consider controllable factors in the model and plan accordingly for the aspects they cannot control. Situational and environmental factors are elements participants can actively affect. Scheduling can be controlled, so participants should not schedule serial Zoom sessions as back-to-back, continuous videoconferences significantly add to Zoom fatigue. Therefore, space videoconferences apart, avoid too many in one day, and be sure to practice self-care by taking breaks in between sessions. To the degree possible, videoconference participants should control their background and environment; if participating at home, attempt to create a professional space within the private space, if possible. Even more important is the type of furniture participants use for videoconferences, as posture is important during the session, and it also contributes to the physical fatigue after a session. Another factor that participants can control is their level of engagement. Interacting on the videoconference through direct feedback, chatting, or the use of reactions will keep participants focused and motivated to listen, whereas passive listening behaviors cause more fatigue. While videoconference participants cannot

control every dimension of the session, controlling certain factors will help alleviate some Zoom fatigue.

6. Recommendations for videoconferencing use in higher education

While videoconferencing technology had existed for years, the events of 2020 accelerated their implementation and usage in exponential ways. Faculty members selected the communication technology to deliver content due to its inherent media richness, perceiving the medium to closely approximate the face-to-face classroom experience. The prevalent use of videoconferencing in higher education resulted in unintended challenges for faculty and students. Videoconferencing can be used as a valuable method for instruction if it is applied in appropriate contexts with proper training and preparation. The indiscriminate utilization of videoconferencing in college courses as an absolute substitution for in-person interactions is ill advised as there are several critical differences between videoconferences and face-to-face communication.

The use of videoconferencing in college classrooms should be implemented intentionally after extensive training and familiarity with the application and with much planning and preparation on the part of faculty members. Videoconferencing is a complex construct for the higher education online classroom, and its utilization should be carefully designed as part of an online course's overall pedagogy. In short, videoconferencing is appropriate in some, but not all, classroom contexts. As past scholars have illuminated, pedagogy, not content delivery, should guide learning [19, 60, 63]. Videoconferencing is a communication tool for content delivery, and its successful use in the online classroom should be situated in an understanding of the larger scope of online education. The implementation of videoconferences into online course instruction should be planned and purposeful. For this reason, faculty members should not plan sessions for a set time just because that is the course time. If a live, synchronous session is planned on videoconference, that session should have a purpose and function. Students criticize class sessions that waste their time, or they deem "pointless" [36]. For instance, videoconferences should not be used to provide long lectures that feature primarily one-way communication from instructor to students. This type of instruction is not effective as a videoconference. When there is a large amount of content that instructors need to deliver to students remotely, chunking the information into short, recorded videos is both preferred by students and more effective for achieving learning outcomes [36].

Further, instructors should realize large classes do not transition well into videoconference sessions because instructors are not able to see all of the students' screens at one time, essentially creating a virtual barrier between students and faculty that discourages student interaction [36]. If videoconferences are used for large class sizes, the classes should be broken into smaller groups as small groups communicate more effectively on videoconferences [36]. Setting up smaller group videoconference sessions to cover content is advised so that all students feel seen and heard. Smaller groups tend to encourage students to participate in videoconferences with their cameras on, adding to the potential for engagement, and faculty may encourage the use of videoconferences for small groups either through the breakout group functions during class videoconference sessions or through group project assignments they complete on their own time [36]. Students are disappointed when they cannot easily communicate with peers through class videoconference sessions, so intentionally designing those opportunities will increase student-student interaction, which improves learning outcomes.

Students also prefer when professors do not mandate synchronous videoconference class sessions. Students prefer autonomy in their learning [36]. Therefore, scheduling optional sessions, recording them, and encouraging attendance through incentives are effective strategies to appeal to students.

In addition, to encourage interaction, faculty members should provide guidelines that address how students should ask questions during videoconferences [36]. These guidelines should refer to how and when they can participate with their microphone unmuted as well as the use of the chat box and reactions, such as hand-waving emojis. Faculty members need to ensure students understand and are comfortable with these policies prior to holding online videoconference discussions. Along those lines, faculty members should consider the use and functionality of the chat box and provide students directions for its use. Identifying a class member or teaching assistant to monitor the chat box will improve its successful implementation. Including the use of polling and reactions during videoconference class sessions also improves student focus and engagement, according to faculty respondents.

