A Scholarly Examination of Zoom Fatigue: A Systematic Review

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Abstract

This systematic review focused on the nature, prevalence, contributing factors and mitigating strategies of Zoom fatigue. The study reviewed 42 research articles identified from the peer-reviewed literature published between 2020-2024. In the current study, Nadler's third skins theory and Latour's Actor-Network Theory were used as the theoretical lens. The results indicate that Zoom fatigue is a construct with cognitive, physical, and social-psychological plight. Some of the main areas are; staring, self-observation, lack of motion and abnormal social signals. The findings reveal variations of the disorder affect more women than men and persons with previous anxiety or stress related disorders. Measures for reduction are development of structured breaks, provision for 'no camera' option, toggling between synchronous and asynchronous communication.

The work shows that Zoom fatigue is a multifaceted phenomenon that relates to human psyche and cognitive activity; technologies and interfaces; as well as organisational and managerial institutions. All of these have important implications for remote work policies and design of video conferencing platforms. The research affirms and prescribes a multi-level response to the problem of Zoom fatigue that entails technology solutions, policy changes, and personal adaptations. More future longitudinal researches are necessary to evaluate the effectiveness of these interferences in the long term, as well as in different circumstances and with people.

Chapter One

1.0 Introduction

1.1 Background of the Study

Zoom fatigue is a popular term for a phenomenon that has become pervasive in the current workplace (Anh et al., 2023). It reflects changes in communication technologies and the nature of work. Video conferencing, previously used only for boardroom meetings held in corporate offices, has become a valuable communication tool for all types of organisations (Bennett et al., 2021). The need for this has become particularly prominent since recent global events forced many workplaces to function remotely (Anh et al., 2023).

While the technology of video-mediated communication has been around for decades (the first 'videophone' was developed in the mid-20th century, (Fauville et al., 2021) the experience of broadcasting video 'from the neck up' only really found a professional audience at the end of the 20th century, when it was made easier by advances on consumer connectivity and digital compression technologies (Fauville et al., 2021). Building on Skype's open-source hardware and software, Zoom made the capability to get together onscreen facilitative, easy to purchase, and inexpensive for even the tiniest of businesses (Bennett et al., 2021).

The year 2020 was the tipping point for video conferencing adoption. As the pandemic raged and governments and organisations across the globe established 'work from home' policies, the use of video conferencing platforms such as Zoom skyrocketed (George & Lakhani, 2020). Zoom's daily meeting participants jumped from 10 million in December 2019 to 300 million by April 2020

(Bennett et al., 2021). The new phenomenon associated with this increased usage was Zoom fatigue.

Zoom fatigue is a phenomenon that encompasses much more than simply a negative valence toward a specific video communications platform (Guggenberger et al., 2021). Zoom fatigue is a complex combination of psychological, physiological and social factors that result in musculoskeletal discomfort such as eyestrain, aches and pains, cognitive load and emotional exhaustion (Giones et al., 2020). Although a specific finding in this regard is not yet available, the relatively new demands of video-mediated communication, including an awareness of the self-due to the recipient's (and one's own) video feed in the window, as well as the cognitive overhead associated with reading non-verbal behaviour in a digital context, are likely to be contributing factors to the general phenomenon (Bleakley et al., 2022).

The rise of terms such as Zoom fatigue and remote fatigue have spurred researchers to study this phenomenon (Hacker et al., 2020). Pioneering work investigating its underlying mechanisms takes a multi-disciplinary approach, drawing upon cognitive psychology, neuroscience and techniques from the field of human-computer interaction, approaching it from the perspective of cognitive and physiological stress (Fauville et al., 2021). When defining Zoom fatigue from the point of physiological stress, researchers find the prolonged, sustained eye contact and lack of mobility stressful, others mention problems with the processing of multiple visual information streams at the same time (Hacker et al., 2020).

Furthermore, disintegrating boundaries between work and home, particularly amid the expansive use of video calls, have created another complication (Webb, 2021). Employees are having to contend with a new world where their home environments are forever visible to coworkers, potentially intensifying feelings of vulnerability and arousal (Matli, 2020). The possibility of being

perpetually available – which could be made easier by the ready accessibility of virtual meetings – just adds fuel to the fire, resulting in what some researchers call 'virtual presenteeism' (Fauville et al., 2021).

According to Anh et al (2023), the growing ubiquity of video communication technologies, especially after the COVID-19 pandemic, has triggered an urgent issue that has become a daily struggle for millions who use video conferencing platforms. Zoom fatigue describes heightened levels of exhaustion and stress from video conferencing (Pan & Cui, 2020). This affects many aspects of human bodies, minds and how people communicate with others. Zoom fatigue can affect individuals of all ages – from first-year university students who need to take multiple classes online, to those working from home, to children who are learning virtually (Pan & Cui, 2020).

Fundamentally, it stems from the bio cognitive strains that video-mediated communication uniquely imposes on the user (Webb, 2021). Guggenberger et al (2021)'s study, showed that video conferencing results in mental overload compared to people's encounters with others in offline settings. When interacting on Zoom, participants are required to process excessive amount of simultaneous information for extended periods. In addition, they must concentrate on multiple heads on the screen, monitor their gazes for nonverbal cues, listen out for time lags in the chat and delay-induced stutters within the audio stream, keep track of their speech speed, avoid turning away from their video windows, and – perhaps most unnervingly keep gaze fixed on each speaker when they move (Fauville et al., 2021).

Unlike face-to-face contact, where gazes can be modulated and adjusted as they speak, the demands of the video conference are relentless and can cause participants to tune out of the experience (Kramer, 2020). Any further sinusoidal interference of the system – be it in the form of

audio drop-outs or sketchy internet connections – can compound informational fatigue (Giones et al., 2020).

For instance, the self-view feature that has become ubiquitous on most videoconferencing channels consistently adds an unprecedented level of self-awareness to every professional interaction (Hepworth, 2021). Coupled with the added anxiety of the very novelty of remote technology, this higher level of self-consciousness can lead to anxiety and cognitive intrusion, as people begin to worry about how their on-screen presence – as well as their background environment – is being perceived (Bartkowiak, 2022). What's most concerning, in fact, is that the profound psychological sequelae of the personal 'mirror' effect can show up long after the initial discomfort of attending virtually (Bartkowiak, 2022). A history of negative self-perceptions during videoconferencing has a lingering, cumulative effect on trait self-esteem and, ultimately, on broader professional confidence as well (Hepworth, 2021).

Against the backdrop of organisations facing heightened competition for talent, Zoom fatigue erodes engagement, participation and performance (Guggenberger et al., 2021). Hence, Zoom fatigue at the level of organs and systems (i.e., tiredness and boredom) portends negative consequences for the whole body politic (Moeckel, 2017). Individuals experiencing growing levels of exhaustion and burnout become less able to engage meaningfully in collective pursuits and therefore begin to decrease rates of participation and contribution to collective accomplishments, a phenomenon that can cascade through teams and adversely impact innovation processes and organisational outcomes (Hepworth, 2021).

The threat of Zoom fatigue to employee turnover also represents another serious organisational liability, given the existing challenges that businesses have faced with the pandemic-induced shift toward remote workforces (Carroll, 2020). Against the backdrop of demanding and rapidly

evolving business ecologies in which organisations in almost every sector of the economy face heightened competition for talent, Zoom fatigue erodes engagement, participation and performance in ways that are difficult to sustain in this critical age (Hepworth, 2021).

The issue won't just be that there are certain organisations that don't work remotely (Al-Habaibeh et al., 2021). It is that the prevalence of Zoom fatigue emerges as a major pitfall of remote collaboration, one that potentially reduces or cancels out the perceived benefits of flexibility (Al-Habaibeh et al., 2021). And if enough people feel that way, it could conceivably dampen progress toward more distributed ways of working, despite other factors that are likely to accelerate it (Brem & Viardot, 2021). Zoom fatigue touches upon deeper societal anxieties about digital health and wellness, and it's a factor in the growing social debate over how to express oneself online (George & Lakhani, 2020). As video conferencing becomes a more and more significant part of people's daily lives, whether in the workplace or at home, its emotional toll might have significant repercussions for public health and social relations well into the future (Matli, 2020).

Despite the wide acknowledgement of Zoom fatigue as an issue, there is still a dearth in literature understanding of what is behind it, how prevalent it is, and how to mitigate it (Safi & Said, 2022). Although some initial research has started building a picture in all these areas, as working-from-home practices and video-conferencing technologies both evolve quickly, it is important to also track the evolving landscape (Safi & Said, 2022).

This presents an urgent need for inclusive, empirical research from multiple disciplines to understand what causes Zoom fatigue, measure when and how frequently it occurs in a variety of work contexts, and provide proven methods to help people mitigate it (Bleakley et al., 2022). Such research is necessary not only to ensure employee health and organisational productivity but also

to provide a path for the design of video conferencing technologies, as well as evidence-based sustainable remote work practices (Brem & Viardot, 2021).

1.2 Problem Statement

The purpose of this research is to investigate the state of existing research on video conferencing fatigue including the factors contributing to Zoom fatigue and strategies that can help alleviate the stress of Zoom fatigue for users. This study seeks to achieve this by conducting a systematic review of literature on the concept of Zoom fatigue.

Objectives

The Objectives of this research are to:

- Assess the nature and prevalence of Zoom fatigue by conducting a systematic literature review to identify and analyse existing studies.
- Identify and analyse the factors that contribute towards Zoom fatigue.
- Examine various strategies and recommendations that have the potential to effectively mitigate and alleviate Zoom fatigue.

1.3 Rationale for the Study

The growing recognition of Zoom fatigue relates to broader conversations about digital wellbeing and technologies that create and exacerbate mental health and physiological issues. Users experience challenges in distinguishing between work and non-work time and spaces, especially in the new era of remote work (Chen & Zou, 2023).

Also, the study is a synthesis of several studies on the topic to get a solid understanding of the concept of Zoom fatigue, its nature and prevalence, its contributing factors and mitigating

strategies. Finally. the theoretical synthesis between Nadler's work on organisational change and Latour's Actor-Network Theory provides a novel theoretical framework to explore Zoom fatigue (Latour, 2005; Nadler, 2020). The intersection of these two bodies of work allows for the examination of how technological, human and organisational phenomena interact in this situation. By connecting Zoom fatigue to these broader theoretical frameworks, contribution is made to the emergence of more nuanced models to understand technology-mediated organisational dynamics (De' et al., 2020).

1.4 Summary

This chapter has set the scene for a thorough analysis of Zoom fatigue, a problem for workplaces today. It has shown how video conferencing technologies went mainstream very quickly, then exploded even more widely in response to the COVID-19 pandemic. It has shown how Zoom fatigue can be understood as a complex, multifaceted phenomenon. This chapter has introduced the research's problem, aim and objectives, and research rationale.

