

EXAMINING PREDICTORS OF ZOOM FATIGUE AMONG UNIVERSITY STUDENTS
DURING COVID-19 PANDEMIC

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Maha M. Harpool

Thesis Committee:

Dr. Rachel Neo, Chairperson

Dr. Ji Young Kim

Dr. Wayne Buente

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Abstract

The COVID-19 pandemic has caused a paradigm shift in online instruction that is mainly driven by an urgent necessity to curb the spread of Coronavirus. With Zoom being the most adopted videoconferencing platform, faculty and students reported use of the tool was “exhausting,” resulting in a phenomenon called “Zoom fatigue”. Using a close-ended survey, this study examined predictors of Zoom fatigue among students as a means to explain why some students experience greater Zoom fatigue than others. The study expanded current understanding of Zoom fatigue through the following theoretical lenses: Social Influence Model of Technology Use (Fulk et al., 1990), Social Presence Theory (Short et al., 1976), Self-Presence (Biocca, 1997), Perceived Social Support, and Big Five Personality Traits (Goldberg, 1990; Costa and McCrae, 1992) with the focus on Extraversion. One of the major findings from this study was that perceived self-presence predicted lower levels of Zoom fatigue students. Another important finding was that perceived emotional support from instructors lowered levels of fatigue. This finding is somewhat in line with previous research that described how emotional instructor support relates to positive reactions necessary, particularly during perceived challenges. One finding, however, ran counter to expectations. That is, perceived emotional support from classmates predicted higher levels of fatigue.

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CHAPTER.1 INTRODUCTION

The COVID-19 pandemic has caused a paradigm shift in online instruction that is mainly driven by the necessity to curb the spread of Coronavirus. Social distancing and quarantines are the new norms. With the cancelation of face-to-face instruction, classes conducted via computer-mediated platforms shifted the routine of millions of students around the globe. Online learning, which had been increasing its prevalence in recent years (Seaman et al., 2018), abruptly became the main method of instruction (Ralph, 2020). In spring 2020, 90% of American colleges and universities moved their in-person classes to online classes (Ralph, 2020). With Zoom being the most adopted videoconferencing platform, faculty and students reported use of the tool was “exhausting,” prompting journalists in the popular press to label this new phenomenon “Zoom fatigue” (Bailenson, 2021; Supiano, 2020).

Zoom fatigue, or videoconferencing fatigue in some recent literature (Bennett et al., 2021; Fosslie & Duffy, 2020; Shockley et al., 2021) have been characterized by physical and mental exhaustion that often occurs following long periods of videoconferencing (Kotera & Winson, 2021; Sklar, 2020). This phenomenon potentially affects 46% of college faculty who teach online (Lederman, 2020; Magda, 2018) and more than six million students who learn online (Seaman et al., 2018; Massner 2021). Given the newness of the pandemic-driven phenomenon, Zoom fatigue has not yet been adequately examined. Existing literature about videoconferencing focuses on motivation, collaboration, learning outcomes, and pedagogy (Al-Samarraie, 2019; Bertsch et al., 2007; Fitzsimons & Turner, 2013). This study aims to fill some gaps in the literature regarding Zoom fatigue among students.

In the current COVID-19 pandemic era (March 2020 – present day), universities around the world have made the general transition from the classroom context to online learning context

(Bao, 2020). In fact, more than 1,300 colleges and universities in all 50 states canceled in-person classes or shifted to online-only instruction (Smalley, 2021). The urgent imperative to move instruction to an online setting required adapting computer programs to help mediate communication. With individuals sheltered at home and trying to remotely conduct their daily activities (Nguyen et al., 2020), videoconferencing has become a crucial tool for education (Lowenthal et al., 2020), healthcare (Feijt et al., 2020), and business (Bloom et al., 2021). One of the major tools used to facilitate communication in this new educational context is the online videoconferencing application, Zoom. Zoom is a prime example of the rapid rise in use from approximately 10 million daily Zoom meeting participants in December 2019 to 200 million in March 2020 and 300 million in April 2020 (Chawla, 2020; Iqbal, 2020). In this complex and dynamic time in the world, Zoom has allowed universities and students to continue education in a mostly comparable fashion especially in terms of class lectures, presentations, and group projects. However, despite the affordances of Zoom, students have been experiencing mental and physical fatigue because of frequent and lengthy Zoom meetings (Kotera & Winson, 2021; Sklar, 2020).

With online learning continuing to expand, meaningful online instructional delivery is essential for students to achieve outcomes and persist in programs (Massner, 2021).

Technological advancements must be elevated by the ability of instructors and institutions to adapt them in effective instructional design. Furthermore, instructors and institutions must help students successfully navigate those online learning tools (Simplicio, 2019). Student academic success and health may be attributable to frequent Zoom classes within the context of a global pandemic. Failing to understand and address the issue of Zoom fatigue among US college

students contributes to students failing to complete their coursework, or even their university programs.

As such, this research study uses a close-ended survey to examine predictors of Zoom fatigue among those students as a means to explain why some students experience greater Zoom fatigue than others. Specifically, this study expands current understating of Zoom fatigue through the following theoretical lenses: Social Influence Model of Technology Use (Fulk et al., 1990), Social Presence Theory (Short et al., 1976), Self-Presence (Biocca, 1997), Perceived Social Support, and Big Five Personality Traits (Costa & McCrae, 1992; Goldberg, 1990;) with the focus on Extraversion.

CHAPTER.2 LITERATURE REVIEW

The COVID-19 Pandemic and The Rise of Distance Based Learning

On January 23, 2020, the city of Wuhan went into a complete lockdown by the Chinese government in an unprecedented move to prevent the spread of the novel COVID-19 virus (Yang, 2021). In total, a city with a population of 11 million people was completely closed off, along with 7.4 million more people in the city of Huanggang, who were under a restricted access protocol (Baker, 2020). Dr. Howard Markel, a history of medicine professor, described the lockdown as “an unbelievable undertaking”. He had never heard of so many people being cordoned off as a disease-prevention measure (Levenson, 2020). Fast forward to March 2020, mandatory or recommended confinements, curfews, and quarantines were instituted in more than 90 countries, involving more than 3.9 billion people, which is nearly half of the world’s population (Sandford, 2020). In compliance with COVID-19 restrictions to quarantine and social distance, people proceeded to conduct their daily activities remotely (Nguyen et al., 2021). With this new reality, videoconferencing has become a critical medium for education (Lowenthal et al., 2020), healthcare (Feijt et al., 2020), and business (Bloom et al., 2021). Focusing on education, the consequent suspension of face-to-face classes and their replacement by classes mediated by information and communication technologies has altered the routine of thousands of students around the world (Joia & Lorenzo, 2021).

Distance learning was first defined as instructional methods used when “communication between the learner and the teacher must be facilitated by print, electronic, mechanical, or other device” (Moore, 1972, p.76; Moore, 2018). Today, distance learning can be viewed as the fifth phase of the distance learning landscape, with the following being the previous phases: correspondence, mass media, teleconferencing, and computer-mediated communication

(Anderson, 2008; Lee, 2017). During the latter part of the twentieth century, distance learning advanced to incorporate computer-mediated education (Massner, 2021). Traditionally, distance learning has been a way to provide educational opportunities to those who are unable to attend conventional, in-person classes (Bell & Federman, 2013; Harsim, 2017; Lee, 2017; Massner, 2021). The Covid-19 pandemic triggered a substantial and abrupt pivot to fully online instruction that offered both opportunities and challenges for students in colleges and universities. Online learning, which had been growing steadily in the past few years (Seaman et al., 2018), unexpectedly became the predominant means of instruction during COVID-19 pandemic (Ralph, 2020). Although more than a third of all higher education students enroll in at least one online course, completion and graduation rates are lower for online learners than that of traditional in-person learners (Massner, 2021). Research has shown that 10-20% fewer students complete online courses compared to their in-class peers. The graduation rate for online undergraduate students is between 35-56% (Muljano & Luo, 2019; Simplicio, 2019). Furthermore, students have more negative attitudes toward synchronous online learning than face-to-face class instruction, and they drop out of asynchronous online courses at a higher rate than face-to-face instruction (Bell & Federman, 2013; Bernard et al., 2004). A great body of research explored a variety of online educational tools (Abdalmalak, 2015; Hamid et al., 2015; Ledbetter & Finn, 2018), however, the use of videoconferencing, such as Zoom and Google Meet, in online learning has drawn the attention of some researchers (Belt & Lowenthal, 2021; Nikuo et al., 2021).

Zoom Fatigue

Zoom is a cloud-based video communication platform that allows videoconferencing and audioconferencing, live chat, webinars, screen-sharing, and other collaborative affordances. This

video conferencing platform experienced a major rise from approximately 10 million daily Zoom meeting participants in December 2019 to 200 million in March 2020 and 300 million in April 2020 (Chawla, 2020; Fauville et al., 2021; Iqbal, 2020). Zoom was the choice of many government agencies, universities, non-profit organizations, and individuals to teach online classes as an alternative to face-to-face ones (Lorenzo, 2021; Serhan, 2020; Joia). Despite other alternatives, such as Skype, Google Meet, and MS Teams, Zoom has been the most used platform to teach online classes during the COVID-19 pandemic (Wiederhold, 2020).