Another method of facilitating concentration on the part of students and faculty members is to keep content simple [36]. Faculty members should not plan to include too many screen switches during a class session; less is more. Faculty members who switch between PowerPoint slides, videos, demonstration screens, and others continuously throughout a class session get overwhelmed and lose focus while students also struggle to keep up with too many messages in a single session. Faculty members should narrow the content to manageable bits of information and ensure that any screen changes are smooth and necessary to avoid information overload [36].

There are suggestions for higher education administrators as well [36]. To begin, videoconferencing should be seen as a supplemental tool for online course delivery and not a substitute for in-person instruction. Secondly, administrators should realize not all types of courses can effectively use videoconferences. For instance, while some scientific laboratory sessions can be taught using online simulations, not all can. Administrators should work with their faculty members to ensure a sound pedagogy is in place in which videoconferencing is part of the online delivery methods. To assist that process, training is desired and required [36]. Additionally, if a course plans to use synchronous online videoconferences, the course size needs to be kept manageable. All participants should be able to be viewed on one screen on the videoconference. Administrators have relied on videoconferencing for many meetings and workshops, and to alleviate fatigue, they should schedule these sessions similarly to in-person meetings, being careful to schedule breaks and being cognizant of length of the videoconference and time of day. Do not assume participants will turn off their camera and microphone to accommodate needed breaks because many will not. Finally, administrators need to respect faculty members' boundaries and privacy. Teaching remotely does not mean that faculty members are suddenly on the clock 24 hours a day. The ability to Zoom does not guarantee that a faculty member is available any time of the day. Respect free time and family time. Administrators need to understand the difficulties and challenges of blurred work and private spaces by demonstrating respect and communicating they appreciate their time and sacrifices.

7. Conclusion

Business demands drove the initial development of videoconference technology, so corporate organizations could save time and money by virtually meeting over geographic distances to collaborate and achieve organizational outcomes.

Globalization efforts in the late 1990s and 2000s intensified the desire and need for such remote technological solutions. Educational institutions realized the potential benefits of videoconferencing once the capital costs associated with such systems became feasible for them to incur [23]. When affordable web conferencing was introduced, higher education embraced videoconferencing as a method to increase online retention by improving interaction and engagement in online education [25]. In business and higher education contexts, videoconferences were limited in use to supplement organizational activities and bring together small groups of remote audiences for brief goal-centered encounters. Early videoconference research determined videoconferencing was adequate to complete tasks with low interpersonal involvement, including information transmission, problem solving, and generating ideas, but cautioned it was not effective for tasks requiring high interpersonal involvement [64].

However, since videoconferencing is commonly viewed as a close alternative to in-person meetings, when remote working and learning became prevalent in 2020 in response to a global health pandemic, its use increased exponentially within a variety of contexts. Videoconferencing has been widely accepted in higher education when face-to-face instruction is not possible. Pedagogically, college faculty embraced videoconferencing in spring 2020 because it intuitively felt like the best alternative to face-to-face instruction [2]. The sudden shift to videoconferencing allowed people to connect with verbal and non-verbal cues present; however, those cues are presented differently through the mediated channel. Challenges to the predominate use of videoconferencing include a sense of exhaustion, known as Zoom fatigue.

The future of higher education continues to be shaped by technology and online learning. It is essential stakeholders realize how to best reach students through online education as its prominence in higher education is well established. Faculty members included videoconferences as part of their response to an abrupt transition to teaching online because videoconferencing was perceived as a rich medium to communicate with students, closely mirroring face-to-face classroom interactions. In practice, faculty and students find the videoconferences differ significantly from face-to-face interactions because natural conversation patterns are primarily lost [36]. While videoconferences can effectively be implemented within college courses, the effort requires significant training, time, and design by faculty to ensure students are engaged with the material and do not view the sessions as “pointless” [36].

Further, Zoom fatigue, a recently identified phenomenon, is associated with the prevalent use of videoconferencing. This chapter presents a working model of Zoom fatigue to explain the multi-dimensional factors that lead to videoconferencing fatigue. As videoconferencing will likely remain a dominant method of communication in the foreseeable future, it is essential its impact on education, relationships, work, worship, and leisure continue to be examined. The proposed model of Zoom fatigue offers a foundation for understanding how the phenomenon affects videoconferencing participants. Although the mediated, virtual communication environment offers opportunities and challenges for its participants to negotiate, the question remains, “Who’s Zoomin’ who?”

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Conflict of interest

The author declares no conflict of interest.

Note

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