Chapter Two

2.0 Literature Review

2.1 Introduction

This review deftly integrates various current streams of research on Zoom fatigue. These interventions come from organisational psychology, human-computer interaction, and communication studies. The paper starts with conceptual foundations of Zoom fatigue, delves into the theoretical grounds that could enlighten with its mechanisms, and presents an exhaustive analysis of potential empirical evidence that affirm its prevalence and impact on professionals. Finally, this review is supplemented by themes emerging from the works of Nunes and Ozog (2024), in their book "You are Muted". Performance, Precarity and the Logic of Zoom. These critical themes for discursive analysis by the book include a panoptic gaze, control, and self-control, which can be applied in the understanding of Zoom fatigue. These themes give broader sociological and psychological context, which enriches theoretical foundation formed by Nadler's 'third skins' and Latour's ANT.

2.2 Conceptual Framework

2.2.1 Zoom Fatigue

Zoom fatigue refers to the mental exhaustion that comes with human interactions through video-conferencing apps such as Zoom, Microsoft Teams and Google Meet (Fauville et al., 2021). As the name suggests, it relates to the platform of this name but no the general tiredness of video communication tools. According to Fauville et al. (2021), Zoom fatigue is the fatigue one feels when in, or after, video calls due to the particularities of the interactions. This goes beyond ordinary work-related stress or screen-related fatigue, focusing on particular cognitive and affective

demands that are different in video conferencing (Elbogen et al., 2022). Specifically, by worrying about how others perceive them and by constantly being aware of the opposite, self-surveillance and hyper-gaze make this fatigue perspective worse, as exemplified in the works of Nunes and Ozog (2024). As distinguished from face-to-face communication, videoconferencing involves the presentation of self at all times and this introduces other forms of mental stress.

2.2.2 Components of Zoom Fatigue

Zoom fatigue can be said to be made up of several related factors but when assumed together they form one unit. Cognitive overload occurs due to the handling of large amounts of both visual and audio data, as well as speech, gestures, and a part of the screen that displays the person (Simbula et al., 2024a). This is on top of the mirror anxiety discussed by Nunes & Ozog, (2024), suggesting that prolonged self-view leads to greater stress and self-consciousness (Pan & Cui, 2020). Also, speaking while at a video conference distorts participants' movements, adding to discomfort (Hepworth, 2021). According to Chen and Zou (2023), temporal compression increases the speed of communicating rhythms thus eliminating natural gaps and hence increasing the interaction. Technostress that is brought about by factors such as connectivity and audio clarity add another form of cognitive load (Lazarevic et al., 2023). In aggregate, these parts form a compounded pressure on participants, thereby perpetuating Zoom fatigue.

2.2.3 Zoom Fatigue in the Context of Remote Work

The increase in remote working has exacerbated Zoom fatigue. Corporations transited to remote working to curtail and manage the spread and effect of COVID-19 on their businesses following strict rules by governments and world leaders (Uachave, 2023). It also propagated the culture of "availability" where constant visibility and response to activities keep the employees charged, thereby escalating fatigue (Weiss et al., 2021a). Moreover, it also shows how the concept of virtual

presenteeism by which employees try so hard to prove they are working during online meetings in fact exacerbates the effects of burnout.

2.2.4 Differentiating Zoom Fatigue from Related Concepts

Zoom fatigue is particularly different from several other related concepts. Other related concepts include digital fatigue and social anxiety among others.

- Digital Fatigue: Zoom fatigue is just one kind of digital fatigue. Digital fatigue can describe a variety of exhaustions, not all of them dependent on video conferencing (Pohjola et al., 2023).
- Zoom fatigue and burnout are only sometimes related: Zoom fatigue can certainly lead to burnout, and of course ongoing Zoom fatigue or exhaustion from other forms of remote work is likely to trigger burnout. However, burnout is a longer-term state of high exhaustion and diminished interest or excitement in one's job, while Zoom fatigue is likely to occur as an acute experience following a video conference session (Anh et al., 2023).
- Social anxiety: Although Zoom exhaustion can aggravate social anxiety for some, it is not the same thing. Zoom exhaustion can undermine one's cognitive functioning and motivation irrespective of predisposition to social anxiety (Pohjola et al., 2023).

2.3 Theoretical Framework

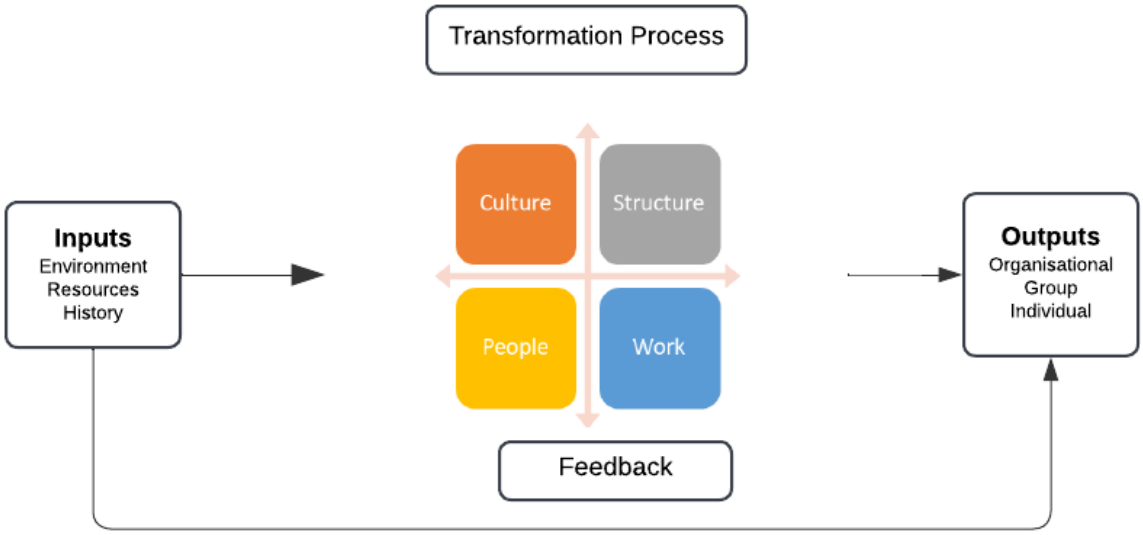
Despite Zoom fatigue being a recent concept, it raises questions of a more general theoretical dynamics concerning organisational psychology and the study of technologies. To address the issue, there are two critical theoretical approaches that are especially useful and can be used in parallel (Guggenberger et al., 2021).

First, the importance of Robby Nadler's 'third skins' concept in CMC (Nadler, 2020). This perspective is useful for conceptualising the spatial and cognitive requirements of virtual communication (Nadler, 2020). Second, Bruno Latour's Actor-Network Theory because it makes it possible to analyse how different actors in a digital communication network communicate with each other and what role technology plays in a set of relationships (Latour, 2005).

2.3.1 Nadler's Theory of Third Skins in CMC

Nadler formulated a concept of 'third skin' that postulates that the nature of spatial dynamics shifts considerably with the use of Computer Mediated Communication (CMC) that includes video conferencing (Nadler, 2020). One must note that in Face-to-Face communications, there is shared space and equal investment of senses in social interaction which happens in a new framework of co-engagement which in CMC is distorted by the loss of presence and projected presence (Mejia-Puig & Chandrasekera, 2023). In a virtual environment, people are 'flattened' into a totality that is composed of the person's body, the background and the technology, creating what is now referred to as 'third skin' (Mejia-Puig & Chandrasekera, 2023). This third skin requires a lot of cognitive effort because each participant constantly manages the digitalisation of the self, the interaction between each other and the technological interface. The constant need to monitor and calibrate the self, and the cognitive effort required to engage with people where only parts are visible, contribute to the fatigue experienced during the virtual meetings (Scheffler, 2018).

Figure 1: Nadler's Theory of Third Skins



Source: Onoigboria, 2024. Adapted from Scheffler, (2018)

Nadler's framework is particularly helpful in understanding Zoom fatigue because it accounts for the mismatch between human's evolved mind, designed for natural embodied communication, and the requirements of virtual communication (Nadler, 2020). The lack of natural affordances in video conferencing, such as spatial and contextual cues, the artefactual demand of constant self-regulation within an invisible digital 'skin' and the lack of natural breaks or pauses in the communication between sender and receiver, all contribute to cognitive overload (Scheffler, 2018). Moreover, all of the affordances and artefacts of video conferencing platforms demand participants to keep their attention at all times, something that their bodies and brains do not anticipate or easily accommodate (Nadler, 2020). The uptake of video conferencing as the dominant mode of online interaction has resulted in a radical shift in participants' bodies, brains and behaviours in ways that are cognitively and emotionally depleting (Nadler, 2020). By itself, this provides a neurological basis for understanding the experience of cognitive and emotional fatigue that leads to Zoom fatigue (Mejia-Puig & Chandrasekera, 2023).

2.3.2 Latour's Actor-Network Theory (ANT)

Bruno Latour's social-scientific perspective, Actor-Network Theory (ANT), offers a complementary explanation for the experience of Zoom fatigue (Latour, 2005). ANT shows that non-human and human actors co-construct the networks in which they are embedded. ANT is particularly helpful in the context of videoconferencing because it helps see video conferencing software not only as a passive tool but as an active agent working together with participants to co-construct their experience (Vitale, 2023). The effect of Latour's theory in the context of videoconferencing is active. Video conferencing platforms like Zoom play active roles and shape human behaviour in the network inhabited by its participants (Vitale, 2023). Technologies like Zoom direct how users will interact together, such as how the conversation will flow, what to say to one another, and even the pacing of the interaction. These are the kinds of network effects that contribute to the experience of Zoom fatigue (Kaur, 2021).

In this view, Zoom fatigue is the result of networked interactions between user and technology, such that the platform's design, which demands continuous visual attention, simultaneous audio-visual inputs and heightened attentional awareness, encourages a certain kind of behavioural control (Vitale, 2023). And, in fact, this is consistent with Latour's claim that nonhuman actors exert influence over human life and social interaction (Uachave, 2023). This is not to deny the psychological and physiological drivers of Zoom fatigue, but it is to suggest that how users feel on Zoom arises out of complex socio-technical relations between users and technological systems. It's a socio-technical phenomenon, not only a psychological one (Vitale, 2023).

2.3.3 Intersection of Theories

The analysis of Nadler's "third skins" and Latour's ANT is useful for considering the case of Zoom fatigue. Nadler's consideration of cognitive adaptation corresponds well with Latour's call for

awareness of socio-technical engagements but the theories also highlight how the design of video conferencing interfaces contributes to wear and tear. Again as Nunes and Ozog (2024) show, the combined use of surveillance, control and technology places pressure on users and looks at Zoom fatigue not only as a cognitive, but, more a socio-technical issue. Collectively, these frameworks demonstrate that zoom-fatigue is not singular incidences but systemic with organisational consequences.