With the prolonged use of Zoom as a substitute to face-to-face instruction, the term “Zoom fatigue” surfaced as a description of the emotional, physical and/or psychological drain that some users have been experiencing (Bailenson, 2021; Fauville et al., 2021; Nadler 2020; Supiano, 2020; Wiederhold 2020; Wolf, 2020). This fatigue has been highlighted in recent literature that explains how mediated alternatives to face-to-face interactions exhausted users. (Bailenson, 2021; Lee, 2020; Massner, 2021; Storck & Sproull, 1995). They further explain how Videoconferencing takes more effort and energy than in-person communication. Interactions that normally do not tire people when conducted in face-to-face contexts now deplete people when these same interactions occur virtually (Nadler, 2020). Many instructors and students reported using the tool Zoom was “exhausting” (Bailenson, 2021; Massner 2021; Supiano, 2020).

To date, few studies have explicitly been done on predictors of Zoom Fatigue. Existing research tackles Zoom fatigue in terms of how to work through it (Williams, 2021), how to avoid it (Brainard & Watson, 2021; Peper et al., 2021; Wiederhold, 2020), and how to measure it (Fauville et al., 2021). This study joins the discussion Nadler (2020) started in which he acknowledges how computer-mediated communication (CMC) falls short compared to face-to-face communication. However, “we cannot mitigate these impediments to virtual interactions

until we understand ...how they are arising” (Nadler, 2020, p.2). Importantly, the COVID-19 pandemic added a sense of urgency to further our understanding as to why Zoom fatigue particularly, and CMC exhaustion in general, occur.

Driven by the need for tools to understand the drastically scaled usage of Zoom during COVID-19 pandemic, a number of scholars from Stanford University and University of Gothenburg presented an empirical creation and validation of the Zoom Exhaustion & Fatigue Scale (ZEF Scale) (Fauville et al., 2020). In four studies which included over 700 participants, Fauville et al. (2020) created a scale examining Zoom fatigue and provided initial evidence for the scale validity. In their qualitative study, Fauville et al. (2020) developed interview prompts that resulted in the creation of 49 survey items that spanned several dimensions. Using factor analyses, the 49-item scale was reduced to 15, revealing five dimensions of fatigue: general, social, emotional, visual, and motivational. The reliability for each construct was above .8 (general fatigue: $\alpha = .88$, visual fatigue: $\alpha = .88$, social fatigue: $\alpha = .84$, motivational fatigue: $\alpha = .83$, emotional fatigue: $\alpha = .86$), indicating a good scale reliability. Thus, this study used the 15-item ZEF Scale to measure fatigue among students. In the emerging media era, people have seamlessly integrated Zoom and other videoconferencing technologies into their work and social lives. Thus, posing important questions such as when, how, and why Zoom fatigue occurs, as well as how to mitigate the fatigue effectively (Fauville et al., 2020).

In normal circumstances, online learning is a choice and thus, students approach it with preconceived notions and expectations. It is imperative to ponder Zoom fatigue in a pandemic context given how online learning became the only option for students who chose to continue their education. Zoom fatigue was tackled in a recent article in an attempt to theorize it as part of a larger experience with CMC exhaustion (Nadler, 2020). CMC, however, can entail voluntary

participation in computer-mediated interactions in which users can choose to disengage. However, Zoom fatigue in the realm of this study differs in that disengagement is not a practicable solution. This is because students are required to participate in the platform for school or work. Therefore, specific research related to Zoom fatigue experienced by students in a pandemic context is necessary.

From a neuropsychological standpoint, Lee's (2020) research attributed the fatigue to reward assessment and how the brain responds to costs and rewards. Other research seems to link it to the increased mental and emotional effort it takes to participate in online meetings (Bailenson, 2021; Miller, 2020; Sander & Bauman, 2020; Storck & Sproull, 1995). Indeed, in a recent study that examined 55 employees working remotely, it was reported that 92.9% of respondents mentioned a psychosomatic or psychological manifestation of fatigue. The study thus provided preliminary evidence of this unique experience (Bennett et al., 2021). Morris (2020), on the other hand, argued that videoconferencing, such as Zoom, offered mediated verbal and nonverbal cues, and thus, slight delays in transmission occur. Delays, as short as 1.2 seconds, triggered negative perceptions of individuals, causing them to be perceived as less friendly or focused (Schroenenberg et al., 2014, Massner, 2021). As a result, Morris (2020) suggested that little nonverbal cues and real-time feedback inhibited seamless communication. Jeremy Bailenson, professor and director of Stanford University's Virtual Human Interaction Lab suggested that videoconferencing could be taxing because technology disrupts normal intricate human communication methods (Morris, 2020; Wiederhold, 2020). Bailenson states, "humans use a range of precisely timed vocalizations, gestures, and movements to communicate, and they rely on precise responses from others to determine if they are being understood" (Wiederhold, 2020, p.437). Mediated technology complicated the analysis of pauses and facial

expressions, eventually disrupting the natural rhythm of conversational patterns (Feder, 2020; Ferran & Watts, 2008; Jiang, 2020; Morris, 2020; Tufvesson, 2020). Also, users view a collage of faces during Zoom, which contributed to both mental and emotional exhaustion (Bailenson, 2021; Miller, 2020; Nicandro, 2020; Tufvesson, 2020). Early research determined teleconferencing was adequate to complete tasks with low interpersonal involvement, but cautioned it was ineffective for tasks that require high interpersonal involvement (Williams 1978).

Existing research agreed on how CMC in general and Zoom in particular failed to replicate face-to-face communication, causing participants to experience mental and physical strain. However, research has not yet investigated why some participants experience Zoom Fatigue more than others. How can we predict that certain users might undergo more fatigue symptoms while others do not? The goal of this study is to draw on the following theoretical frameworks to extract predictors to be tested.

Theoretical Frameworks

This study draws on theories and concepts such as the Social Influence Model of Technology Use (Fulk et al., 1990), Social Presence Theory (Short et al., 1976), Self-Presence (Biocca, 1997), Perceived Social Support, and Big Five Personality Traits (Costa and McCrae, 1992; Goldberg, 1990) with the focus on Extraversion. These concepts help predict why some students experience greater Zoom fatigue symptoms than others.

Given the computer-mediated presence, be it social or self, and its effect on establishing social ties, such as social support, testing these concepts in relation to the physical, psychological, and mental effects of Zoom is important. Particularly, perceptions of Zoom vary regarding its richness as a medium of communication and its ability to replicate a quality of

communication similar to that of face-to-face. The distortion of face-to-face communication can affect us differently, especially when it comes to those whose personalities are more externally stimulated or socially oriented. This sets the basis for the current study to examine perceived richness of Zoom, perceived social/self-presence, perceived social support, and extraversion as predictors of Zoom fatigue among students.

Social Influence Model

The Social Influence Model of technology challenges the premise of Media Richness Theory (Daft & Lengel, 1986) that claimed the use of a particular medium is objectively determined. Meaning, it is derived from an objective view of media characteristics. The social influence model of technology proposed by Fulk, Schmitz, and Steinfield (1990) posits that media perceptions are, in part, subjective and socially constructed. In other words, media use is not determined only by the objective media characteristics, but also socially influenced by multiple factors such as attitudes towards the medium, knowledge about the medium, and personal experience (Fulk et al., 1987; Ishii et al., 2019). “The net effect is that media perceptions are not fixed and objective; instead, they will vary across individuals and situations” (Fulk et al., 1990, p. 121). This is not to say that interactions during videoconferencing are not negatively affected through the mediated environment (O’Connell et al., 1993; Storck & Sproull, 1995). Instead, it is to say that individuals perceive and process those negative effects differently. For example, users who perceive higher richness of a medium in online interactions have increased satisfaction with their participation in the interactions (Fan-Chen et al., 2019).

