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Review Paper

Combating Zoom Fatigue: A Review of the Causes and Recommendations to Curb it

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ABSTRACT

The covid-19 pandemic is synonymous with many new phenomena. One such phenomenon is videoconferencing fatigue or zoom fatigue which translates to the exhaustion experienced by a person after a videoconference meeting. The paper aims to know the factors negatively affecting videoconferencing sessions so that various methods can be devised to combat zoom/videoconferencing fatigue and increase the productivity of work-from-home employees and students studying online. Scoping review using Arksey and O'Malley framework was employed. Fifty-eight research articles and literature were reviewed to know various factors negatively affecting videoconferences and contributing to fatigue. Multiple themes with subthemes emerged after conceptual content analysis and recommendations for each were made to combat zoom fatigue and enable organizations to formulate effective policies for work-from-home employees and online students.

Keywords: *Videoconferencing, Zoom fatigue, Work-from-home employees, Online students, scoping review, conceptual content analysis*

With the surge of COVID-19 and social distancing, companies and academic teams rushed to embrace virtual meeting tools to fill the gaps in communication. The pandemic-enforced remote work led to the emergence of "Zoom Fatigue" or "Videoconferencing Fatigue'' which has recently been focused on but not much researched. Zoom fatigue refers to the exhaustion and burnout caused by engaging in long videotelephony. There can be multiple causes for Zoom fatigue. One such is the high cognitive demands videoconferencing places on a person. Zoom fatigue originates from software for online video conferencing but encompasses non-zoom video conferencing platforms. Steered by the need for social distancing and remote working, videoconferencing has become an indispensable part of our daily functioning. Sullivan-Hasson (2020) described how Video Conferencing is now an essential part of everyday life, helping users successfully sail the challenges of social distancing, remote jobs, and online learning. Daft & Lengel (1986) suggested that Video-conferencing intuitively feels like a logical substitution when face-to-face communication is impossible due to its media richness.

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The coronavirus forced us all to adapt to new and uncertain situations. Online communication via video conferences, especially during the pandemic, has become the only viable instrument to communicate, work, depart, and receive an education. Ralph (2020) suggested that video-conferencing tools saw exponential growth during 2020. The pandemic brought a paradigm shift in people's lives with social distancing norms in place. People were isolated and confined to their homes without physical contact or having interaction. Interaction. Still, video conferencing played a vital role in establishing connections for businesses and institutions to operate virtually. Wong (2020) suggests that Remote working became normalized during the crisis, with 42% of people working from home. During remote work, people were video-conferencing for long hours, which made them feel burned out and exhausted.

Adjusting to new situations is never easy and involves many hurdles. Zoom Fatigue is one such hurdle or bump that many face. Abulibdeh (2020) said there had been unexpected side effects on workers worldwide that deserve attention. Telework often relies heavily on videoconferencing activities, bringing different apparent repercussions. Videoconferencing fatigue or Zoom fatigue took a toll on employees' mental health, and symptoms included a feeling of burnout and exhaustion.

Further, Fauville et al. (2021) concluded that burnout and exhaustion were seen in every domain, including emotional, visual, motivational, and social fatigue. Other symptoms included hopelessness, apathy, low productivity, anger, and physical symptoms, including headaches, insomnia, muscle pain, and tension. In their research, Blandin et al. (2021) concluded that zoom fatigue could directly affect workers' mental health.

Bailenson (2021) reported different potential explanations for videoconferencing fatigue, including a specific type of anxiety called Mirror Anxiety. This burnout usually happens when people are in front of their reflection, become self-aware, and tend to self-evaluate themselves. In videoconferencing, the user constantly observes their image on the screen;
This can relate to prolonged scrutiny of their appearance and behavior in front of the camera, resulting in a stressful event. It has been seen that mirror anxiety is relatively higher in females than men, and this clearly explains the statistics that of the 10,322 people questioned for the study, around 1 in 7 women (13.8 percent) reported feeling "very" to "extremely" fatigued after Zoom calls, compared to approximately 1 in 20 men (5.5 percent), (Neild, 2021).

METHODOLOGY

Arksey and O'Malley's five-stage framework for scoping review was followed. Stage 1) Identifying the research question; (2) identifying the relevant literature; (3) selecting the studies; (4) charting the data and (5) collating, summarising, and reporting the results.

Stage 1

Key questions were identified to guide our analysis of existing research.