2.3.4 Limitations and Gaps in the Theories

Yet, despite these merits, Latour's approaches have their limitations when it comes to explaining Zoom fatigue (Collin, 2011). Nadler's theory is a powerful conceptual framework when it comes to understanding the cognitive dynamics of CMC, but describing these interactions prevents participants from fully grasping the more social and sentimental dimensions of Zoom fatigue (Nadler, 2020). In Nadler's theory, the focus is still mainly on the spatial and cognitive aspects of CMC platforms, thereby leaving out the question of how these interactions affect the users' emotional situations or their evolving social and psychic attachments over time. On the other hand, while Latour's ANT is a particularly powerful conceptual framework for networks, its form of relativism is open to the charge that it can at times serve to obscure their importantly specific and often damaging human effects (Latour, 2005).

Further, neither articulates the long-term effects and impacts of Zoom fatigue on the work, lives and mental health of many people. More and more, work and Zoom are becoming synonymous. Meanwhile, there's a need for more empirical research to marry the theoretical insights with data on how these systems are lived. Additionally, both theories could benefit from a more nuanced view of how user demographics (e.g., age, gender, socio-economic status) experience and react to

Zoom fatigue. This avenue points to an interdisciplinary framing, uniting neurocognitive psychology and organisational studies.

2.4 Empirical Review

2.4.1 Nature and Prevalence of Zoom Fatigue

One of the first empirical studies of Zoom fatigue was published by Bailenson where he developed the Zoom Exhaustion fatigue Scale (ZEF), a 15-item scale consisting of five dimensions (general, visual, social, motivational and emotional) (Bailenson, 2021). Zoom exhaustion is said to be common Zoom fatigue is experienced especially by women, who report significantly higher levels of mirror anxiety and fatigue than men do (Fauville et al., 2021).

A later study by Fauville et al (2021) built on this work, confirming the multidimensional nature of Zoom fatigue and demonstrating its prevalence across the sample. Best of all, they demonstrated that factors such as meeting length and weekly meeting count were highly correlated with fatigue – findings that suggest 'the accumulation of Zoom hours may result in an additive fatigue', leading to the pool of current longitudinal experiments (Guggenberger et al., 2021). Other studies feeding current scientific evidence of the phenomenon reported that excessive video calls were correlated with increased exhaustion and burnout and increased risk of detrimental psychological effects (Giones et al., 2020). In a 2020 article for the Harvard Business Review, Jenny Fosslien and Francesca Gino studied the experience of Zoom fatigue within large corporations and surveyed the effects of increased video calls on the mental state of workers (Fosslien & Duffy, 2020). They reported that 57 per cent of surveyed professionals experienced increased levels of fatigue because of these videoconferences. When examining data from 10 different companies with more than

100,000 employees, they found that introverts and those with social anxiety disorder were the most affected (Fosslien & Duffy, 2020).

2.4.2 Factors Contributing to Zoom Fatigue

Other studies have pinpointed different reasons that have culminated in this phenomenon. Bailenson (2021) points to the amount of eye contact occurring in video calls as an explanation for Zoom fatigue. Normally, even in a meeting, people wouldn't be looking at each other all the time, but in a video call, everyone is looking at everyone else all the time, which can be exhausting. It also increases arousal, he adds. 'Video conferencing places particularly burdensome cognitive demands on the users,' says Nadler, who links video conferencing to a cognitive tax on people's anxiety, their distractibility and their social abilities (Nadler, 2020). This anxiety stems from the fact that users not only have to interact with their colleagues on a verbal level, but they must also pay attention to visual cues, and simultaneously manage their own in-frame realities (Kramer, 2020).

The near-constant self-view function of most video-conferencing streams leads to heightened self-consciousness. Bailenson (2021) claims that this creates a mirror-like effect that can be stressful for users, particularly women and younger users. Ratan et al found that the requirement to stay in the camera frame served to limit the degree of physical movement possible – which could be physically and mentally exhausting. Jared (2017) explains the way in which slight delays in audio or video prompt attributions of personality characteristics, increasing the cognitive workload – asking participants to read and interpret these delayed social signals. A study by Nadler (2020) found that one of the main factors behind fatigue and stress related to video-conferencing was how it introduced the home into the working environment.

2.4.3 Strategies and Best Practices to Address Zoom Fatigue

Some studies into the condition particularly have started to examine ways to tackle Zoom fatigue. For instance, Bailenson (2021) thinks it might be possible to design video conferencing applications so that the shutter stays closed by default, an audio-only mode could be enabled by default, and users can easily toggle self-view off and on. Fosslien and Duffy (2020) suggest that managers within companies should adopt formal policies on how to run video calls so that users know, for instance, what the ground rules are around meeting duration and frequency and 'camera-off' time. Fosslien and Duffy (2020) further recommend factoring in some movement breaks during a video call, while Karl et al specifically recommend using mobile devices in lieu of laptop computers. This way, employees can lean, move around and take notes. Wiltshire (2020) recommend recalibrating the usage to incorporate a mix of synchronous calls with asynchronous communication of files and documents, which can reduce the average amount of screen time and productivity. This hybrid approach can also create more flexibility in work. Fauville et al (2020) suggest letting people 'funnel themselves' into the video set-up that most suits them and their particular levels of fatigue at that moment. Neeley advocates for virtual co-working spaces that support more organic, drop-in interactions, which could help to reduce the formality and accompanying stress that created some degree of cognitive burden in scheduled video calls.

Though these interventions show promise, the key takeaway from this study is that mitigating strategies for Zoom fatigue are nascent; most studies to date are small and short term, and the ability of these interventions to work over the long term and in different workplace contexts with larger sample sizes has not yet been adequately addressed in empirical studies (Uachave, 2023). The heterogeneity of Zoom fatigue – namely, its multidimensional nature and far-reaching consequences for individuals and organisations alike – points to the need for ongoing research on

people's experiences of using video-conferencing technologies. The rapid shift to remote work due to the pandemic has encouraged a surge in this type of research, and yet many key questions remain unanswered (Pan & Cui, 2020).

2.5 Summary

This literature review looks at Zoom fatigue, which refers to the psychological tiredness that results from video conference interactions. The review uses literature from the fields of organisational psychology, human computer interaction and communication. It explores two main theoretical frameworks. The first is the third skins of virtual communication developed by Nadler (2020) to denote the excessive cognitive load of digital self- management. The second is the Actor-Network-Theory of technology derived from Latour's work that makes technology an actant in their social systems. Research evidence shows that Zoom fatigue is real and affects women most and is as a result of factors such as endless staring at the faces, anxiety associated with seeing one's own face, and limited mobility. There has been outlined different measures on how it could be managed; however, the efficiency of the methods in the long-run has not been determined.

Chapter Three

3.0 Research Methodology

3.1 Introduction

Chapter Three focuses on the method used in this research about Zoom fatigue. It starts by justifying why a systematic literature review was deemed to be the main approach of conducting the research. This work explains more on this approach of integrating evidence from different sources and the advantages of the approach are well explained in the chapter. It then outlines in detail the steps taken in a methodical manner such as the approach that was employed to choose the databases, the type of searches conducted and how the process involved the use of inclusion as well as the exclusion of particular studies. It also provides an overview on how the data extracted and analysed, special focus on the theme synthesis approach. lastly, it discusses the methodological quality of the concerned studies so as to assess their reliability and generalisability.

3.2 Research Design

The research design adopted for this study is a systematic review of literature. The systematic review will be conducted in a clear and rigorous manner in order to find out the nature and prevalence of Zoom fatigue alongside the underlying factors which contribute to it. A systematic review entails assessment of studies based on some specific objectives or research questions, inclusion and exclusion criteria, number of studies available, search for relevant studies, data extraction from the studies, analysis and synthesis of data (Cajal et al., 2020; Gopalakrishnan and Ganeshkumar, 2013; Worthington et al., 2008).

Systematic reviews are used to achieve the purpose of research questions and objectives of a study through the use of available body of knowledge or literature (Lockwood et al., 2019; Peters et al., 2015). Systematic reviews are a more structured and systematic approach to understanding, appraising and synthesising the data that is available and as such are useful in responding to certain research questions (Ahn and Kang, 2018; Wong et al., 2013)

A systematic review is a structured thematic and/or meta-analysis of original studies looking for relevant research on a specific subject within a particular field of study and conducting a systematic review of the results to summarize the evidence in a study (Nunn and Chang, 2020). This present study adopted a systematic review of literature for a number of reasons. One of them is because as stated by (Mulrow, (1994), systematic reviews are the gold standard for synthesising evidence because of their methodological stringency which makes them invaluable for policy making process. The reason for this is because, systematic reviews embody multiple evidences which is grounded in theory and practice, making them perfect for policy making.

Critical appraisal involves pinpointing all the available studies, assessing the quality of each of the studies, synthesizing the data from the various studies in a way that there are no bias and providing a fair and accurate account of the results while acknowledging the limitations of the evidence. Systematic review as a form of meta-analysis is one of the types of synthesis of the research evidence which is the highest level of evidence and therefore one of the best in the hierarchy of evidence as suggested by Gopalakrishnan and Ganeshkumar (2013).

3.2.1 Why Systematic Review is Appropriate for this Study?

A systematic review was used in this study as it is one of the most rigorous methods of synthesising and appraising evidence on the prevalence and nature of Zoom fatigue including studying its

underlying contributing factors, while providing strategies and best practices toward combatting it. This is particularly a strength because the systematic review methodology pools all the literature on a topic into one systematic and coherent piece.

Also, the systematic review method of data analysis and synthesis ensure that the findings are likely to reveal trends and patterns over time. They can also identify the several grey areas of Zoom fatigue, including knowledge gaps thereby showing the need and direction for further research in the field.

3.3 Databases and Search Strategy

The basis of any systematic review is the search strategy used in the conduct of the review. It is a work that requires a careful and well-organized approach so that it can be complete in terms of scope and applicability. Search terms were used to retrieve relevant literature needed for the study. The next step in a systematic literature review study is to identify the databases to be used in the study having understood the purpose of the study. The main library used for this study was the MSVU database which linked to several hundreds of data bases such as EBSCO, Scopus, CINAHL, and PubMed, among others. The EBSCO databases were the entry points for the selection of literature. This was done to ensure that all articles used for the study are from reputable journals

The use of Boolean operators was utilized in this study. The search terms are adequately chosen and from the several combinations of the Boolean operators including AND, truncations, OR and its modifiers, they embrace all the facets of literature that research or document on the nature, prevalent, and contributors to Zoom fatigue. Lastly, the dataset is quite large which is beneficial in

developing a reference base of relevance to guarantee that the review embraces most if not all the significant studies.