According to social influence model, media richness is a constructive concept that is redefined by the users or by the communication network to which they belong (Fulk et al., 1991). Thus, perceived richness of a technology, or an individual's perception of the technology's ability

to facilitate shared meaning, varies individually (Fulk et al., 1991; Higa et al., 2000). In other words, perceived media richness can be defined as the degree to which an individual believes a communication medium has the capability to communicate information based on the characteristics it possesses. This is where the social influence model differs from media richness theory. The latter views richness as a relatively objective feature that is largely inherent in the medium. Rich media are needed to process information about highly uncertain, complex tasks, whereas media low in richness are suitable for low- uncertainty, simple tasks (Daft & Lengel, 1984; Webster & Trevino, 1995). A significant number of studies (Alexander et al., 1991; Dennis & Kinney, 1998; El-Shinnawy & Markus, 1998; Rice et al., 1989; Rice & Shook, 1990) fail to support media richness premise. For example, El-Shinnawy and Markus (1998) failed to support the prediction that voice mail (a richer medium) is preferred over email for complex messages (Timmerman, 2002). Therefore, “it appears that social and other contextual influences are more important in the media selection process” (Steinfeld, 1992, p. 354). The empirical evidence has been reasonably consistent with social influence premise when applied to formal work groups (Fulk & Boyd, 1991), colleagues and supervisors (Schmitz & Fulk, 1991), and variations of perceptions of media richness (Webster & Trevino, 1995). Campbell and Russo (2010), for example, presented evidence that perceptions and uses of communication technologies are, at least in part, constructed socially among close personal contacts. Other research (Handke et al., 2018) suggests individuals do not have to be restricted by the physical properties of a medium, but can actively shape its characteristics through their own perceptions, attitudes, and appropriation. That is, individuals are capable of adapting media to their causes by compensating suppressed communicative cues and can enhance their own perceptions of a rich medium through experience (Handke et al., 2018)

Based on the tenets of the social influence model, richness here is not defined objectively by the medium characteristics. Rather, richness is defined subjectively by feelings towards the medium, personal experiences, and quality of interactions with other students in a Zoom class. Thus, the richer the perception of a medium to fulfil interactions and communications among students, the less feeling of fatigue students would experience. Based on that, the following hypothesis is proposed:

H1: Perceived richness of Zoom will be negatively associated with self-reported levels of Zoom Fatigue

Social Presence and Self-Presence

Social presence gained significant importance in the field of online learning and as a key component in theoretical frameworks for computer mediated learning (Anderson et al., 2001; Gunawardena & Zittle, 1997; Kim, 2011; Richardson & Swan, 2003; Tu & McIssac, 2002; Yen & Tu, 2011). Social Presence Theory (Short et al., 1976) conceptualizes communication media as falling along a single continuum of social presence (Fulk & Steinfield, 1990). Social presence is the degree to which the medium facilitates awareness of the other person and interpersonal relationships during the interaction. In other words, Social Presence Theory (SPT) argues that media vary in its ability to convey the psychological perception that *other people* are physically present (Calefato & Lanubil, 2010). This can be attributed to the different abilities of media to transmit visual and verbal cues such as physical distance, gaze, postures, facial expressions, and voice intonation (Calefato & Lanubil, 2010). Face-to-face communication, due to its ability to convey social presence, is more effective for relational/interpersonal communication than text-based media, such as e-mails. The latter does not diffuse any cues and thus are more useful for information exchange tasks (Short et al., 1976). The theory is built on a unidimensional

consideration of social presence as a subjective quality of the medium, which is determined by the perceptions of the social participants (Short et al., 1976). Garrison, Anderson, and Archer (2000) defined social presence as the ability of participants in a community of inquiry to project themselves socially and emotionally, as real people through the medium of communication being used. Lee (2004) provides a more conceptually operationalized definition of social presence in that it is a psychological state in which virtual social actors are experienced as actual social actors in either sensory or nonsensory ways. Lee (2004) states, “social presence occurs when technology users do not notice the para-authenticity of mediated humans and/or the artificiality of simulated nonhuman social actors” (p. 45).

Social presence has been found to determine learners’ experience and perception of social interaction (Yang et al, 2006). Studies have shown that a lack of social presence may lead to a high level of frustration, a negative attitude toward the teacher’s effectiveness, and a lower level of affective learning (Hughes et al., 2007; Rifkind, 1992; Song et al., 2004; Vonderwell, 2003). Supporting evidence indicates that low levels of social presence within virtual teams can lead to a lower quality of communication (Roberts et al., 2006). The function of social presence can make the nature of online learning more interactive, appealing, engaging, and rewarding (Reio & Crim, 2006). This leads to increased academic and social integration, resulting in persistence and course completion (Tinto, 1987). Research suggests that there is a considerable lack of dialogue among distance-learning students (Sherry, 1996), which impacts the quality and integrity of the educational process (Garrison, 1990). When social presence is lacking, people recognize the environment as impersonal and share less with others (Leh, 2001). Another study suggests that perceptions of the efficacy of social interaction can have a significant impact on learning outcomes for example increased interest, participation, collaboration, and active learning)

(Northrup, 2001). Biocca et al. (2003) suggest that social presence is of particular interest because it may mediate other variables of interest such as persuasion, mental health, and learning.

Consequently, this study hypothesized that people who perceive higher levels of social presence on Zoom are less likely to experience Zoom fatigue.

H2: Perceived social presence on Zoom will be negatively associated with self-reported levels of Zoom Fatigue

Extending social presence theory to the presence of self, Lee (2004) defines Self Presence as “a psychological state in which virtual (para-authentic or artificial) self/selves are experienced as the actual self in either sensory or nonsensory ways” (p.32). Self-presence ensues when users do not notice the virtuality of either para-authentic representation of themselves or the artificially fashioned alter-selves in a virtual environment. Additional research is needed on modern communication technologies, such as videoconferencing and virtual reality, and their impact on communication quality, performance, and satisfaction in different contexts (Koutsabasis et al., 2012; Loode, 2021). Specifically, the concept of presence has a noteworthy sensible relevance, especially in telecommunications (videoconferencing, computer-mediated collaborative work, etc.) and education (online education, training classes, etc.) (Whitmer & Singer, 1998). Presence has been important to theorizing advanced human-computer interfaces such as virtual reality and videoconferencing platforms (Fägersten, 2010; Loode, 2021). Unmediated face-to-face interactions allow for the highest perceived self-presence, while computer-mediated interactions yield a lower perceived self-presence (Roberts et al., 2006). Furthermore, low self-presence within virtual teams decreases the quality of communication within a team which in turn affects productivity and results (Roberts et al., 2006). A recent study by Fitter et al. (2020) compared

different remote learning technologies in a classroom. The findings show in-person learning as more social and expressive of oneself compared to other learning methods. Also, feelings of presence and interaction abilities found to improve in person compared to online settings (Fitter et al., 2020).

Lack of perceived self-presence here is used to determine whether it can be a predictor of Zoom Fatigue:

H3: Perceived self-presence will be negatively associated with self-reported levels of Zoom Fatigue

Social Support

Research on social support reveals how and why relationships are central to emotional, psychological, and even physical wellbeing (Burlison & MacGeorge, 2002; Goldsmith, 2004; Sarason et al., 1994; Vangelisti, 2009;). Definitions of social support varies among researchers (Cohen & Syme, 1985; Gottlieb, 1981; Lin, 1986). Social support refers to the social and psychological support an individual receives or perceives in their environment (Lin, 1986), such as respect, care, and help. In a classroom context, Hombrados-Mendieta et al. (2012) identified three types of social support: emotional, instrumental, and informational. Emotional support entails affection and care, instrumental support entails assistance with homework and activities, and informational support entails tips and information to deal with questions and daily problems (Hombrados-Mendieta et al., 2012).

Studies that have investigated social support in relation to the transition to university have usually taken a psychological perspective and have shown that social support is vital for successful adjustment to university life (Lamonthe et al., 1995). Focusing on emotional support, a study that examined relationships between adolescent classmates determined that acceptance

by classmates was positively associated with good school adjustment, less risk of academic failure, and a greater likelihood of developing successful social relationships (Farrington, 1993). Other studies examined emotions such as belonging and relatedness between adolescent classmates and found associations with achievement motivation (Anderman & Anderman, 1999; Nelson & DeBacker, 2008), school interest (Wentzel et al., 2010), expectancies for success (Goodenow, 1993), and behavioral and emotional engagement (Furrer & Skinner, 2003). Wilcox et al. (2005) examined the role of the three types of social support in the first-year experience of higher education documented students' views on perceived or actual support received. The study found emotional support to be especially important for feelings of self-confidence and ease in the self, but instrumental, informational support gave students confidence in terms of their academic work (Wilcox et al., 2005).

Perceived support from classmates is found to be related to perceived scholastic competence, self-reported academic achievement, and school well-being (Danielsen et al., 2009; Samdal et al., 1998; Samdal et al., 1999). Another study found a positive correlation between perceived acceptance and appreciation by classmates and motivation (Nelson & DeBacker, 2008). Perceived social support predicted improved adjustment to university among first year undergraduates (Friedlander et al., 2007). Furthermore, students with higher perceived social support reported better attendance (Rosenfeld et al., 1998). Researchers who study perceived social support indicate that individuals who believe support is available to them tend to experience less stress (Mossakowski & Zhang, 2014; Lakey et al., 2002; Wethington & Kessler, 1986).