- Question 1) What are the negative factors affecting videoconferencing?
- Question 2) What is zoom fatigue?
- Question 3) What factors lead to zoom fatigue?

Stage 2

This stage involves identifying literature from various databases. A good scoping review aims to map literature from electronic databases, reference lists, conference abstracts, editorials, and grey literature. Therefore, three significant steps were followed.

- A systematic search of peer-reviewed studies using multiple electronic databases like JSTOR, APA, EBSCO, Science Direct, etc.
- 'Snowballing' from article reference lists to identify additional studies that may not have been indexed in the online research databases.
- Searching grey literature from the internet using Google, the most widely used search engine. The first 20 Google results yielded by each search string were reviewed.

Stage 3

Study selection was made based on inclusion and exclusion criteria. One researcher collected all the literature, and two researchers screened the literature based on the inclusion and exclusion criteria. *Table 1 shows the inclusion and exclusion criteria for the review.*

Table 1 Inclusion and Exclusion Criteria

Inclusion	**Exclusion**
Population	
Employees in an organization include teachers and other stakeholders.	Self-employed individuals who are not attached to any organizations
Exposure Situation	
Formal, work-related videoconferencing meetings with more than two people present or a group meeting.	Informal video-conferencing meetings and meetings involving only two people

Outcomes

All outcomes of these formal meetings

Study Designs

All kinds of analytical research designs, Conference abstracts, editorials, articles, commentaries, and grey literature.

Stage 4

Stage 4 requires charting the data obtained. Charting data helps provide a summary of the information gained. *Table 2 shows the charting of included research papers.*

Stage 5

This stage requires collating and summarising the results. This stage will then develop themes and sub-themes to know the negative factors contributing to videoconferencing and how to avoid Zoom fatigue.

Table 2 Shows included articles

Authors	**Contents**	**Results**
1.Döring et al., 2022	The theoretical research design employing an eight-phase model is a revised version of the approach by Bröder et al. that was used to create the conceptual model.	A conceptual model of VC fatigue with four key causal dimensions was concluded with A: (1) personal factors, (2) organizational factors, (3) technological factors, and (4) environmental factors.
2. George et al., 2022	N=10 Exploratory Research Design	It was found that participants in remote meetings were less distracted when they participated in

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		large group meetings. Self-monitoring was found to be distracting to participants. Females were disproportionately distracted from self-gazing/monitoring.
3.Kara and Esroy ,2022	N=51Semi-Structured Interview and data analyzed through descriptive analysis technique.	The purpose of Usage, Duration of usage, and the number of participants in the meeting affected people's performance during an online session. Social anxiety increased when the cameras in the forum were on. Females were more particular about their appearance than their male counterparts. Illiteracy about program usage also contributed to fatigue. Immobility and constant sitting contributed to fatigue.
4. Karl et al., 2022	N=549 A qualitative method was employed. Text mining and content analysis was used to analyze LinkedIn comments.	Three themes emerged from the analysis, which is as follows 1)Lurking, 2)Meeting Management issues, 3)Camera issues, 4) Eating During meetings, 5)Microphone issues, and 6)Work from-home issues.
5. Lee et al.,2022	N=18 A qualitative method was employed. Focussed group interviews and a participatory design workshop were conducted to gather information about the distracting factors in videoconferences.	Five major distracting factors were found that adversely affected the videoconferencing experience. These factors are as follows-1) People and pets in the same physical environment. 2)Other people engaged in the same videoconference.3)Environment around the user while videoconferencing.4)Usability of the videoconferencing.5)Performance of the device during the videoconference.
6. Li and Yee, 2022	Systematic Review Paper	It was concluded that zoom/Videoconferencing fatigue could be classified into four dimensions: physical, emotional, cognitive, and social. Antecedents of VF can be organized into psychological, social, technical, chronemic, and productivity factors.
8. Li et al.2022	N=1145 Descriptive, correlational, cross-sectional study design was used	Perceived ease of use of videoconference apps led to the perceived usefulness of videoconferencing apps, which led to an increased frequency of use.