The next step was to assess the keywords. The key words selected for the beginning of this study are words concerning a broad topic of the concepts to be presented. The keywords assist in the identification of any study concerning the discussion topic. Some of the keywords were also adopted from the theoretical lens upon which the study was based, which was the Nadler's theory (Nadler, 2020).

The search keywords were:

- Computer-mediated communication exhaustion
- Zoom meeting exhaustion
- Zoom meeting fatigue
- Video conferencing fatigue
- Video conferencing exhaustion
- virtual meetings fatigue
- Virtual meeting exhaustion

However, a joint search term denoted with Boolean operators was: (computer-mediated communication or CMC or Zoom meeting or video conferencing or video communications or virtual meetings or Zoom conferencing or video conferencing or google meet or microsoft teams or remote work or virtual work or telework or work from home) AND (fatigue or exhaustion or tiredness or lethargy or burnout or strain or drain)

The next step was to setup a time frame for the data being collected. In the case of this study, the time frame was limited to studies from 2020 to 2024. This was because, the term Zoom fatigue stemmed from when remote working peaked in 2020 due to the Covid-19 pandemic.

The third phase is to acquire information about the articles which were retrieved from the search. The databases contain information on the date of publication of the journal, abstract, keywords and language of the publication. After all these were done the researcher screened and sorted through the articles. There were 4859 articles published between 2020-2024 in total. 634 were marked ineligible based off the inclusion and exclusion crtieria employed for the studies. After the inclusion and exclusion criteria were used to screen studies. The studies were limited based on their scope. The scopes of the published studies covered a wide range of subjects and concepts, most of which were not related to work physiology, Zoom fatigue and occupational health.

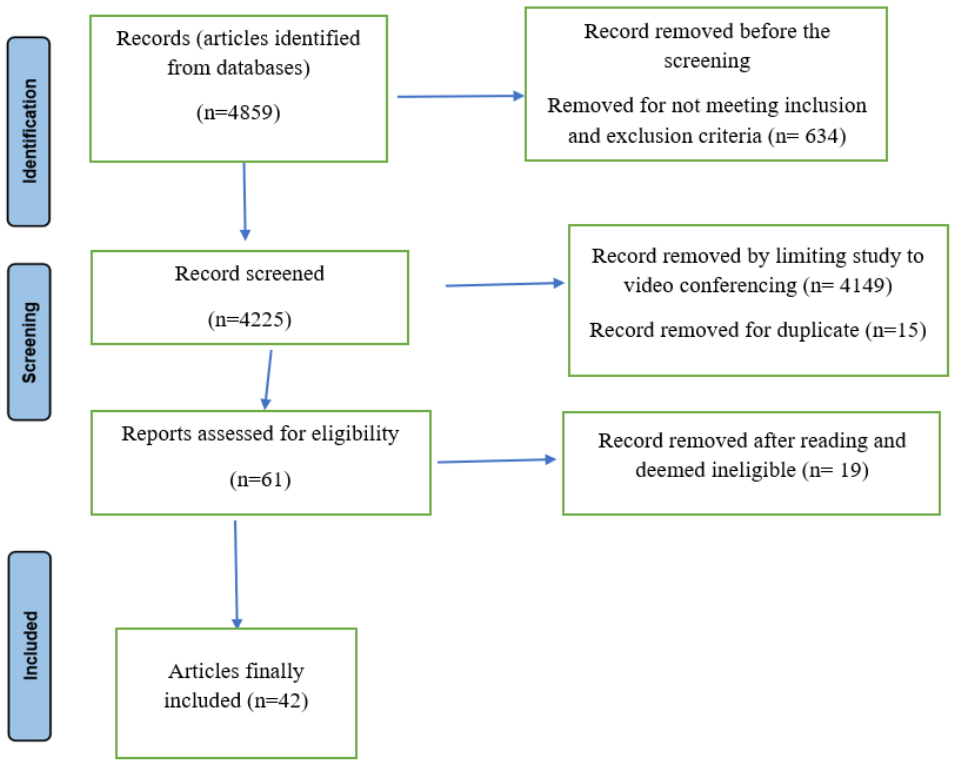
The use of limiters were employed so as to streamline the scope of the studies. The scope of the studies from MSVU database was wide and most of the articles were not in anyway related to video conferencing. As a result, the search was limited in scope such as fatigue, video conferencing and psychological stress, upon doing this, 76 studies were remaining. Duplicates were removed and there were 61 articles. These 61 articles were then downloaded and thoroughly read. The reading of the articles stemmed beyond the abstract, the full content of the studies was read. At the end, 42 articles were found to meet the research objectives

The process flowchart of the publications that were numbered for every step of the process was done based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). From PRISMA, the authors and articles would be able to see how they would ensure that they go through all the steps of documenting the systematic review and do it in a very systematic manner.

This process of refining the search is cyclical and is done frequently in order to control for the level of precision and the level of the number of sources included. It could be seen that the effectiveness of the keywords and phrases was evaluated; more terms and conditions might be included or excluded in order to enhance the specificity or inclusiveness of the search.

3.4 PRISMA Flow Diagram

Figure 2: PRISMA Diagram



This flow diagram (Figure 2) following the PRISMA guideline is used to explain the selective screening of articles and refinement common in systematic reviews and meta-analyses.

Starting with the identification phase, initially, 4,859 articles were retrieved primarily from the EBSCO database. In the first step of screening, 634 records were excluded from further consideration as they failed on the eligibility criteria. Some were written in other languages apart from English, some were not peer reviewed articles, some were not in the required time frame for studies. Judging by the inclusion and exclusion criteria, a total of 634 articles were removed from the initial 4859 records, remaining 4225 articles to be screened.

In the screening stage, only 4,225 records were analysed in a more comprehensive manner. This was the largest chunk of records removed in this phase; the reason was because there were several studies that were not related to Video Conferencing nor Zoom fatigue. Therefore, the use of limiters were employed to limit the scope of the study to fatigue and Video conferencing. 4149 records were then removed from the study, remaining 76 studies. These 76 studies were screened for duplicates and 15 articles were removed for duplicates. In all, 61 articles passed the screening phase.

These 61 papers were subjected to even more rigorous examination during the eligibility assessment phase. At this stage, the 61 articles were downloaded and read individually. On reading the articles 19 more records were excluded as they were not relevant to the research problem and objectives. Due to such a meticulous approach towards selecting the articles, the research provided 42 articles that met all the criteria for including them in this review.

3.5 Eligibility Criteria

All research which employed either qualitative or quantitative methods of data collection and analysis were included. The inclusion and exclusion criteria of the studies used and adopted for this review included location, date, language and accessibility.

3.5.1 Inclusion Criteria

The literatures reviewed were only those done in English language, peer reviewed journals, written between 2020 and 2024.

3.5.2 Exclusion criteria

Only studies in English were included; any study in any language other than English Language was excluded. Also studies published prior to 2020 were not included. Research whose body of work were not centered on Zoom fatigue were also excluded.

Table 3.1: Inclusion and Exclusion Criteria

Standard for inclusion	**Standard for exclusion**
Written in English	Written in other languages like Arabic, Portuguese, French etc
About video conference and Zoom fatigue	Works not relevant to the topic of discourse.
Academic journals, thesis and publications	Non-academic materials
Studies undertaken between March 2020 and June 2024,	Studies conducted prior to 2020
Studies from the MSVU library (primarily EBSCO)	Studies not reputable or recognised databases.

3.6 Data Extraction and Analysis

Collection of data is important in arranging the information in a proper manner and to conduct a proper and comprehensive analysis (Xiao and Watson, 2019). After identifying the studies, there was a process followed whereby all the details were examined and information from the publication was entered into different categories on a spreadsheet depending on issues such as the design of the study, the findings, and the characteristics of the participants in the study

After extracting the data, it was analysed. It was during this stage that each of the findings from all the studies included in the review was examined for pattern, trends and inconsistencies. This is the stage of the systematic review known as synthesis and it was done using qualitative methods. The data analysis was done by following the process of synthesis using the thematic synthesis method. Several themes were proposed for the study objectives and for the research questions. The findings were discussed in the form of themes and the analysis was done through narrative synthesis.

In extracting the themes, the researcher did not just use low level languages for the thematic analysis, despite the fact that the data extraction table used the actual words used in the individual journal articles. The data extraction process followed through a rigorous process of extracting themes for high schorlarly articles and literature like the recent work of Nunes & Ozog (2024), in their book You're Muted. The book contained several high-level language and terms which can be used to describe and code a wide range of low-level codes and thematic concepts identified from the articles.

The codes and themes identified from the data extraction table were then coded and categorised and arranged under the high level themes that have been identified from the work of Nunes &

Ozog (2024). When this was done, the themes were then arranged in tables, with their details and frequency as shown in Table 1: Theme Summary.

3.7 Quality Assessment and Reporting

This step of the systematic review process is centered on the critical evaluation of the quality of the studies that have been incorporated within the review. It aims at assessing the extent of soundness of the research in regards to major methodological issues concerning internal and external validity and thus should be regarded as a highly credible study. The most important goal of quality assessment is to make sure that the conclusions of the review are valid due to the fact that they are based on a set of studies that is large enough and of good quality rather than being based on some well conducted studies in the sample or a large number of studies that are of poor quality. The criteria that shall be used in this quality assessment must be well defined and used uniformly to each of the studies that are to be included in the review (Øvrebø et al., 2022).

The credibility of the included studies was assessed by using the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) checklist which is a measurement tool to assess systematic reviews. AMSTAR is a tool which can be applied to analyse the scientific rigor and relevance of the articles, and their outcomes. It integrates the best evidence in a particular area of interest and synthesises the answers to questions that use the best evidence from published research about a particular area (Agbata et al., 2022; Burda et al., 2016; Yuan et al., 2021)

3.8 Summary

In this chapter, the research method used in the investigation of Zoom fatigue was described in detail. The rationale for choosing systematic literature review approach is in its methodology and ability to synthesise the evidence. This systematic review was undertaken using the best picked

databases and the right keywords and the criteria for inclusion and exclusion of the studies that were to be used in the review. In the present study, the PRISMA flow diagram was utilized for selection of included articles. Data extraction and analysis was done through thematic synthesis since it reveals pattern and trend. To validate the findings, it was ensured that the presented paper used AMSTAR checklist for quality assessment. Hence, such a methodological approach lay the foundation for the findings and subsequent conclusions of this study.