Given the abundant literature linking social support to the success and well-being of students, it is important to examine emotional, instrumental, and informational social support as predictors of Zoom fatigue:

H4a: Perceived emotional support from classmates will be negatively associated with self-reported levels of Zoom Fatigue

H4b: Perceived instrumental support from classmates will be negatively associated with self-reported levels of Zoom Fatigue

H4c: Perceived informational support from classmates will be negatively associated with self-reported levels of Zoom Fatigue

Furthermore, social agents, such as teachers and friends, are hypothesized to influence academic and career outcomes indirectly, especially in terms of self-perceptions of ability and interest/attitudes (Rice et al., 2013). Teacher and parental support were found to be significantly related to adolescents' cognitive engagement through their academic efficacy (Sahil & Hashim, 2011). Furthermore, support from friends and instructors, for example, contributed to academic, social, and emotional development of first year undergraduates (Friedlander et al., 2007; Tao et al., 2000). Other studies have focused on the effects of students' perceptions of social support from instructors on motivation and performance in school (Skinner & Belmont, 1993; Van Ryzin et al., 2009). For example, supportive teacher-student relationships have been linked to student motivation, engagement, interest in school, prosocial behavior, and academic achievement (Roeser & Eccles 1998; Roeser et al. 1998; Ryan & Grolnick 1986). Given the importance of social support from instructors, or the perception of it, on the academic success and achievement of university students, the following hypotheses will be tested in relation to Zoom fatigue:

H4d: Perceived emotional support from instructors will be negatively associated with self-reported levels of Zoom Fatigue

H4e: Perceived instrumental support from instructors will be negatively associated with self-reported levels of Zoom Fatigue

H4f: Perceived informational support from instructors will be negatively associated with self-reported levels of Zoom Fatigue

Five-Factor Theory of Personality: Extraversion

Driven by a desire to understand the complexity of human personality, a comprehensive model called the big five model (Goldberg, 1990) or five-factor theory personality (McCrae & Costa, 2008), was developed to explain major personality traits. After its development, widespread support was received for the five dimensions proposed by the model, causing the big five to be the most widely used reference in personality studies (Gosling et al., 2003; Brandstätter, 2011). The model includes the following five dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism (McCrae & Costa, 2008). Each of these dimensions represents a range between two extremes. That is, extraversion represents a continuum between extreme extraversion and extreme introversion.

Personality traits act as predictors in a wide range of personal and interpersonal domains, including occupational success, health, longevity, and social outcomes (Back & Vazire, 2015; Ozer & Benet-Martinez, 2006; Roberts et al., 2007). Several studies (Berry & Hansen, 2000; Funder & Sneed, 1993; Graziano et al., 1996; Iizuka, 1992; Simpson et al., 1993) examined the ability of big five personality traits to predict specific social interaction behaviors such as the frequency of talking, smiling, gazing, verbal acknowledgments, and nonverbal acknowledgments.

A strong agreement among factor analysts classifies extraversion and agreeableness as particularly relevant to social behavior (Cuperman & Ickes, 2009; Goldberg et al., 1998; John, 1990; John & Srivastava, 1999; McCrae & Costa, 1989;). Focusing on extraversion, high levels of extraversion imply higher levels of sociability, activity, assertiveness, and positive emotionality (John et al., 2008). Extraversion refers to the tendency to seek the stimulation of others. Low level extraversion tends to be characterized as being reserved and less involved in social situations (Lucas, & Diener, 2001). Extraverts tends to need more external stimulation while introverts tend to become stimulated very easily (Kehoe, 2012).

There is an adequate body of research that associates patterns of behavior on social media with big five personality traits (Matz et al., 2017; Özgüven & Mucan, 2013); Liu & Campbell, 2017); Paunonen, 2003). Focusing on extraversion in relation to social-based technologies, literature provides consistent evidence that extraverts are more likely to use social media (Paunonen, 2003), use social media frequently (Bachrach et al., 2012), and spend more of time using one or more social media platforms (Jaradat & Atyeh, 2017). Social media naturally appeals to extraverts, who tend to desire social attention (Paunonen, 2003). Indeed, the positive effects associated with social media for extraverts leads them to pay more attention to social media, resulting in excessive use of Facebook (Atroszko et al., 2018) and of social media in general (Jaradat & Atyeh, 2017). Comparing social media use to Zoom, social media is often related to the voluntary use for entertainment, leisure purposes, and socializing. Zoom, on the other hand, differs in that its use is required for work and educational purposes.

Videoconferencing is regarded as a less sociable medium than face-to-face meetings because it is less spontaneous (Campbell, 2006). Furthermore, students rate videoconferencing courses lower than in-person courses in presence, interaction, and communication (Clark et al., 2015; Doggett,

2008; Francescucci & Rohani, 2019; Umphrey et al., 2008). For these reasons, one cannot help but wonder whether high extraverted students would experience more Zoom fatigue than those lower in extraversion given the distorted social and communication interactions in Zoom:

H5: Extraversion will be positively associated with self-reported levels of Zoom fatigue

CHAPTER.3 METHODS

This study utilized a quantitative approach using a close-ended survey to test the hypotheses on predictors of Zoom fatigue. This study targeted predictors of Zoom fatigue among students as a means to explain why some students experience greater Zoom fatigue than others. Therefore, the close-ended quantitative survey is an appropriate research method for testing these hypotheses.

Sample

Data for this study was collected using non-probability online surveys designed and maintained using Qualtrics. An online survey format was utilized in this study due to its both convenience and cost-efficiency. Online surveys also help stay in compliance with current conditions of social-distancing due to COVID-19 pandemic.

In terms of sampling techniques, participants were recruited using a: 1) combination of purposive and snowball sampling techniques, which are non-probability sampling techniques, and 2) participant recruitment through the Department of Communicology's SONA participant pool. Non-probability sampling techniques are appropriate as it helps fulfil the goal of the study- -that is, to examine predictors that are derived from existing literature and theoretical frameworks.

With regards to participants recruited through purposive and snowball sampling techniques, first, participants were purposively selected based on the criteria that they must be currently taking or have taken classes via Zoom as this is the important dependent variable across the study. Both graduate and undergraduate students were eligible to participate in this study. Graduate students usually engage in classes that are longer in time, and thus, the results from such participants could be beneficial to the study. These initially selected eligible

participants came from large introductory undergraduate courses, core graduate classes, and both undergraduate and graduate student organizations. Second, in terms of snowball sampling, these initially selected student participants were then asked to forward the survey link on to as many of their other friends or classmates who were likewise enrolled at US universities and have taken or are currently taking Zoom classes during the COVID-19 pandemic. A total of 145 students participated in the non-SONA version of the survey. Furthermore, participants recruited through the Department of Communicology's SONA participant pool system received 0.5 SONA points of extra credit in exchange for study participation. A total of 154 responses were obtained from the SONA participant pool, with a total of 299 survey responses obtained across both surveys.

Seven respondents who spent too much time on the survey, and two respondents who declined to participate were deleted, leaving a total of 290 usable responses. The average time taken to complete the survey was 13.45 minutes. In terms of sample demographics, 63% were female, and 34.8 were male. 80% of respondents were undergraduate students, with the rest (19.7%) being graduate students. The respondents' average age was 22 years age ($M = 22$, $S.D. = 6.3$). As for race, 44% of respondents were Asians, 33% were White Caucasians, and 8% were Hispanic/Latino. These students took an average of 29 Zoom classes ($S.D. = 294$) since the pandemic started, with an average of 3.5 hours ($S.D. = 2.0$) spent taking Zoom classes. 87.6% of the respondents reported having good internet connectivity while using Zoom, with 12.4% of the respondents saying they do not.

Measures

Perceived Richness of Zoom (Independent Variable)

In order to measure perceived richness of Zoom, four statements are adapted from Carlson and Zmud (1999). The statements include "Zoom allows my communication partner(s)

and me to give and receive timely feedback”, and “Zoom allows my communication partner(s) and me to tailor our messages to fit our communication requirements”. The statements are measured on a 5-point Likert scale (1= Strongly disagree; 2=Disagree; 3= Neither agree nor disagree; 4=Agree; 5=Strongly agree) and were summed up to form a scale ($M = 3.47$, $S.D. = 0.79$; Cronbach alpha = 0.81).

Perceived Social Presence (Independent Variable)

Social presence is measured by a set of five questions from Nowak and Biocca (2003) assessing the extent to which participants felt close to their meeting partner in their most recent video meeting session. Questions such as “To what extent did you feel able to assess your classmate’s reactions to what you said?” has a sliding scale of possible responses ranging from 0 to 100 (0 = “Not like being in the same room at all” and 100= “A lot like being in the same room”), and were summed up to form a scale ($M = 49$ $S.D. = 18.2$; Cronbach alpha = 0.84).

Perceived Self-Presence (Independent Variable)

To measure perceived self-presence, four statements derived from Ratan and Hasler (2009) are used to measure the extent to which participants felt their virtual self is perceived as their actual self. Statements such as “My video on Zoom feels like it is really me” and “My body movements on Zoom feel natural” are based on a 7-point Likert scale (1= Very Strongly Disagree, 2= Strongly Disagree, 3=Disagree, 4=Neither agree nor disagree, 5=Agree, 6=Strongly Agree, 7= Very Strongly Agree). These statements were summed up to form a scale ($M = 3.94$, $S.D. = 1.16$; Cronbach alpha = 0.85).