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		There was a significant relationship between frequency of use and feelings of videoconference fatigue, moderated by users' perceived satisfaction with their internet connection.
9. Raake et al.2022	Review of papers to form a conceptual model.	Communication-related such as absence of nonverbal cues, turn-taking, conversation timing, effort in maintaining the network connection, and impression formation contributed to zoom fatigue. Associated with zoom fatigue. Further, usability-related factors such as VC user expectations, security concerns, technostress, and techno-exhaustion all contribute to the development of zoom fatigue.
10.Ratan et al, 2022	N =130 A quantitative approach.	Facial dissatisfaction plays a role in video conferencing fatigue. The facial blow was higher in female participants than male participants and Asian people than white people.
11.Shkurko, 2022	Theoretical Paper	It was concluded that face-to-face interaction and its effectiveness are in sync with our evolutionary and biological apparatus of communication, and attempts should be made to explore alternative ways to make videoconferences effective by leveling the imperfections of face-to-face interaction, such as excessive ritualization, particularism, prejudice, biased perceptions, etc.
12.Terason et al, 2022	N =9 Qualitative method was employed. A phenomenological approach was used.	Three themes with categories and sub-categories emerged. The first theme is the organizational theme, and under this theme are two types: resource use and communication. This theme mainly discusses the reduced cost and communication patterns of working from home. The second theme is the meeting logistics theme. Under this theme also. There are two categories, namely logistics and social etiquette. The logistics theme revolves around appropriate equipment and internet connectivity

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		available to organize and attend virtual meetings. The third theme is about the personal impact of virtual meetings. This theme revolves around the physical and mental health impact of working from home and the use of interpersonal rapport.
13.Abravoma et al ,2022	N=179 A quantitative study was employed.	It was found that self-view engagement is negatively associated with meeting satisfaction, perceived productivity, and meeting enjoyment. Looking at self while listening has a negative indirect and direct effect on meeting outcomes
14.Abarca et al , 2021	N =317 A quantitative causal study using partial least squares (PLS) was employed using an online questionnaire.	It was found that trust in virtual teams leads to better performance. The Empowerment of team members contributed to high levels of trust. Further, it was seen that the ability of the members of a virtual team to get along with each other is critical to the well-being of the group and task performance. Leadership was essential to establishing trust and communication in virtual teams, enhancing performance.
15. Amponsah,2021	N =8 Qualitative approach employing phenomenological research paradigm	Results showed that 'zoom fatigue' is viewed as a physical, emotional, and energy-draining COVID-19 phenomenon. Internal resources (cognitive features and action patterns) of the faculty members positively correlated to their motivation which in turn helped to reduce their cognitive load in the face of the challenges. The following recommendations were deduced to help reduce video-conference fatigue Automatic noise muting or alerting system; fatigue detection systems using either voice or facial cues or both; A feature that allows the scheduling of time allotment for personal agenda and breaks before the start of the meeting or during the scheduling of the meeting.

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16. Bailenson,2021	Theoretical Research Design	The amount of eye gaze in zoom is eight times higher, there is much cognitive overload, which includes speaking louder during videoconferences, and non-verbal communication becomes hard to decipher. Users don't understand the natural head movements of the people in the meeting; there is an increase in self-evaluation due to seeing oneself in the forum, which contributes to stress and zoom fatigue. Lack of mobility during a VN meeting makes people feel suffocated, contributing to fatigue.
17.Bennet et al,2021	N =55 A mixed-Method design was employed.	Fatigue was found to be unique. General work fatigue and videoconferencing fatigue are both different. Timings of the meeting have an impact on fatigue. A high level of belongingness among the attendees of the conference can lead to a low level of fatigue; reducing attentional demands imposed by the platform, like muting oneself while not speaking, tends to reduce fatigue.
18.Delgado et al, 2021	N =488 quantitative research methodology was employed.	The usability of the platform and workload demands were positively related to zoom fatigue.
19.Fauville et al., 2021	N =10,591 A mixed method approach used the ZEF scale. After that, open-ended questions were asked then meaning, and the extraction method was used to conduct a topic modeling analysis to discover key themes from the answers to the open-ended questions.	It was seen that Zoom fatigue increased with frequency, duration of meetings, and burstiness (i.e., the shorter time between sessions). Nonverbal mechanisms were related to fatigue. It was also revealed that there exists a gender difference in how zoom fatigue is experienced. Women were found to be more prone to experiencing fatigue. Additionally, it was found that zoom fatigue was less in extroverts, older people, and in a social context than in the work context. Still, fatigue in women was consistently more, irrespective of the changing or contributing factors.
20.Hidayati and Irwansya,2021	N =3Qualitative approach with an explorative method was used.	