Chapter 4

4.0 Results

4.1 Introduction

This chapter provides the research findings regarding Zoom Fatigue by reporting on the systematic review undertaken. Therefore, this review included 42 papers published between March 2020 and June 2024, focusing on Zoom fatigue. The analysis is structured around three primary research objectives:

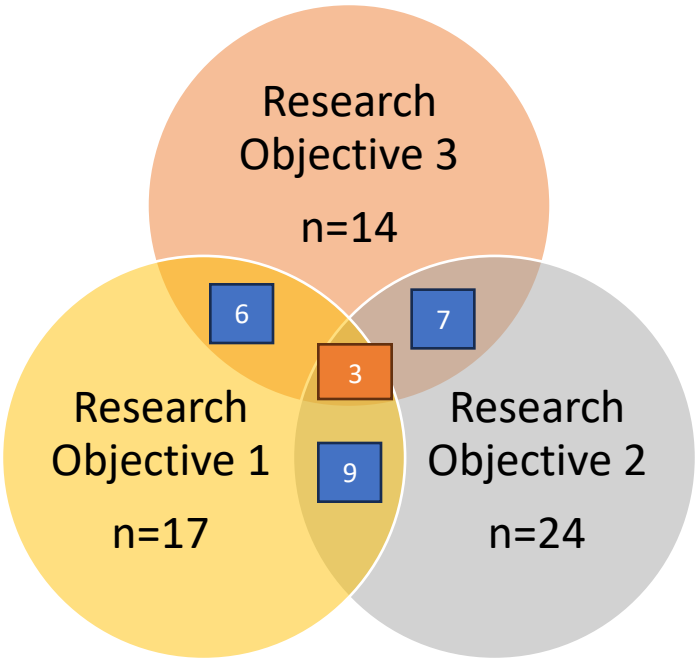
1. Assess the nature and prevalence of Zoom fatigue by conducting a systematic literature review to identify and analyse existing studies.
2. Identify and analyse the factors that contribute towards Zoom fatigue.
3. Examine various strategies and recommendations that have the potential to effectively mitigate and alleviate Zoom fatigue.

Each objective is further divided into specific themes and sub-themes to ensure a comprehensive understanding of Zoom fatigue.

4.2 Presentation of Findings

4.2.1 Distribution of papers by research Objectives

In total 42 papers were analysed; for research objective one, 17 papers could be used; for research objective two, 24 papers could be used; and for research objective three, 14 papers could be used. In terms of intersections, nine were used for research objectives one and two, six for research objectives one and three, seven for research objectives two and three, and only three for all the research objectives.



4.2.2 Distribution According to Population

The studies include various types of participants and were devoted mostly to educational context. Of the studies a little over 45% (19 papers) focused on students: undergraduate, graduate, and medical students in particular. Of these, seven papers were designed for medical students. The last area of concern was also workplace that also got attention in 12 papers (29%) where employees of different industry were explored. Other studies were carried out on various types of the general adult population, knowledge workers, university faculty members and healthcare givers.

4.2.3 Distribution based on research methods

The type of methodological approach used in the reviewed studies is diverse, due to the holistic subject matter discussed in the research papers. Quantitative approaches were the most commonly applied with 24 papers (57%). Such designs as cross-sectional studies, surveys and experiments were used. The cross-over point or threshold for consideration as Randomised Controlled Trials

was the use of appropriate qualitative approaches in eight studies (19%) involving interviews, case studies and thematic analysis. There was applied variety of mixed-methods designs in four cases (9.5%). The rest of the studies included, theoretical models, review of the literature and number of electrophysiological studies.

4.2.4 Geographical Distribution

The United States led the way with 15 studies conducted in that country prominently. Out of all the countries, European countries formed the largest representation with United Kingdom, Germany, and Italy producing 10 studies. Thailand, the Philippines: seven studies. The rest of the studies was carried out in other countries or had no specific reference to the country of setting.

4.3 Results Analysis

The analysis of the themes and subthemes from the systematic review uses a frequency distribution to present the findings of this section. Each objective is discussed in turn to establish the frequency of the themes in the studies and their relevance to the articles reviewed herein.

4.3.1 Objective 1: The Nature and Prevalence of Zoom Fatigue

Within this objective, three themes were found as they appeared a total of 17 times within the studies reviewed. The themes focus on the processes that underpin the characteristics and occurrence of Zoom tiredness in different settings.

The first emerging theme was *Surveillance and Control in Digital Spaces* which appeared in four studies. These studies focused the auto-critical approach, the Panoptic view and video-conferencing visibility pressures. Xu et al. (2024) explained that self-view on video calls creates the mirror effect that makes female participants excessively conscious, resulting in exhaustion. Likewise, Bailenson (2021) explained that constant self-surveillance takes a mental toll on people

due to self-presentations in video conferences. This theme captures how the social media environment brings forth constant assessment, thereby aggregating to fatigue.

Looking at the frequency the second theme, *Social Dynamics and Communication Challenges* dominated this objective with seven studies. Privacy, hyper-staring, and gender discrimination are categorised as risk factors for Zoom fatigue. Using an online survey method, Shockley et al. (2021) found that employees experiencing higher levels of fatigue were women and organisation members with relatively low tenure, because of which they feel stressed by camera presence and other difficulties that come with online interactions. Additionally, Moralista et al. (2022) observed that graduate students were unable to understand non-verbal communication over video calls, which led to feelings of isolation, and increase fatigue among students. These studies raise awareness of the social elements present in an environment typical of virtual space, which play a crucial role in the sensation of exhaustion.

The third theme *Psychological and Emotional aspects of Virtual Interaction* was found in six studies. This theme concerns itself with psychological and informational loads which are likely to build up during protracted interactions mediated by information and communication technologies. Elbogen (2022) underlined that low social support and increased financial stress resulted in increased levels of fatigue regarding mental demands from virtual communication. This was corroborated by Riedl (2022) elaborating on the neurophysiological consequences of such videoconferencing, including stress and cognitive overload. The study findings under this theme shows the large psychological stress that accrues from Zoom fatigue, which is prevalent across all age groups.

4.3.2 Objective 2: Factors Contributing to Zoom Fatigue

For this objective, three themes were identified and they appeared in a total of 24 studies. This way the themes are aimed at the main issues that constitute Zoom fatigue and can offer some insights on its causes.

The first theme, *Psychological and Emotional Aspects* of virtual interaction was evidenced in six studies. As the use of video meetings and calls have increased significantly, researchers have attributed Zoom fatigue to cognitive overload, stress, emotional exhaustion and self-awareness. According to Bailenson (2021), close up eye contact in videoconferencing causes a significant mental load that ends up in mental fatigue. Likewise, Aagaard (2022) investigated the tensed atmosphere, forced joviality and latency randomness disrupting effective turn-taking in virtual meetings as added stressor to participants' affective and cognitive workloads.

Of all the objective's themes, *Physical and Environmental Factors* was considered the most on, with 10 articles pointing to its significance. Muscoloskeletal discomforts and extended sitting down was a common complain attributing to zoom fatigue. In their studies, both Lee (2020) and De Oliveira et al. (2022) reported that high duration of video conferencing was likely to take a toll on vision and posture, especially where ergonomics of the set up were poor.

The third emergent theme was labelled as *Social Dynamics & Communication Challenges* was found in eight of the included studies. The study under this theme reveals how social stress factors, including the inability to understand the gestures and the feeling of loneliness, lead to fatigue. According to Bailenson (2021), attention to multiple visual cues in large meetings increases fatigue due to the cognitive load; Moralista et al. (2022) discussed hyper-gaze and mirror anxiety for graduate students. These papers contribute towards the discourse by showing that social and communication difficulties complicate the impact of Zoom fatigue.

4.3.3 Objective 3: Strategies to mitigate Zoom Fatigue

This objective mainly yielded two themes in the course of the study with frequency count of 14. It was found that the themes are concerned with more prescriptive approaches of reducing zoom fatigue, and the discovery of potential ways of doing so.

The first is the theme titled *Strategies and Interventions to Mitigate Zoom Fatigue*, mentioned in eight articles. These studies described a range of possible approaches to fatigue prevention, at the level of the organisation and the individual. Neshershoshan and Wehrt (2022) suggested that meetings should include time for rest. Similarly, Xu et al. (2024) proposed allowing participants to be on camera and off camera at the same time as a way of avoiding increasing people's psychological duties to constantly police themselves. These strategies explain visible tactics that can be taken to reduce the impact of Zoom fatigue.

The second theme is *Surveillance and Control in Digital Spaces* and was present in six studies. This theme is all about trying to diminish the panoptic effect and lessen the impact of the surveillance of the self. According to Bailenson (2021), people can reduce stress and cognitive fatigue if avatars are used but the mirror effect is avoided. Ratan et al. (2022) spoke about how technological tools involved in, for instance, changing the background during a video call, can help decrease the regulatory focus that is attached to one's appearance. These results speak to the need for technological and behavioral adaptations in order to minimise the impact of Zoom fatigue.

Table 2: Thematic Summary

Objective	Aligned Themes	Frequency	Details
Objective 1: The Nature	Surveillance and Control in Digital Spaces	4	Panoptic Gaze, Self-Surveillance, and Control help explain how constant monitoring impacts prevalence.

and Prevalence of Zoom Fatigue	Social Dynamics and Communication Challenges	7	Isolation, Gender Disparities, and Hyper-Gaze shed light on the demographic and social dynamics influencing prevalence.
	Psychological and Emotional Impacts of Virtual Interaction	6	Cognitive Overload, Stress, and Emotional Exhaustion explore why fatigue is widespread in certain demographics.
Objective 2: Factors Contributing to Zoom Fatigue	Psychological and Emotional Impacts of Virtual Interaction	6	Anxiety, Marginalization, and Stress directly relate to the underlying factors of fatigue.
	Physical and Environmental Factors	10	Eye Strain, Musculoskeletal Discomfort, and Inadequate Ergonomic Setups are key physical contributors.
	Social Dynamics and Communication Challenges	8	Social Cue Distortion, Isolation, and Non-Verbal Communication barriers are significant contributors.
Objective 3: Strategies to Mitigate Zoom Fatigue	Strategies and Interventions to Mitigate Zoom Fatigue	8	Breaks, Organisational Policies, Technological Adjustments, and Ergonomic Enhancements directly address mitigation.
	Surveillance and Control in Digital Spaces	6	Reducing Self-Surveillance (e.g., turning off self-view) and lessening the Panoptic Gaze (e.g., allowing cameras off) are actionable strategies.

4.4 Assessment of Findings

The present literature review makes it possible to identify many-faceted nature of the phenomenon of Zoom fatigue with corresponding consequences for different aspects of modern work and education. Conducted among different populations, the Zoom fatigue seems to be rather high among people with particular gender, academic status and professional setting. Prevalence of such

a phenomenon proves that Zoom fatigue should be recognized as one of the pressing phenomena satisfying recent research into modern digital interactions.

The antecedents of Zoom fatigue determined include psychological, physical, technological, and social phenomena, which confirm that this issue requires attention in all these perspectives. It is evidence that not only reflects Zoom fatigue as a product of distant communication but also as a mutual relationship between human cognition and affordances of technological environment.

The mitigation strategies reveal a number of possible interventions at the individual, organisational, and technological levels of analysis. Nevertheless, the success of these approaches might be different and much more research is necessary in order to prove the sustainability of those concepts. The variances in the methods have implications that indicate that there is no one way of us sorting out a trial and it may require customizations depending on the circumstances.