Perceived Social Support (Independent Variable)

This study uses Hombrados-Mendieta et al., (2012) scale to assess the level of support received from father, mother, classmates, and instructors. For the purpose of this study, support

received from classmates and instructors on Zoom will be assessed. Thus, single-item measures will be used as measures for each type of social support received: emotional, instrumental, and informational. For example, “They are willing to do specific things for you, like helping with homework or any other activity” is asked to measure for instrumental support received from both classmates and instructors. The questions score responses on a Likert-type scale ranging between 1 to 5 points for the frequency of support received. These single item measures have been well validated by previous research (Hombrados-Mendieta et al., 2012). The mean emotional support score from classmates was as follows, ($M = 2.42$, $S.D. = 1.16$), the mean instrumental support score from classmates was 2.29 ($S.D. = 1.14$), and the mean informational support from classmates score was 2.47 ($S.D. = 1.21$). The emotional social support from instructors item had the following mean and standard deviation ($M = 2.95$, $S.D. = 1.20$), the instrumental social support item had the following mean and standard deviation ($M = 3.21$, $S.D. = 1.19$), and informational support from instructors item had a mean of 3.14 ($S.D. = 1.20$).

Extraversion (Independent Variable)

Donnellan et al. (2006) developed and evaluated a mini-IPIP scale, which is a 20-item short form of the 50-item International Personality Item Pool-Five-Factor Model measure (Goldberg, 1999). The scale is used as a shorter version of the 44-item big-five inventory (Benet-Martínez & John, 1998; John & Srivastava, 1999), or the 60-item NEO Five-Factor Inventory (Costa & McCrae, 1992). In the mini-IPIP scale, each big five trait is measured by four items using the common stem “in general, I...”. For example, the extraversion statements are “Am the life of the party” and “Talk to a lot of different people at parties”. The four items measuring extraversion were rated on 5-point Likert scale ranging from 1= Strongly disagree to 5=Strongly agree and were summed up to form a scale ($M = 3.02$, $S.D. = 0.99$; Cronbach alpha = 0.83).

Zoom Fatigue (Dependent Variable)

A peer-reviewed Zoom Exhaustion & Fatigue Scale (ZEF) has been developed by Fauville, et al. (2021) to help measure how much fatigue people are experiencing from videoconferencing. A short version of the 49-item scale is used in this study as a means to boost survey completion rate. The short version consists of 15 items revealing five dimensions of fatigue: general, social, emotional, visual, and motivational fatigue. Participants are asked “How tired do you feel after video conferencing?”, and “How much do you want to be alone after video conferencing?”. Items are measured on a 5-point Likert scale ranging from 1 = Not at all; 2 = Slightly; 3 = Moderately; 4 = Very; 5 = Extremely except for the two frequency questions (marked with asterisks) from 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Always. These items were then summed up to form a scale, ($M = 2.94$, $S.D. = 0.88$; Cronbach alpha = 0.93).

Demographic Controls (Control Variables)

In terms of controls, seven questions were asked to record gender, year of study, age, race, internet connectivity status, number of Zoom classes attended, and number of hours spent taking Zoom classes (see Appendix E).

CHAPTER.4 RESULTS

Zero-Order Correlations

First, zero-order correlations were conducted between the independent variables and the Zoom fatigue dependent variable. From Table 1 (see Appendix F), the zero-order correlational analyses showed that Zoom richness was negatively correlated with Zoom fatigue, $r(285) = -0.12, p < .05$, social presence was negatively correlated with Zoom fatigue, $r(188) = -0.18, p < .05$. In addition, perceived self-presence was negatively correlated with Zoom fatigue, $r(290) = -0.32, p < .001$. Informational social support from classmates was negatively correlated with Zoom fatigue, $r(285) = -0.13, p < .05$. Also, emotional social support from instructors was negatively correlated with Zoom fatigue, $r(290) = -0.25, p < .001$. Instrumental social support from instructors was negatively correlated with Zoom fatigue, $r(290) = -0.22, p < .001$. Finally, informational social support from instructors was negatively correlated with Zoom fatigue, $r(290) = -0.18, p < .001$.

Linear Regression Analyses

Next, linear regression analyses was generated in Jamovi to test the five hypotheses. It must be noted that although the total usable responses were 290, listwise deletion caused attrition down to 180 responses used in the regression analysis. The six variables perceived richness of Zoom, perceived social presence, perceived self-presence, perceived social support (from instructors and classmates), and extraversion were specified as independent variables, while Zoom fatigue served as the dependent variable in the analyses. Other variables, namely gender, age, number of Zoom classes, number of hours in Zoom classes, race, year of study, and internet connectivity served as demographic controls in these analyses.

From Table 2 below, regression analyses showed that perceived Zoom richness had no significant association with Zoom fatigue. H1 is not supported. Also, the analysis showed that perceived social presence had no significant association with Zoom fatigue. H2 is not supported. However, perceived self-presence was negatively associated with Zoom fatigue, $b = -0.25$, $SE = 0.08$, $t(163) = -3.29$, $p < .001$. The higher the perception of self-presence, the lower the levels of Zoom fatigue. Thus, H3 is supported. Another significant association was evident between perceived emotional social support from classmates and Zoom fatigue, $b = 0.17$, $SE = 0.08$, $t(163) = 2.20$, $p < .05$. This is a positive association, meaning the more emotional support students perceived from classmates, the higher they felt Zoom fatigue. This result is in the opposite direction of H4a; thus, it is not supported. Perceived instrumental and informational social support from classmates both had no significant association with Zoom fatigue. H4b and H4c are not supported. The analysis further showed emotional social support from instructors was negatively associated with Zoom fatigue, $b = -0.23$, $SE = 0.09$, $t(163) = -2.48$, $p < .05$. Meaning, the higher emotional social support from instructors a student perceived, the lower they felt Zoom fatigue. Thus, H4d is supported. On the other hand, instrumental and informational social support from instructors had no significant associations with Zoom fatigue. H4e and H4f are not supported. Finally, regression analyses showed that extraversion had no significant association with Zoom fatigue, lending no support to H5.

Table 2*Unstandardized Regression Coefficients of the Independent Variables on the Zoom Fatigue**Dependent Variable*

	Dependent Variable: Zoom Fatigue (N = 180)
Demographic Controls	
Gender	0.12(.13)
Age	-0.03(.01)*
Number of Classes	-0.00(.00)
Number of Hours	0.06(.03)*
Race	0.04(.03)
Year of Study	0.04(.05)
Internet Connectivity	0.16(.24)
Independent Variables	
Zoom Richness	0.03(.09)
Social Presence	3.84e ⁻⁴ (.00)
Self-Presence	-0.25(.08) ***
Social Support-Classmates (Emotional)	0.17(.08)*
Social Support-Classmates (Instrumental)	-0.02(.09)
Social Support- Classmates (Informational)	0.01(.09)
Social Support- Instructors (Emotional)	-0.23(.09)*
Social Support-Instructors (Instrumental)	-0.05(.09)
Social Support- Instructors (Informational)	0.17(.10)
Extraversion	0.06(.06)
<i>R</i> ²	0.24

Note. **p* < .05, ****p* < .001.

CHAPTER.5 DISCUSSION

Zoom fatigue, a COVID-19 pandemic-driven phenomenon, is understudied. This research was an attempt to offer new insights to this phenomenon. It examined perceived richness of Zoom, perceived social presence, perceived self-presence, perceived social support from classmates and instructors, and extraversion as predictors of Zoom fatigue among university students. The findings revealed how perceived self-presence and emotional social support from instructors do indeed predict lower levels of self-reported Zoom fatigue among students. However, perceived richness of Zoom, perceived social presence, perceived instrumental and informational social support from classmates, perceived instrumental and informational social support from instructors, and extraversion did not have significant associations with Zoom fatigue. One unexpected and interesting finding was emotional social support from classmates and how it was positively associated with fatigue. The following section offers deeper interpretations of those results.

Perceived richness of Zoom (H1) did not receive support as a predictor of Zoom fatigue. When evaluating Zoom richness, students here considered timeliness of feedback, message personalization, language variety, communication cues and channels (Daft & Lengel, 1986; Carlson & Zmud, 1999). Handke and colleagues (2018) discussed how people are not necessarily constrained by the physical properties of a medium. Rather, they are capable of adapting media to their causes by compensating suppressed communicative cues (Handke et al., 2018). Another explanation for this finding could go beyond the usage of the medium itself. It could mean that Zoom became a symbol of the impact of COVID-19 pandemic on in-person classes. Meaning, the idea of being in a computer-mediated classroom because it is the only way classes can be conducted could be exhausting, not the use of Zoom itself. In fact, Neshor Shoshan and Wehrt

(2021), using a mixed-method approach, provide evidence that a medium (i.e., video) gained symbolic meaning. Particularly, videoconferencing became a symbol of “what has been lost” (Nesher Shoshan & Wehrt, 2021, p.18). Barley et al., 2011 provide a similar approach when examining email as a source and symbol of stress. Supporting Nesher Shoshan and Wehrt’s (2021) argument, the context of the pandemic is critical to Zoom fatigue.