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		The interview showed that social media use users and gratification theory could be used to avoid zoom fatigue.
21.Jacquez et al,2021	N= 515 A quantitative method was employed.	Results suggested that videoconferencing meetings induce more significant fatigue than in-person meetings and that future work is warranted to investigate mitigating these effects.
22. Kushlev and Shuman, 2021	N =65 Field experiment employing a within-subjects design was employed	It was found that when students had their cameras on during online classes, they experienced increased engagement without increased fatigue
23. Lal et al., 2021	N= 29 The qualitative and interpretive approach was undertaken. Diary keeping technique was utilized to collect data.	It was found that it is difficult to convey emotions and discuss sensitive topics during a video conference as there was a lot of miscommunication and misinterpretation of messages. There was a lot of careful planning and rules of etiquette before any virtual meeting.
24.Mamtani et al, 2021	Theoretical research design	Looking for non-verbal cues can be very tiring for a video-conferencing user as our body is visible only further; misinterpretation of expressions in the video conference adds to fatigue. Prolonged eye contact with the speaker in a videoconferencing platform can contribute to fatigue in the listener. Preoccupation with one's appearance contributes to zoom fatigue. Response delays due to transmission problems in the telephonic system make users feel that the The person at the other end was less attentive and less friendly, causing fatigue.
25.Peper and Yang,2021	N=36 An experimental method was employed.	It was seen that when participants were animated and responsive during the zoom class, they felt less stressed and fatigued. It was also concluded that body posture

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		affected the thoughts and emotions of the students.
26.Prasetyo et al,2021	N= 513A quantitative research method was employed..	Results suggested that organizational commitment to virtual meetings during the COVID-19 pandemic impacted the employees' positive attitude, subsequently leading to virtual meetings' perceived effectiveness as collaboration and social tools.
27. Oducado, 2021	A descriptive, correlational, cross-sectional study design was used	It was found that the duration of videoconferencing, mirror anxiety, being physically trapped, and hyper gaze are significantly correlated with Zoom fatigue among teachers.
28.Rößler et al,2021	N =35 An experimental method was employed. Emotion was tracked Through Zoom, face video snapshots using facial emotion recognition recognized six emotions. (happy, sad, fearful, angry, neutral, and surprised).	Consistent emotional display by the presenter in a video conference contributes to fatigue. Still, a presentation with emotional highs and lows leads to engagement and can have lower fatigue levels in the audience. It was also found that when the presenter's facial emotions were happy, it led to a sense of joy in the audience. Thereby implying that facial emotions play a contributing role in videoconferencing fatigue.
29. Shockley et al., 2021	N=109 Field-experiment within-person sampling was employed where camera manipulation was done for four long weeks.	The usage of the camera during video conferencing contributed to fatigue. Women and newer employees were more prone to zoom fatigue.
30.Shoshan and Wehrt,2021	N=81A mixed-method approach was employed. Surveys were circulated, and there was a within-person investigation to investigate the level of exhaustion both during work meetings and family meetings. To measure fatigue, previous within-person studies were followed further the four items adjusted for daily use, adapted from the German and theHebrew versions of the emotional exhaustion subscale of the	Results showed that zoom fatigue exists, and meeting duration, meeting size, and the supervisor's presence did not play a role in tiredness. A qualitative study revealed that through video - conference meetings, participants are reminded of what they lost.(e.g., everyday face-to-face communication, clearly structured work), compare their situation to working life before the pandemic. Difficulties in reading the social cues of others while perceiving pressure to provide such alerts themselves and technical obstacles all contributed to zoom fatigue. Nonetheless, it was concluded that

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	Maslach Burnout Inventory were also used.	informal, friendly, and less task-related video conference meetings were described as rejuvenating and helpful.
31.Standaert,2021	N=841	It was found that virtual meetings can be associated with both resource loss and gains. More virtual meetings are associated with more negative well-being factors. The perceived workload was found to be higher in women.
32. Vidolov,2021	N=11 A qualitative method was employed. Interpretive Phenomenological Analysis was used, and interviews were done with the selected participants.	It was seen that videoconferences could be co-constitutive of emotional, relational experiences. The findings established the role of circularity of seeing and being seen as a structuring process of emotional experiences and expressions. The research states that the self-view window impacts mutual gazing and replaces the role of others as a mirror for the self. There is room for manipulation by the interlocutors as people cannot gauge who is seeing in a virtual meeting. The split in mutual gaze contributes to heightened anxiety and self -consciousness.
33. Williams et al., 2021	Theoretical research design	Video -conferences were found to have greater psychological demands. It has been suggested that individuals have a reduced ability to interpret body language and cues, difficulty detecting humor and irony, and difficulty relaxing in a natural conversation than face-to-face. The synchronicity of talk is hard to achieve in videoconference meetings, which causes fatigue—setting up for a discussion on video requires people to clean up their surroundings and mend how they look, which can cause stress and fatigue.
33. Zaharie, 2021	N=498 A quantitative research design was used. Cross-sectional survey data were circulated, and responses were then analyzed using path analysis with STATA.	Trust in the members of the virtual teams leads to better performance. It was also found that the preference for working in VTs mediates the relationship between the Virtual team's challenges and performance. The results indicated no significant moderation effect of openness on the relationship