Moreover, the theoretical on which the studies are developed, Nadler's 'third skins' as well as Latour's ANT, offer rich theoretical perspectives from whence the phenomenon under analysis could be easily comprehended. These frameworks accentuate the fact that spatial and relational Concerns in virtual communication are not simply secondary to the technical.

In conclusion, we have seen that the research on Zoom fatigue did see a spike beginning in 2020 and while a research area that has garnered much interest; there is still much to be discovered. There are few longitudinal researches focused on the consequences of the long-term usage of video conferencing. Furthermore, as to the evaluation of the various mitigation measures in differentiated contexts and groups more research is called for. Since virtual communication is going to remain a viable and important aspect of professional and educational environments, it will be imperative to fill these gaps in research in order to create a solid foundation for online communication practice.

Chapter 5

5.0 Discussion of Research Findings

Inferential to the study goals explained in Chapter one, this chapter synthesises the attributed record and leverages on the study objectives to analyse the research results extracted from the data extraction table (Appendix 1). The findings are presented around the research objectives, applying the themes to structure a detailed narrative synthesis. Each theme is discussed comprehensively, providing quotation from the data extraction table, as well as theoretical implications from the literature.

5.1 Objective 1: The Nature and Prevalence of Zoom Fatigue

Zoom fatigue impacts professionals and persons across the globe. The analysis of its nature and prevalence was guided by three core themes: Surveillance and Control in Digital Spaces, Social Dynamics and Communication Challenges, and Psychological and Emotional Impacts of Virtual Interaction.

The concepts of surveillance and control explain how the use of videoconferencing platforms creates an environment where individual self-monitoring is tightened. Other scholars have labelled this as ‘mirror-anxiety’, as reflected by Xu et al., (2024) who explained that participants are always conscious of how they looked because of the self-view display in videoconferencing software like Zoom. Such constant visibility makes everyone constantly feels they are under surveillance to perform the duties of a professional and hardworking employee hence an example of panoptic gaze. The conclusions obtained contribute to the works of Bailenson (2021) who stressed that constant gaze in virtual meetings is not typical for face-to-face interactions, which creates a psychological pressure.

Building on this idea, findings of Nunes and Ozog, (2024)shed more light into the argument that behavioural regulation is actually magnified across the digital space. Especially, the female participants seem to experience more self-objectification and exhaustion cause by pressure of looking good on the screen and having to multitask while participating in virtual meetings. This is supported by other empirical research conducted by Fauville et al. (2021) who pointed out that women reporting levels of fatigue were higher than men. Technologies are designed and developed in a given sociocultural context and in turn reproduce social relations that cause fatigue, which shows the vicious cycle.

Videoconferencing erases nonverbal communication cues, making face-to-face communication challenging and complicated. Such manifestation of surveillance as hyper-gaze, illustrated by (Nunes and Ozog, 2024) refers to an uncomfortable feeling due to people's looks as if all of them are staring at the subject at once. This accords with the observation made by Shockley et al. (2021) who stated that in a mode of communication devoid of physical cues like nodding, gestures participants feel compelled to make up for the lack of cues as they overload their cognition.

The essence of virtual meeting when there is no spatial dynamics removes most of the perceived hierarchy hence novel interactions that require more cognitive effort. The isolation caused by these abnormal social interactions hit the minorities and introverted individuals hardest because they mostly depend on body language to form those bonds. Moralista et al. (2022) went further to point that virtual meetings increase levels of loneliness and isolation, as they capture the general social deprivation effects from disrupted social interactions.

The other is emotional exhaustion as virtual communication barely allows the participants to take brief physical breaks as in physical meetings. According to the Elbogen et al. (2022), rigid work environments or poor ergonomics expose people to emotional exhaustion. These findings support Riedl's (2022) neurophysiologic view that defines videoconferencing as a stimulus causing increased arousal and mental workload.

Finally, Zoom fatigue is not just an artefact of new technology or specific user tendencies, but is closely related to the architecture of videoconferencing applications and the psychological and social requirements they entail. Whereas, this paper has revealed that these factors are the root cause of the problem, making it important to strive at eradicating the root cause to minimize fatigue.

5.2 Objective 2: Factors Contributing to Zoom Fatigue

Exploring the psychological, physical and social factors of Zoom Fatigue calls for a synthesis examination that considers the connections between them. The findings were categorized under three themes: The key themes here were Psychological and Emotional Impacts of Virtual Interaction, Physical and Environmental Factors and Social Dynamics and Communication Challenges

The psychological cost of videoconferencing is due to a different kind of pressure it puts on attention and emotional work. Bailenson (2021) noted that, the adherent use of eye contact that accompany the virtual meetings results into high arousals and subsequently stress. This finding is further backed by Aagaard (2022) who explained the emotional demands that are required in terms of engagement and looking interested in an online setting.

Literature builds upon these facts asserting that the ongoing presence of interactions on video conferencing platforms only exacerbates the cognitive and emotional toll. For instance, participants remain pressured to perform regardless of the degree of workload and this leads to increased stress and fatigue. This was so stated with Kramer (2020), who concluded that the self-presentation is also one of the causes of Zoom fatigue especially among those in professions where they frequently have to appear in public.

Physical discomfort is one of Zoom's four causes of fatigue, with eye strain, musculoskeletal issues, and static postures being the most common complaints. From the research done by Lee (2020), it was established that exposure to screens for a long time affects the fundamental way the eyes function causing digital eye strain. These results are supported by De Oliveira et al. (2022), who noted that if ergonomic settings are not met, physical discomfort increases especially in people working in small home environments due the COVID 19 pandemic.

Similar to the findings in Objective 1, the lack of nonverbal communication cue is a leading cause of Zoom fatigue. Virtual interactions are characteristically less structured than face-to-face interactions and as such require the individuals to spend more effort in comprehending visual signals and staying on top of cues. In addition, the structure distribution of the videoconferencing platform flatten the social interactions which is quite confusing sometimes.

There are also positive aspects of such dynamics as well as how the inability to give verbal cues in return only escalate feelings of loneliness. Its effect is most pronounced in intercultural or linguistically diverse environments particularly when gesture is a prominent mechanism for conveying meaning. According to Moralista et al., (2022) this action plays out disproportionately in a way that has negative effects on marginalized communities particularly because they may

stand to be impacted in both their ability to fully or comprehensively engage in professionally acceptable forms of communication as well as have their identity erased.

The breakdown of factors contributing to Zoom fatigue identifies its complexity on the psychological, physical, and social levels, implying that the solutions are required on all three dimensions.

5.3 Objective 3: Strategies to Mitigating Zoom Fatigue

Reducing Zoom fatigue entails a coordinated effort that how we prevent the inherent fatigue while simultaneously promoting more efficient means of virtual interactions. The findings were organized under two themes: Prevention and Prevention Measures With Regard to Zoom Fatigue as Well as Surveillance and Control in Digital Environments.

A number of scholarly articles mentioned tangible methods of alleviating Zoom fatigue that include; limiting the time spent in meetings, integrating time out or breaks during a Zoom call and allowing people to be turn off cameras in meetings. For instance, Fosslien and Duffy (2020) encouraged the formulation of clear expectation with regards to meeting protocols and cadence, pointing out that despite forming an essential shield, formalities serve to greatly decrease levels of tiredness

Nunez and Ozog encouraged simultaneous and sequential use of talk and write to implement a combined synchronous and asynchronous system which may lessen the pressure of synchronous interactions. This makes it easier for participants to engage at a level that suites them while at the same time promoting engagement in virtual module forums., Xu et al. (2024) also stressed that technologies including AI voicewriting, AI automatic transcription services, and dynamic meeting

structures also played a significant part in improving user satisfaction and decreasing meeting fatigue.

Extinguishing the self-panoptic function and shortening the periods of panopticism were suggested ways through which to minimize Zoom fatigue. In his 2021 article, Bailenson suggested turning off the mirror and enabling, at best, voluntary video presence to alleviate the mental burden of self surveillance and mirror gaze.

The research findings also emphasize the need for a multifaceted perspective on Zoom fatigue, including of people-focused measures and organisational and technological solutions. In this sense, the particular focus on the organisational nature of the given phenomenon makes the mentioned interventions effective for developing a healthier and more sustainable virtual context.

5.4 Summary

The discussion builds on the structured summary in the data extraction table through citations and theoretical frameworks to synthesise the findings and depict the assumed relationships and dynamics.

Chapter 6:

6.0 Conclusion and Recommendations.

6.1 Introduction

In this chapter, the presented research highlights will be discussed in light of the research aim and objectives, and will highlight their relevance to theory, practice and particular sectors. How the research aim was addressed, the specific implications in different areas, and the further suggestions on reducing Zoom fatigue are also explained. Finally, it recognizes the drawback of the study and recommend of where future research should focus. Satisfactory conclusion of this examination adds strength to the outcome and importance of the study in providing explanation on Zoom fatigue.

6.2 Summary of Findings

The research purpose of the present paper was to define what contributes to Zoom fatigue, its nature and prevalence, and what can reduce it. The results are presented under the research objectives as subtopics under major categories.

6.2.1 Summary of Findings of Research Objective One

The study established three research postulates regarding Zoom fatigue, which squarely pointed out its psychological-sociological and behavioural profiles. Many participants noted increased self-surveillance due to features such as self-view and grid layouts under the theme; Surveillance and Control in Digital Spaces. It was discovered that such features enhance anxiety, but particularly in female workers because they are expected to look better than others.

The theme Social Dynamics and Communication Challenges depicted how what was formerly done physically in a face-to-face meeting was impacted on by virtual meetings. Many participants realised that they had trouble in understanding nonverbal communication and this made them feel lonely and misunderstood. Chen and Zou (2023) observed that erasing the spatial aspect displacement has on interactions distorts social relationships and dynamics in virtual meetings. Such difficulties are more severe in culturally diverse or multilingual settings, especially since non-verbal interaction constitutes a major aspect of such interlocution.

Regarding the theme Psychological and Emotional Impacts of Virtual Interaction, cognitive overload stood to be one of the key challenges. Both male and female participants explained the cognitive burden of simultaneously comprehending audio and video stimuli as well as maintaining the appearance of the self. Elbogen et al. (2022) found that this cognitive demand is magnified by synchronicity of virtual communication eliminating breaks. Associated with this burnout is emotional exhaustion, especially for people offering care or working in demanding fields.

6.2.2 Summary of Findings of Research Objective Two:

The causes of Zoom Fatigue extend psychological, physiologic, and contextual domains. The theme Psychological and Emotional Impacts of Virtual Interaction discussed how saturation with videoconferencing environment can induce specific stressors. Lazarevic et al. (2023) noted that eye contact and the need to stay alert at all times represent an undue load in cognitive processes. Emotional work, and especially the requirement to appear cheerful and interested in one's work, increases the pressure.