Social presence as a predictor of Zoom fatigue (H2) was not supported by the study findings. In previous research, social presence was identified as an important factor for improving learning (Gunawardena & McIsaac, 2004) by motivating learners, enhancing the sense of active community, promoting learners’ engagement (Hall & Herrington, 2010), and facilitating interaction (Leh, 2001). It was also found to overcome the potential negative reactions by enabling stronger peer connections, reducing feelings of isolation, and strengthening feelings of psychological connection and community (Zhan & Mei, 2013). However, research has also shown that in a computer-mediated environment, one cannot take for granted that participants will socially interact simply because the environment makes it possible (Kreijns, Kirschner, & Jochems, 2003). For instance, certain types of classes or knowledge do *not* require a rich sharing learning environment where collaboration and interactions with other social actors are key, thus social presence might not have much effect on learning (Zhan & Mei, 2013). It is important to remember that Zoom fatigue does not necessarily entail learning difficulties. Rather, it is an emotional, psychological, and physical phenomenon in which perceived presence of other social factors might not improve or worsen the symptoms of fatigue.

As predicted, perceived self-presence was negatively associated with Zoom fatigue (H3). As Lee (2004) explains, self-presence ensues when users do not notice the virtuality of either para-authentic representation of themselves or the artificially fashioned alter-selves in a virtual

environment. In relation to Zoom, students were asked whether their video on Zoom feels like them, sounds like them, relates to their identity, and feels natural (see Appendix E). The more they perceived their Zoom presence represents them, the lower levels of fatigue they experienced, and vice versa. This also means that during a Zoom session, we are constantly engaged in self-evaluation of our virtual representation. “Zoom users are seeing reflections of themselves at a frequency and duration that hasn’t been seen before in the history of media” (Bailenson, 2021, p.4). Previous research has shown people tend to evaluate themselves when seeing a mirror image of themselves (Duval & Wicklund, 1972; Gonzales & Hancock, 2011). While this can lead to more prosocial behavior, the self-evaluation can be stressful (Bailenson, 2021). Therefore, adapting communication tools that allow for a better mediated self-presence could potentially eliminate levels of videoconferencing fatigue.

As hypothesized in H4d, perceived emotional social support from instructors does predict lower levels of fatigue experienced by students. This is not quite surprising given how the COVID-19 pandemic inflicted a huge emotional drain on students at all academic levels and challenged their mental health (Gavin et al., 2020; Grubic et al., 2020; Pfefferbaum and North, 2020). Indeed, research shows how negative feelings such as boredom, burnout, and anxiety are known to diminish cognitive resources thus negatively impacting school performance and academic achievement (Madigan & Curran, 2020; Moeller et al., 2020; Samuel & Burger, 2020). Whereas positive feelings are associated with students' attention, concentration, engagement, and persistence in learning activities which positively correlate with academic achievements (Eccles, 2005; Moeller et al., 2020; Schiefele, 1996). This is also reflected in Malecki and Demaray (2003) findings that shows emotional support perceived from teachers was a significant and sole individual predictor of students’ social skills and academic competence. Furthermore, Albrecht

and Goldsmith (2003) asserted that dealing with emotions is more important than providing a lot of information. Gasser et al. (2018) describe how emotional instructor support relates to positive reactions necessary to support human development in any learning contexts, but particularly where there are actual or perceived challenges. Given how universities face unexpected challenges as students have manifested signs of anxiety and stress during the pandemic (Camacho-Zuñigaa et al., 2021), it is rather important for instructors to recognize the importance of providing emotional support to their students. Being attentive to not only the classroom environment, but also the type of perceptions the classroom inspires is another important role instructors fulfill.

Interestingly, emotional social support from classmates was opposite to H4a in that it had a positive association with Zoom fatigue. It is hard to compare this finding with existing literature given the lack of research regarding specific type/source of support in videoconferencing. Again, emotional support from classmates in the realm of this study entails affection and care. This surprising finding could be interpreted in different ways. One being, perceived emotional social support does not necessarily mean such support is satisfactory or needed. Furthermore, satisfaction with support is determined largely by the needs of the individuals (Lin, 1986; Hombrados-Mendieta et al., 2012). Meaning, receiving care from classmates does not essentially mean feelings of fatigue will be alleviated. This aspect is reflected in the specificity hypothesis of Cohen and McKay (1984). They suggest social support is more effective if it targets the problem that must be solved, which is Zoom fatigue here. There is some consensus that for many problems emotional support is the most important (Cutrona, 1986), but each type of support fulfills a specific function. Building a bit more on that, the type

of support coming from a specific source of support that fulfills a specific function/need is also very critical when considering social support as a predictor.

The previous argument can also be considered when interpreting the lack of support hypotheses 4b and 4c received regarding perceived instrumental and informational social support from classmates. Instrumental support is generally fulfilled in the form of active engagement in offering aid or in helping with specific tasks (Parsons, 2019). Previous studies found classmates to always provide lower levels of instrumental support than parents, for example (Del Valle et al., 2010; Hombrados-Mendieta et al., 2012). This could be attributed to the traditional role of classmates as friends and confidantes (Del Valle et al., 2010). It also could be attributed to the nature of online learning in which such support is not easily translated or conveyed in a virtual setting. Informational support generally means giving advice, providing facts, and sharing tips (Chang, 2009; Hombrados-Mendieta et al., 2012; Parsons, 2019). In a classroom context, this type of support can take place in the form of study groups during which information sharing happens (Boren, 2013, Boren, 2014; Chang, 2009; Gray, 2014; Hsu et al., 2018; Nick et al., 2018; Parsons, 2019). These supportive informational ties, however, do seem to form in the classroom as students spend a great deal of their time at school, an environment in which friendships with peers develop (Hombrados-Mendieta et al., 2012). It is possible that the transition to online learning due to the pandemic halted such ties from being established. Thus, playing no role in predicting or even alleviating levels of fatigue.

Furthermore, the results lent no support to both H4e and H4f regarding perceived instrumental and informational support from instructors and Zoom fatigue. This is also relevant to the previous discussion about the effectiveness of social support when it targets a specific problem. Furthermore, the support dynamics (received, given, or reciprocal) and the roles of the

receiver and the giver are vital determinants of not only the support experience, but also the related outcomes (Cohen & Syme 1985; Feeney & Collins 2015; Vekkaila et al., 2018).

The fifth hypothesis which predicted extraversion would have a positive relationship with Zoom fatigue was not supported. This finding could be attributed to the fact that Zoom is not a social setting in the context of this study. It is a necessary alternative to physical classrooms. Thus, it should not be thought of and analyzed as a normal social interaction given the important pandemic context.

Finally, one of the demographic controls, age, ended up having a significant correlation with Zoom fatigue. Although age was not hypothesized as a predictor in this study, this finding is still worth noting. The significance could be attributed to the 19.7% graduate students who participated in this study. At least half of those graduate students were 30 years old or older. This could also mean that graduate students suffer less symptoms of fatigue than those undergraduate students, who made up 80% of the study respondents.

Limitations

Although this study provides an interesting overview of the factors predicting Zoom fatigue, this study is not without its limitations. The first limitation is using a close-ended survey that uses convenience sampling. Close-ended surveys influence the respondents by the options available. Furthermore, using convenience sampling limits the generalizability of the findings; therefore, this sample cannot be construed as representative of all university students.

Another limitation pertains to the single-item social support measures for each type of support (i.e., emotional, instrumental, and informational). Even though these single-item measures have been well validated by previous research, multiple-item scales are generally more

robust. Also, multiple-item scales test a wider range of meanings to cover the full range of a construct.

The timing in which the data was collected could also be considered as a limitation. Levels of Zoom fatigue could be more salient directly after taking a Zoom class. This is especially relevant to the physical side effects (i.e., blurry vision and irritated eye).

Also, this study did not account for major type as a control variable. It is plausible that some types of majors, e.g., statistics and data analysis classes that STEM majors take could induce higher level of Zoom fatigue than a purely discussion-based class such as a graduate level seminar on Communication Theory.