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		between trust and the preference for working in VTs.
34. Lee,2020	Newspaper Editorial	Audio has been seen as the main reason that video meetings are draining. It turns out that millisecond delays in virtual verbal responses negatively affect our interpersonal perceptions, even without any internet or technical issues. Lack of perceived reward relative to cost during videoconferencing is viewed as the primary psychological mechanism of Zoom fatigue. Eye contact improves connection—faster responses, more memorization of faces, and increased likeability and attractiveness. These tools that make interactions organically rewarding are compromised over video. In the video, the gaze must be directed at the camera to appear like making eye contact with an observer. During conferences with three or more people, it can be impossible to distinguish mutual gaze between two people.
35. Manstead et al., 2020	Narrative review	It was found that emotional communication occurs even in the absence of any possibility of communicating it directly to another and is more influenced by the quality of the relationship between the communicators and the cultural norms for the expression of emotions than by the kind of communication medium used. It was concluded that face-to-face communication via the internet could create more emotionally intimate conditions for interaction than everyday face-to-face communication with physical co-presence by removing the barriers of face-to-face communication.
36. Nadler, 2020	Theoretical research design	It theorized that each element of synchronous online communication pulls energy at each level, and that is at cognitive, emotional, and physical levels. The media we use in our relationships with people influence those very relationships. Newness in computer-mediated

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		communication can cause cognitive overload and can contribute to exhaustion. The spatial dynamics between speaker and listener do not carry over. Spatial feelings were found to influence behavior. Fatigued experiences from computer-mediated communication are unique and not a shared experience as the spatial dynamics of each individual is different.
37. Lockwood and Forey,2016	N=38 Qualitative research Design. Critical Discourse analysis and systemic functional linguistics, particularly appraisal analysis, were used.	Off-shore participants of the meetings felt marginalized and disempowered. Onshore managers were found to assert more dominance and power. Those members who used proclamations were found to be more assertive and dominant. Idiomatic expressions and metaphors contributed to the feeling of marginalization in off-shore participants.
38. Onishi et al., 2016	N=38 An experimental Research Design was used. Three experiments were conducted, and the subjects participated only in one experiment at a time.	It was seen that embodying only one body part of the remote partner reduced the feeling of being far from the remote partner and enhanced social telepresence.
39.Alkhaldi et al, 2012	N =434 A quantitative approach was employed. Close-ended surveys that had multiple-choice questions and the Likert scale were used. Further, structural equation modeling was used to estimate the structural model and test the hypothesized effects among the four constructs.	The findings show that user training and support can directly affect video conferencing usage and indirectly affect the user's perceived ease of use.
40. Rantanen,2012	Review of papers	Three conclusions were made to enhance the videoconferencing experience, which are as follows - 1) keeping interlocutors' image as near the camera as possible.2)sitting back a bit to improve the impression of mutual eye contact, 3)Avoiding a small view of the interlocutor
41.Lowden and Hostetter,2011	N =127 Mixed-method approach was employed. A quantitative survey was	It was found that there exists a gender difference in the levels of perception of social presence.