The very Physical and Environmental Factors witnessed by participants was physical discomfort as the prominent factor. The study conducted by Lee (2020) has exposed that increased screen time

rates to digital eye strain as well as the static postures in their workplace augment musculoskeletal disorders. These findings are similar to those presented in Nunes and Ozog (2024) in which the poor ergonomics when working remotely aggravate physical exhaustion during work, especially when one is confined in a small working space.

Specifically in the theme Social Dynamics and Communication Challenges it was clear that disruption of normal social signals increases fatigue. Virtual interactions are inherently less structured and clear than fully molded face-to-face interactions which requires more effort for its' participants to decode a set of cues based on either vision or hearing. It was observed that this breeds inequality mainly in the workplace, because those in leadership positions have to deal with it while being in charge.

6.2.3 Summary of Findings of Research Objective Three.

The measures aimed at reducing Zoom fatigue were categorized into technological, organisational, and personal. Recommendations based on the theme Strategies and Interventions to Mitigate Zoom Fatigue were to shorten the meeting length, allow face camera off and incorporating break timers during the meeting. Fosslien and Duffy (2020) noted that many techniques concern focus on the fact that participants can come to the meeting and start their conversation at any time, thus helping to avoid information overload as in case with live interaction.

Nunes & Ozog, (2024) discussed a possibility of using a blended schedule approach, where synchronous and asynchronous communication are used in combination as effectively arranged. Other suggestions include the use of transcription aides such as the AI transcription tools and adoptable meeting designs. These tools shorten interactions and reduce cognitive load by simplifying, automating and enabling user control of routine processes.

The theme Surveillance and Control in Digital Spaces shifted the focus away self- surveillance. The strategies were seen to include disabling self-view, enabling only optional video participation, and using virtual backgrounds. Studies pointed out that these measures have end users constructively choose what to attend to over their appearance, thereby reducing the social anxiety caused by over-worrying on appearance and image on camera.

6.2.4 How the Aim of the Research Was Met

The aim of the research was to investigate the state of existing research on video conferencing fatigue including the factors contributing to Zoom fatigue and strategies that can help alleviate the stress of Zoom fatigue for users. This study seeks to achieve this by conducting a systematic review of literature on the concept of Zoom fatigue. This aim was met through conduction of systematic review of literature which comprised of 42 scholarly articles which the authors wrote and researched extensively on the concept of Zoom fatigue in relation to their prevalence, nature, contributing factors and mitigating strategies. Therefore, the study clearly investigated the state of existing research regarding video conferencing fatigue.

6.3 Implications of the Study

6.3.1 Theoretical Implications

This work further enriches the existing body of knowledge by applying principles from these theories to the phenomenon of Zoom fatigue. The study provides a strong support for Nadler's "third skins" theory as the idea of how digital interfaces transform the cognitive and spatial realms is supported. Likewise, ANT in Latour's framework offers theoretical tools for regarding the active engagement of technology in regulating social relations. Thus, such integration of findings from the works of Nunes and Ozo (2024), Nadler (2020) and Latour (2005) the study connects these

frameworks and proposes that surveillance and technological enactments of agency form the bases for experiences of Zoom fatigue.

This theoretical contribution points to the urgency of approaching digital work environments as an intersection of insights from organisational psychology, human-computer interaction, as well as communication science.

6.3.2 Practical Implications

This study provides guidelines for people and organisations to consider and also implement in order to both understand the nature of Zoom fatigue and also to set up mitigating strategies regarding Zoom fatigue. Organisations need implement open leadership and structures for meetings. Companies also need to establish rules on how to conduct video-conference meetings. The implications for individuals are self-regulation and the enactment of best practice such as regular breaks, no self-view, ergonomic working conditions. These measures will not only prevent fatigue, but also increase productivity and level of participation.

6.4 Research Conclusion

The phenomenon of getting fatigued due to use of Zoom is the confluence of psychological, physical and socio-psychological aspects. The study also shows how surveillance dynamics, cognitive and emotional demands, physical constraints lead to this common problem. In this way, the research produces a theoretically and empirically-grounded framework for addressing Zoom fatigue and avails practical recommendations for its alleviation.

The findings highlight that all sides of Zoom fatiguing are individual units of a deeply interconnected whole that need to be tackled by such approaches. Knowing these issues will be vital in furthering the sustainable and inclusive teleworking into the future.

6.5 Research Recommendations

From the literature identified through the systematic review, the following general recommendations cut across organisational, technological and policy perspectives. In reference to the why, what, and how of video communication timing and structure, organisations should reconsider their strategy in this respect. Fatigue may be lower when video meetings are done asynchronously rather than synchronously implying that organisations should minimize synchronous video meetings (Macneill et al., 2024a). Thus, although Bailenson (2021) suggests structured breaks, the 45-minute meeting maximum needs to be buttressed with more empirical research to confirm that it works.

Organisations should also pay attention to the ergonomics and employee well-being educational programmes. Staff members need to be well equipped and educated about virtual workplace wellness. These are such as providing good chairs and lighting, training the workers on different exercises to do on their devices.

Several of the studies also underscore the need to design fatigue-related solutions into technologies such as video conferencing (de Oliveira Kubrusly Sobral et al., 2022; Moralista et al., 2022a; Sukhanonsawat et al., 2024a). According to (Dorothy, 2021a; Li and Yee, 2023a)self-view displays raise both mental load and stress; thus, it is crucial for platforms to include the option to automatically turn off the self-view and customize the meeting layout . The use of AI technology for transcription and communication enhancement, to save participants' attention.

In case of individual practices, some physical activity during the video calls should be encouraged. It was found that employing methods such as exercise and adopting time management of screen use markedly decreases modification in fatigue (de Oliveira et al., 2022).

Appendix 1: Data Extraction Table

Citation	Research aim	Methodology	Key Findings
(Elbogen et al., 2022)	this study investigated Zoom fatigue at work and its potential link to mental health symptoms	A survey of psychosocial well-being among a large national sample of middle- and low-income U.S. adults in August 2020 amid the nationally implemented social distancing efforts intended to mitigate the spread of COVID-19	Zoom fatigue is feeling anxious, socially isolated, or emotionally exhausted due to lack of social connection. Zoom fatigue was prevalent among people who were married, nonwhite race, post-high school education, severe mental illness, greater loneliness, lower social support, lacking money for food, and more weekly videoconference calls
(Lee, 2020)	The purpose of the biopsychosocial formulation, however, is to guide the treatment plan.	biopsychosocial formulation	Zoom fatigue is widely prevalent, intense, and completely new. It affects more than 300 million daily participants of Zoom Contributing factors include audio which has been proposed as the main reason that video meetings are draining, lack of reward, direct mutual gaze,
(De Oliveira et al., 2022)	To assess the association of the teaching method used and the prevalence of zoom fatigue.	A cross-sectional, quantitative, analytical study was carried out in Medical Schools of Ceará, Brazil. Problem- Based Learning (PBL) teaching methodology is the only methodology used in the first semester and PBL together with traditional teaching, i.e., hybrid teaching, is used in the other ones.	The prevalence of zoom fatigue reached 56% in students using the hybrid model, versus 41% in those using the PBL methodology, with a statistically significant difference (p value = 0.027). The mean prevalence of overall zoom fatigue was 48%. Students using the hybrid methodology differed from PBL students by having a significantly higher frequency of feelings of wanting to be alone after a videoconference (16.9 vs. 7.1%, respectively) and needing time to be alone after a video conference (10.2 vs. 3.6%, respectively). One way to mitigate and reduce zoom fatigue is that the active participation of students and the number of activities are important factors to be considered.
(Weiss et al., 2021b)	This article discusses one strategy employed to stay connected to students during virtual, Zoom-based teaching: the use of "Are you awake?" questions	Reflective observation and use of The Student Perception of Instruction (SPoI) survey	Constant engagement of audience is a way to prevent zoom fatigue
(Moralista et al., 2022b)	This study examined Zoom fatigue and selected associated factors among graduate students.	An electronic one-shot survey using the Zoom Exhaustion and Fatigue scale was conducted among 109 graduate students of the College of Teacher Education in the Philippines.	Graduate students generally had a moderate level of Zoom fatigue, while it is more prevalent among undergraduate students Approximately 41-56% prevalence of Zoom fatigue was reported among medical school students in Brazil This research also noted that among the five nonverbal factors, the sense of being physically trapped is the most significant predictor of Zoom fatigue. Being non-responsive when attending synchronous Zoom classes can exacerbate fatigue symptoms and decrease learning capacity and attention. Hyper gaze and mirror anxiety were significantly correlated with Zoom fatigue Steps to lessen the fatigue experienced in video calls in graduate education may be made, such as better video conference management and technical improvements in videoconferencing application.
(Luebstorf et al., 2023)	The aim of this study is to better understand the stress associated with remote work and videoconferencing, with an emphasis on how workers cope with the added stress	thematic analysis to open-ended survey data from employees in the US (n = 349) and in-depth telephone interviews of 50 meeting leaders from the US and Germany.	Camera usage, early meeting phases, and multitasking to be central stressors of videoconferences which are contributing factors to zoom fatigue individual- and team-level coping strategies to reduce the impacts of zoom fatigue
(Xu et al., 2024)	to test the assumption that enabling self-view mode is associated with videoconferencing fatigue, particularly for women by gathering neurophysiological evidence	neurophysiological evidence and use of electroencephalography	self-view or mirror effect causes zoom fatigue
(Kushner, 2021)	This study determined the minimum threshold of eccentric gaze in a videoconferencing setup above which subjects are perceived as not making direct eye contact by the majority of untrained observers.	Image capture analysis	The hardware setups commonly used for videoconferencing result in persistent eccentric gaze of the participating individuals if they look at the image of the other participants. In theory, this could be a contributing cause of Zoom Fatigue.
(Ratan et al., 2022)	To replicate previous findings of gender and race/ethnicity differences in VM fatigue, 10 while also considering facial dissatisfaction as a mediator of these differences (e.g., a pathfrom gender to facial dissatisfaction to VM fatigue	Survey panel platform Prolific was used to recruit participants who report living in the United States,	Zoom fatigue prevalence was 14.9 percent higher for women than for men, and 11.1 percent higher for Asian than for White participants. These gender and race/ethnicity differences were found to be mediated by facial dissatisfaction. This study replicates earlier VM fatigue research, extends the theoretical understanding of facial dissatisfaction as a contributing factor to Zoom fatigue. Practical approaches to mitigating VM fatigue could include implementing technological features that reduce self-focused attention during VMs (e.g., employing avatars)
(Oducado et al., 2022a)	This study examined the predictors of videoconferencing fatigue among higher education faculty in the Philippine	Quantitative research method using surveys	Significant contributing factors of videoconferencing fatigue among higher education faculty include attitude, sense of being physically trapped, mirror anxiety, emotional stability domain of personality, interval between videoconferences, and duration of videoconferences.
(Dorothy, 2021b)	to understand the causes of this fatigue and to provide insights	Case study reviews	Contributing factors of zoom fatigue are excessive close eye contact, self view stress, lack of mobility, increased cognitive load Zoom fatigue can be reduced by holding meetings later in the evening, using mute button, and sense of connection