Future Research

In terms of future research directions, first of all, it might be interesting to examine these predictors from a qualitative perspective, especially regarding perceived social support for classmates and instructors. The context of COVID-19 pandemic puts more emphasis on the emotional drain that both students and instructors feel. Thus, looking further into emotional social support from instructors and its effect on lowering levels of fatigue is important. It is also as important to investigate levels of fatigue that instructors might be experiencing, and the implications of that on the online class environment. Future research could also investigate the type of classes conducted using Zoom as an independent variable. For example, a seminar-style class in which collaboration and discussions between students often occur might induce higher levels of fatigue. However, a lecture-style class might not be as draining given the lower levels of students' engagement and participation. It might also be interesting to compare Zoom as a medium to other videoconferencing mediums that universities adapted to investigate videoconferencing fatigue from an affordance standpoint. Indeed, the use of Zoom affordances,

such as the chat box, breakout rooms, hand raising, and reactions could also be examined as variables in future research. It could be that utilizing such features changes the dynamic of the class to become more engaging and participatory, thus impacting levels of fatigue. Finally, another direction for research could involve the full range of personality traits, especially those that are susceptible to feeling emotional drains and anxiety such as neuroticism.

Conclusion

The COVID-19 pandemic has caused a paradigm shift in online instruction that is mainly driven by an urgent necessity to curb the spread of Coronavirus. With Zoom being the most adapted videoconferencing platform, faculty and students reported using the tool was exhausting, resulting in a phenomenon called Zoom fatigue. This study was an attempt to contribute to the understanding of Zoom fatigue experienced by university students. Perceived richness of Zoom, perceived social presence, perceived self-presence, perceived social support from classmates and instructors, and extraversion were examined as potential predictors of Zoom fatigue.

Overall, this study contributed to the general understanding of the use of Zoom fatigue in a pandemic context. A few implications need to be noted here. One being adopting videoconferencing platforms that are best in translating self-presence might potentially improve the quality of online classes. Furthermore, several of these videoconferencing platforms have features that can be used to enhance the learning process and engagement. Zoom classroom, for instance, can become much more collaborative by employing breakout rooms feature to have students work in smaller groups. This will potentially improve the chances of social support ties being established between students. Another implication puts more effort on instructors regarding their roles in the classroom. Even though generally, instructors are more perceived as

academic mentors, the pandemic seems to assign them another counterintuitive role that involves providing emotional support to their students.

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Appendices

Appendix A: Recruitment Email (Non-SONA Participants)

Recruitment Email (Non-SONA Participants)

Hello,

My name is Maha Harpool and I am a graduate student at the University of Hawai'i at Mānoa in the School of Communications. You are being invited to participate in a close-ended survey on Zoom Fatigue that is being conducted as part of the requirements for earning my graduate degree.

This close ended survey will take approximately 30 minutes to complete. You will be one of about a few hundred survey participants. You are asked to forward the survey link to as many friends or classmates who are likewise enrolled at U.S colleges and have taken or are currently taking Zoom classes during the COVID-19 pandemic.

Your participation is completely voluntary, and you can skip any questions you feel uncomfortable answering. There are no significant risks to participating in this survey outside of what you ordinarily encounter in daily life. You will benefit from participation in this survey by possibly gaining new knowledge about what factors predict Zoom fatigue among college students.

Survey data will be kept secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. All results of this survey will be reported in the aggregate and will not be linked to individual participants. I will report my findings in a way that protects your privacy and confidentiality to the extent allowed by law.

For questions, concerns, complaints you may contact Maha Harpool, the principal investigator for this study by email at mharpool@hawaii.edu. You can also contact her advisor, Dr. Rachel Neo at rneo@hawaii.edu or phone at 808-956-3332.

Sincerely,
Maha Harpool
School of Communications
The University of Hawaii at Manoa

Appendix B: Informed Consent (Non-SONA Participants)



Informed Consent University of Hawai'i Consent to Participate in a Research Project Maha Harpool, Principal Investigator

Project title: Examining Predictors of Zoom Fatigue

Aloha! My name is Maha Harpool and you are invited to take part in a research study. I am a graduate student at the University of Hawai'i at Mānoa in the School of Communications. As part of the requirements for earning my graduate degree, I am doing a research project.

What am I being asked to do?

If you participate in this project, you will be asked to fill out a survey. You are asked to forward the survey link to as many friends or classmates who are likewise enrolled at U.S colleges and have taken or are currently taking Zoom classes during the COVID-19 pandemic.

Taking part in this study is your choice.

Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss to you. Your choice to participate or not participate will not affect your status as a student.

Why is this study being done?

The purpose of my project is to examine what factors predict Zoom fatigue among college students. I am asking you to participate because you are taking or have taken classes via Zoom.

What will happen if I decide to take part in this study?

The survey will consist of 47 close-ended survey questions. It will take approximately 30 minutes. The survey questions will include questions like, "How tired do you feel after video conferencing?" and "To what extent do you feel you can get to know someone that you met only through Zoom? ". The survey is accessed on a website to which I will provide you a link.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. You may become stressed or uncomfortable answering any of the survey questions. If you do become stressed or uncomfortable, you can skip the question or take a break. You can also stop taking the survey or you can withdraw from the project altogether.

There will be no direct benefit to you for participating in this survey. The results of this project may further academic understanding of specific factors that predict Zoom fatigue among university students.

Confidentiality and Privacy:

I will keep all study data secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawai'i Human Studies Program has the right to review research records for this study.

Compensation:

There will be no compensation for your time and effort in participating in this research project.

Future Research Studies:

Even after removing identifiers, the data from this study will not be used or distributed for future research studies.

Questions: For questions, concerns, complaints you may contact Maha Harpool, the principal investigator for this study by email at mharpool@hawaii.edu. You can also contact her advisor, Dr. Rachel Neo at rneo@hawaii.edu or phone at 808-956-3332. You may contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu to discuss problems, concerns and questions, obtain information, or offer input with an informed individual who is unaffiliated with the specific research protocol. Please visit <http://go.hawaii.edu/jRd> for more information on your rights as a research participant.

To Access the Survey: Please go to the following web page:

https://manoahawaiiiss.az1.qualtrics.com/jfe/preview/SV_6zDwCKXHEyDG02W?Q_CHL=preview&Q_SurveyVersionID=current

You should find a link and instructions for completing the survey. Clicking the ">" button at the bottom of the informed consent page implies your consent to participate in this study.

Please print or save a copy of this page for your reference.

Mahalo!

Appendix C: Recruitment Email- (SONA Participants)

Recruitment Email

Aloha!

My name is Maha Harpool and I am a graduate student at the University of Hawai'i at Mānoa in the School of Communications. You are being invited to participate in a close-ended survey on Zoom Fatigue that is being conducted as part of the requirements for earning my graduate degree.

This close ended survey will take approximately 30 minutes to complete. You will be one of about a few hundred survey participants. By participating in this survey, you will earn extra credit based on the length of participation (0.50 SONA credit= 30 minutes). You will further benefit from participation in this survey by possibly gaining new knowledge about what factors predict Zoom fatigue among college students.

Your participation is completely voluntary, and you can skip any questions you feel uncomfortable answering. There are no significant risks to participating in this survey outside of what you ordinarily encounter in daily life.

Survey data will be kept secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. All results of this survey will be reported in the aggregate and will not be linked to individual participants. I will report my findings in a way that protects your privacy and confidentiality to the extent allowed by law.

For questions, concerns, complaints you may contact Maha Harpool, the principal investigator for this study by email at mharpool@hawaii.edu. You can also contact her advisor, Dr. Rachel Neo at rneo@hawaii.edu or phone at 808-956-3332.

Sincerely,
Maha Harpool
School of Communications
The University of Hawaii at Manoa

Appendix D: Informed Consent (SONA Participants)



University of Hawai'i Consent to Participate in a Research Project Maha Harpool, Principal Investigator

Project title: Examining Predictors of Zoom Fatigue

Aloha! My name is Maha Harpool and you are invited to take part in a research study. I am a graduate student at the University of Hawai'i at Mānoa in the School of Communications. As part of the requirements for earning my graduate degree, I am doing a research project.

What am I being asked to do?

If you participate in this project, you will be asked to fill out a survey.

Taking part in this study is your choice.

Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss to you. Your choice to participate or not participate will not affect your status as a student at UH Manoa.

Why is this study being done?

The purpose of my project is to examine what factors predict Zoom fatigue among college students. I am asking you to participate because you are taking or have taken classes via Zoom.

What will happen if I decide to take part in this study?

The survey will consist of 47 close-ended survey questions. It will take approximately 30 minutes. The survey questions will include questions like, "How tired do you feel after video conferencing?" and "To what extent do you feel you can get to know someone that you met only through Zoom?". The survey is accessed on a website to which I will provide you a link.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. You may become stressed or uncomfortable answering any of the survey questions. If you do become stressed or uncomfortable, you can skip the question or take a break. You can also stop taking the survey or you can withdraw from the project altogether.

By choosing to participate in this survey, you will earn SONA credit based on the length of participation (0.50 SONA credit= 30 minutes). Also, the results of this project may further academic understanding of specific factors that predict Zoom fatigue among university students.

Confidentiality and Privacy:

No personal data or identifiers will be collected using the SONA system. All study data will be kept in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawai'i Human Studies Program has the right to review research records for this study.

Compensation:

You will be rewarded extra credit (approximately 0.50 SONA credit) in exchange for approximately 30 minutes of your time to complete this survey.

Future Research Studies:

Even after removing identifiers, the data from this study will not be used or distributed for future research studies.

Questions: For questions, concerns, complaints you may contact Maha Harpool, the principal investigator for this study by email at mharpool@hawaii.edu. You can also contact her advisor, Dr. Rachel Neo at rneo@hawaii.edu or phone at 808-956-3332. You may contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu to discuss problems, concerns and questions, obtain information, or offer input with an informed individual who is unaffiliated with the specific research protocol. Please visit <http://go.hawaii.edu/jRd> for more information on your rights as a research participant.

To Access the Survey: Please go to the following web page:

https://manoahawaiiiss.az1.qualtrics.com/jfe/form/SV_cYlyRxbFcNKQbX0 &id=%SURVEY_CODE%
You should find a link and instructions for completing the survey.

Please print or save a copy of this page for your reference.

Mahalo!

Appendix E: Complete List of Survey Questions

Perceived Richness of Zoom

Thinking about the use of Zoom for classes and your interactions with your communication partner(s) (i.e., classmates, teachers), to what extent do you agree with the following statements:

(1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree

1. Zoom allows my communication partner(s) and me to give and receive timely feedback.
2. Zoom allows my communication partner(s) and me to tailor our messages to fit our communication requirements.
3. Zoom allows my communication partner(s) and me to communicate a variety of different cues (such as emotional tone, attitude, or formality) in our communication.
4. Zoom allows my communication partner(s) and me to use rich and varied language in our communication.

Perceived Social Presence

Thinking about the use of Zoom for classes and your interactions with your communication partner(s) (i.e., classmates, teachers), how do you rate the following statements:

100-0 sliding scale

1. To what extent do you feel able to assess your partner's reactions to what you say?
100 Able to assess reactions, **0** not able to assess reactions.
2. To what extent Zoom is like a face-to-face interaction?
100 A lot like face-to-face, **0** not like face to face at all.
3. To what extent Zoom is like you are in the same room with your partner?
100 A lot like being in the same room, **0** not like being in the same room at all.
4. To what extent does your partner seem "real"?
100 Very real, **0** not real at all.
5. To what extent do you feel you can get to know someone that you met only through Zoom?
100Very well, **0** not at all.

Perceived Self- Presence

Thinking about the use of Zoom for classes and your interactions with your communication partner(s) (i.e., classmates, teachers), to what extent do you agree with the following statements:

(1) Very Strongly Disagree; (2) Strongly Disagree; (3) Disagree; (4) neither agree nor disagree; (5) Agree; (6) Strongly Agree; (7) Very Strongly Agree

1. My video on Zoom feels like it is really me
2. My body movements on Zoom feels natural
3. My video on Zoom sounds like it is really me
4. My video on Zoom is related to my identity

Perceived Social Support

Thinking about the use of Zoom for classes and your interactions with your classmates, how often do you get support from your classmates?

(1) Rarely; (2) Sometimes; (3) Quite often; (4) Almost always; (5) Always

1. Emotional Support: They give you affection and listen when you want to talk and express your feelings
2. Instrumental Support: They are willing to do specific things for you, like helping with homework or any other activity
3. Informational Support: They give you useful tips and information to deal with questions, problems, or everyday tasks

Thinking about the use of Zoom for classes and your interactions with your instructors, how often do you get support from your instructors?

(2) Rarely; (2) Sometimes; (3) Quite often; (4) Almost always; (5) Always

1. Emotional Support: They give you affection and listen when you want to talk and express your feelings
2. Instrumental Support: They are willing to do specific things for you, like helping with homework or any other activity
3. Informational Support: They give you useful tips and information to deal with questions, problems, or everyday tasks

Extraversion (The Mini-IPIP Scales-Big Five Personality Traits)

How much do you agree with each statement about you as you generally are now, not as you wish to be in the future?

Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
1	2	3	4	5

In general I...

1. Am the life of the party.
2. Sympathize with others' feelings.
3. Get chores done right away.
4. Have frequent mood swings.
5. Have a vivid imagination.
6. Don't talk a lot.
7. Am not interested in other people's problems.
8. Often forget to put things back in their proper place.
9. Am relaxed most of the time.
10. Am not interested in abstract ideas.
11. Talk to a lot of different people at parties.
12. Feel others' emotions
13. Like order.
14. Get upset easily.
15. Have difficulty understanding abstract ideas.
16. Keep in the background.

17. Am not really interested in others.
18. Make a mess of things.
19. Seldom feel blue.
20. Do not have a good imagination.

Mini-IPIP scale scoring: Items 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, and 20 need to first be reverse scored before scoring the five domains: Neuroticism 4, 9r, 14, 19r; Extraversion 1, 6r, 11, 16r; Openness 5, 10r, 15r, 20r; Agreeableness 2, 7r, 12, 17r; Conscientiousness 3, 8r, 13, 18r.

Zoom Fatigue Scale

The following questions are meant to assess how you feel after meeting on Zoom for classes. 1 = “Not at all”, 2 = “Slightly”, 3 = “Moderately”, 4 = “Very” to 5 = “Extremely” except for the two frequency questions (marked with asterisks) from 1 = “Never”, 2 = “Rarely”, 3 = “Sometimes”, 4 = “Often” to 5 = “Always”

1. How tired do you feel after video conferencing?
2. How exhausted do you feel after video conferencing?
3. How mentally drained do you feel after video conferencing?
4. How blurred does your vision get after video conferencing?
5. How irritated do your eyes feel after video conferencing?
6. How much do your eyes hurt after video conferencing?
7. How much do you tend to avoid social situations after video conferencing?
8. How much do you want to be alone after video conferencing?
9. How much do you need time by yourself after video conferencing?
10. How much do you dread having to do things after video conferencing?
11. How often do you feel like doing nothing after video conferencing? *
12. How often do you feel too tired to do other things after video conferencing? *
13. How emotionally drained do you feel after video conferencing?
14. How irritable do you feel after video conferencing?
15. How moody do you feel after video conferencing?

Demographics and Questions About General Zoom Use

1. What is your gender:
 - a. Male
 - b. Female
 - c. Other

2. What is your year of study:
 - a. Freshman
 - b. Sophomore
 - c. Junior
 - d. Senior
 - e. Graduate Student

3. What is your age? _____

4. Do you have good internet connectivity while using Zoom?
 - a. Yes
 - b. No

5. Ever since the start of the COVID-19 pandemic, approximately how many of your classes have been conducted on Zoom? _____

6. Ever since the start of the COVID-19 pandemic, approximately how many hours per day do you spend taking Zoom-based classes? _____

7. When describing your race, would you best describe yourself as:
 - a. American Indian or Alaska Native
 - b. Asian
 - c. Black or African American
 - d. Hispanic or Latino
 - e. Native Hawaiian or Other Pacific Islander
 - f. White Caucasian
 - g. Something else, please specify: _____

We have come to the end of this survey. Thank you for participating in our study!

Appendix F: Zero-Order Correlations Table 1

Table 1

Zero-Order Correlation Matrix Between Perceived Richness of Zoom, Perceived Social Presence, Perceived Self Presence, Perceived Social Support (From Instructors and Classmates), Extraversion and Zoom Fatigue

	Zoom Richness	Social Presence	Self-Presence	Social Support Classmates (Emotional)	Social Support Classmates (Instrumental)	Social Support Classmates (Informational)	Social Support Instructors (Emotional)	Social Support Instructors (Instrumental)	Social Support Instructors (Informational)	Extraversion	Zoom Fatigue
Zoom Richness	--										
Social Presence	0.43***	--									
Self-Presence	0.44***	0.54***	--								
Social Support-Classmates (Emotional)	0.29***	0.39***	0.42***	--							
Social Support-Classmates (Instrumental)	0.31***	0.38***	0.32***	0.58***	--						
Social Support-Classmates (Informational)	0.31***	0.42***	0.36***	0.58***	0.79***	--					
Social Support-Instructors (Emotional)	0.28***	0.32***	0.39***	0.56***	0.36***	0.41***	--				
Social Support-Instructors (Instrumental)	0.25***	0.31***	0.34***	0.47***	0.38***	0.44***	0.70***	--			
Social Support-Instructors (Informational)	0.31***	0.35***	0.38***	0.47***	0.38***	0.48***	0.71***	0.78***	--		
Extraversion	-0.07	-0.00	0.04	0.09	-0.034	0.02	0.14*	0.01	0.05	--	
Zoom Fatigue	-0.11*	-0.18*	-0.32***	-0.11	-0.10	-0.12*	-0.24***	-0.22***	-0.17**	0.00	--

Note. * $p < .05$, ** $p < .01$, *** $p < .001$