	into how it can be mitigated based on recent research studies.		
(Oducado et al., 2022b)	to assess the experiences of Zoom fatigue or videoconference fatigue among nursing students	The research used descriptive, comparative and correlational data analyses and the Zoom Exhaustion and Fatigue (ZEF) scale to determine the fatigue experiences of nursing students	Zoom fatigue was prevalent among students with unstable internet and poor academic performance were mainly affected.
(Fernandes, 2020)	To determine the signaling effect of zoom fatigue	Descriptive observation	Digital fatigue is leading many to undertake a 'digital detox' and disconnect from the noisy online world. For some this means rediscovering the benefits of the printed page; paper is easier to reference, annotate and causes less strain on the eyes than a screen. Time away from screens that emit blue light, especially prior to sleeping, also has a beneficial effect on sleep patterns which in turn can support better mental health – something that has become a priority as home-workers adapt to the unique stresses of recent months.
(Knox et al., 2023)	TO measure zoom fatigue in college students, develop and validate the meeting fatigue scale for videoconferencing (mfs-v) and the meeting fatigue scale for in-person (mfs-i).	psychometrically sound tool for the measurement	Zoom fatigue is a conceptually distinct phenomenon from in-person meeting fatigue.
(Sukhanonsawat et al., 2024b)	This study evaluated Zoom fatigue and undergraduate medical students' perceptions of online lectures	cross-sectional study	In terms of zoom fatigue prevalence, most participants experienced moderate Zoom fatigue, with a mean composite ZEF score of 2.82. Zoom fatigue was found to be more prevalent in women Some of the ways to reduce zoom fatigue include turning off cameras. The place of strategic intervention is necessary in preventing in reducing zoom fatigue
(Bergmann et al., 2023)	this paper examines videoconferencing fatigue in the context of employees' reported experiences of tensions between work effectiveness and sociality.	dialectic method	It is caused by the intensive and/or inappropriate use of videoconferencing tools Non verbal factors, immobility, cognitive exhaustion are contributing factors to zoom fatigue There is a need to reconceptualize ideas around designing technologies and practices to enable both effectiveness and sociality in the context of video meetings
(Bailenson, 2021)	To focus on the non verbal overload as potential cuase for fatigue	theoretical framework based on existing academic research in psychology and synthesis of existing studies and theories	excessive amounts of close-up eye gaze, cognitive load, increased self evaluation from staring at video of oneself, and constraints on physical mobility are contributing factors to zoom fatigue
(Aagaard, 2022)	to explore the interpersonal dynamics that lie behind zoom fatigue	Desktop research	Contributing factors of zoom include awkward turn-taking, inhibited spontaneity, restricted mobility, lack of eye contact and increased self-awareness
(Riedl, 2022)	This paper develops a definition for Zoom fatigue and presents a conceptual framework that explores the major root causes of videoconferencing fatigue and stress.	Desktop research	prolonged and inappropriate use of videoconferencing contributes to zoom fatigue other contributing factors include stress, self awareness, lack of body language, interaction with multiple faces, lack of shared attention, lack of eye contact
(Macneill et al., 2024b)	Perceived Advantages and Disadvantages of Online Continuing Professional Development (CPD) During COVID-19: CPD Providers' Perspectives.	Quantitative research using surveys	faculty development, particularly toward asynchronous and HyFlex delivery methods will help negate zoom fatigue
(Rößler et al., 2021)	To investigate the impact of emotions on zoom fatigue	recorded and evaluated presentations from a virtual seminar called Collaborative Innovation Networks (COINs) over the course of twelve weeks with a total of seven two hour meetings using Zoom.	better and less tiring meetings will lead to a decrease in zoom fatigue
(Yosep et al., 2022)	To determine the relationship between Zoom fatigue and level tasks commitment on the students-level	quantitative with a descriptive correlation design.	Task commitment level is not a contributing factor to zoom fatigue
(Shockley et al., 2021)	to better understand how one salient feature of virtual meetings-the camera-impacts fatigue, which may affect outcomes during meetings	the use of a 4-week within-person experience sampling field experiment where camera use was manipulated. Drawing from theory related to self-presentation	gender and organizational tenure will moderate this relationship such that using a camera during virtual meetings will be more fatiguing for women and newer members of the organization. This means that zoom fatigue is more prevalent in women and newer members of an organization
(Ngien and Hogan, 2023)	This study tested a mediated model linking Zoom use with the camera on ('ZUC') to Zoom fatigue, through the mediator of social interaction anxiety on Zoom	survey sample	It was posited that self-monitoring positively moderated the effects of ZUC on social interaction anxiety on Zoom. ZUC is a contributing factor to Zoom fatigue
(Queiroz et al., 2023)	to examine the relationship between video-conferencing, video-conference fatigue (Zoom fatigue), and individuals' feelings of social connection, social skills, and life satisfaction.	quantitative with a descriptive correlation design.	Contributing factors to zoom fatigue are social sensitiveness in video conference, isolation, depression, poor life results, mirror effect, self gaze
(Nadler, 2020b)	this work presents a framework to test the ideas proposed and develop mitigating strategies,	Conceptual framework analysis	CMC exhaustion, is characterized by the physical and mental depletion experienced after prolonged use of computer-mediated communication platforms like Zoom

(Li and Yee, 2023b)	This paper presents a systematic review of existing literature to understand the empirical manifestations of the phenomenon, the causes behind it and potential theoretical explanations behind its effects.	Systematic Reviews	Zoom fatigue can be classified into four dimensions: physical, emotional, cognitive and social prolonged amount of time individuals spend on videoconferencing contributes to zoom fatigue focusing on multiple visual cues causes zoom fatigue contributing factors to zoom fatigue also include self view and focus, public self awareness,
(Nesher Shoshan and Wehrt, 2022)	To understand zoom fatigue and the characteristics shaping it	Mixed method	better management of meetings by leaders and technical improvements, are ways of reducing zoom fatigue
(Charoenporn and Charernboon, 2023)	This study examined convergent validity, factor validity, internal consistency and test-retest reliability of the Thai version of the Zoom Exhaustion & Fatigue Scale (ZEF-T).	quantitative with a descriptive correlation design.	Zoom fatigue was more prevalent among medical students
(Gerdan and Dunder, 2024)	to examine the psychometric properties of the Turkish version of the Zoom Exhaustion and Fatigue Scale (ZEFS) and obtain a cut-off score from the scale to distinguish the state of feeling mentally exhausted and fatigued.	quantitative with a descriptive correlation design.	additional cognitive effort required for videoconferencing, nonverbal cues, and mirror effect contributes to zoom fatigue
(Riedl et al., 2023)	To examine VCF from a neurophysiological perspective	neurophysiological perspective.	Longer period (above 50 mins) contribute to zoom fatigue Best practice include not ignoring the fatigue that comes with zoom use and also companies must try as much as possible to only use zoom as a complement to face to face interaction
(Simbula et al., 2024b)	to validate the Zoom Exhaustion & Fatigue Scale (ZEFS) in its Italian version, examining its relationship with videoconferencing characteristics, and outcomes such as emotional exhaustion, sleep problems, and technostress.	quantitative with a descriptive correlation design.	There are five dimensions of zoom fatigue which include general fatigue, visual fatigue, social fatigue, emotional fatigue, and motivational fatigue Contributing factors to zoom fatigue include sleep problems, emotional exhaustion, techno-stressors, frequency of video conferences and burstiness, and negatively correlated with attitudes toward video conferences,
(Nurmi and Pakarinen, 2023)	To investigate the relationships between virtual versus face-to-face meetings and different types of fatigue	multilevel path analysis	additional cognitive processing, non verbal cues, high frequency, long duration, and increase self-awareness demands contributes to zoom fatigue
(Zaidi et al., 2021)	This paper addresses the most commonly seen issues while teaching through Zoom.	Desktop research	Long zoom sessions, distracting backgrounds, contributes to zoom fatigue Faculty development workshops for the less tech-savy can help improve zoom meeting outcomes. Plain backgrounds should be used and solo zoom sessions should be used for large group settings
(Massner, 2022)	to explore why videoconferencing fatigue occurs in higher education settings, and the data revealed Zoom fatigue	qualitative case study	Four distinct factors contribute to level of zoom fatigue which are Situational Individual Trait Environmental Communication. Number of participants, relationship between them, the host and internet connectivity are situational factors, personality, anxiety level, self awareness and self esteem are individual factors, background, physical location and device accessibility are environmental factors while gesture, eye contact, pauses and interuptions are communication factors
(Allen et al., 2022)	explore the idea that people need meeting recovery, or time to transition from meetings to their next task	quantitative survey	A best practice needed in zoom use is ensuring that there is enough time for meeting recovery so that individuals can recover from fatigue before jumping on another zoom meeting
(Anh et al., 2022)	examines the causes and consequences of zoom fatigue	Quantitative research	milli-second delay, lack of perceived reward, are contributing factors to zoom fatigue
(Oducado et al., 2022c)	To investigate the impact of zoom fatigue on mental wellbeing	online survey	nonverbal factors contributes to zoom fatigue
(Khan et al., 2022)	To investigate the phenomenon of zoom fatigue in University Teachers.	Qualitative research design followed by thematic analysis technique	physical health issues, psychological concerns, connectivity fret, home life opinion and social life disturbances and preference to face to face interaction are contributors to zoom fatigue
(Bullock et al., 2022)	to explore the videoconferencing fatigue that has emerged during the COVID-19 pandemic.	Theoretical model using desktop research	Contributing factors to zoom fatigue include lack of preparedness, weak connectivity Best practices and recommendations include incorporating regular breaks, setting clear cut boundaries and time, changing scenery between meetings, and reducing distractions
(Engin Deniz et al., 2022)	To understand the psychological consequences of this recent global lifestyle change in different populations, the psychometric validation of the Zoom Exhaustion and Fatigue Scale (ZEFS)	Quantitative research	Zoom fatigue was more prevalent among people having anxiety, depression, and stress, and less prevalent among people with life satisfaction and academic well-being, supporting the scale's concurrent validity
(Yaman and Hocaoğlu, 2022)	To explore the topic of literature review	Literature review	Zoom fatigue level is low among people who love and participate in video calls

			Frequent and prolonged virtual interactions, mirror anxiety, cognitive load of managing nonverbal cues are all contributing factors to zoom fatigue Recommended best practices included scheduling meeting later in the day like evenings, using mute button when not talking, and turning off webcam

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