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	circulated online to identify participants who used videoconferencing platforms. Further, qualitative interviews were taken with the identified participants to know their level of satisfaction with videoconference meetings.	Further, it was seen that videoconferences provide the same level of satisfaction and perception of social reality as that face-to-face meetings. Females were reported to have a higher satisfaction level with videoconferencing than men, and it was reported that technical glitches hampered participants' positive perception of videoconferencing.
42. Teoh et al, 2010	N=64 Experimental Research Design. The experiment had a 2x2 design; two manipulated variables were task type and amount of visual information. Task type was a within-subject variable with two levels: an idea generation task and a negotiation task. The amount of visual information was also a within-subject variable and had two groups: minimum visual information about one's partner (head-and-shoulders view or Restricted View) and maximum visual information about one's partner (Unrestricted View from head to waist).	It was found that participants trusted more in the creative task than in negotiation tasks, irrespective of the scope of view, thereby reaffirming that task type does mediate the relationship between the amount of visual information available and trust. Widening the range of thought did not affect generating trust during negotiating tasks.
43.Kleij et al, 2009	N=66 Experimental Research Design employed with our two × four mixed repeated measures designs. Twenty-two groups in two communication environments, i.e., face-to-face same-room and video teleconferencing non-collocated communication at four consecutive test sessions for 1 hour at 2-week intervals, were employed.	It was seen that regulating conversations in videoconferencing was difficult. Conversation satisfaction was reported to be more in ftf conversations. However, no decrement in performance was found in video conferencing. The adaptation effect was seen by using video conferences. Experience with the medium was not found to increase satisfaction and group performance.
44. Zhang and Zhang, 2009	N=42 Experimental Research Design. Two tasks were there in the experiment, the first task involved negotiating charges among the pairs,	It was concluded that video-mediated communication generated high levels of affective trust perception among strangers but did not lead to high levels of cognitive trust. In other words, when people

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	and the second task was brainstorming among the teams.	in a video conference meeting are strangers, the video does not always increase trust perception, as it only helps when a conflict is involved.
45. Ferran and Watts,2008	N=143 A field quasi-experimental method was used in which participants were surveyed.	It was found that participants in the videoconference reported being more influenced by the speaker they liked, irrespective of the arguments they presented. On the contrary, this wasn't the case for participants attending the face-to-face seminar. The cognitive workload was higher in participants attending the video conference.
46. Townsend et al., 2008	N=64 Experimental Research Design. The study used five variables, two independent, two mediating, and one dependent. The study used five variables, two separate, two mediating, and one dependent.	The participant's Anticipated ease of use and usefulness of videoconferencing platform contributed to a positive post-experience attitude towards the overall perception of System utility. Anticipated system usefulness also contributed to a positive post-experience attitude toward system satisfaction. There exist a negative relationship between System satisfaction and Workgroup. Performance.
47. Campbell, 2006	N=80 The quantitative method was employed. Task and media traits were measured using a thirty-item instrument developed by Campbell. User apprehension was measured with a modified tool developed by Reinsch, Steele, Lewis, Stano, and Beswick (1990).	It was found that User aversion and discomfort during video-conferenced meetings can significantly impact perceptions of tasks, processes, and performance.
48. Fullwood, 2006	N=48 Experimental research. Between-group design was employed. The independent variable was whether the participant completed the task face-to-face or across a video link, and the dependent variables were the assessments made of the participants about how likable and intelligent they were and their mind-reading ability. Participants expected to be rated differently on measures of	It was seen that participants rated higher the likeability and intelligence of their partner in face-to-face communication more than in vitiated touch. No significant difference was found in the perceived mind-reading abilities of the participants.

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	intelligence and likeability between the two conditions.	
49.Cuhadaroglu and Mchaney,2005	A qualitative method was employed. A narrative review of research papers was done to know the benefits and limitations of Videoconferences.	It was concluded that there are various benefits of using videoconferencing that include quantitative returns such as cost, productivity, and efficiency. Videoconferencing can also ensure work-life balance. The limitations include a lack of training, an unsuitable connection between the participants, and a lack of personal contact.
50.Mukawa et al, 2005	N=14 Experimental Research Design was employed. Video-mediated communication system with eye contact was produced using a half-silvered mirror with 30 percent transmittance. The plan was arranged so that the camera center axis meets the conversational partner's gaze.	Results indicate that eye-contact systems provide immediate awareness of visual connection through users' mutual gaze. This is conjunct with the behavior observed in face-to-face communication. On the other hand, participants using non-eye-contact systems are likely to need confirmation of opening the conversation by waving their hands and uttering a greeting.
51.Burgoon et al.2002	N=128 Experimental Research Design. The experiment was a 4 (Modality) x 2(Truth/Deception) design with cells balanced byGender. The four modalities consisted of (1) FtF, (2)Text, (3) audio, and (4) AV communication.	It was concluded that ftf communications are not essential for establishing trust; truth bias was seen to be active in all the formats.
52. Huang et al., 2002	N=28 Laboratory Research Design. Used between-subject design with camera Angle: high vs. low [-/+30]. The screen size was 14".The distance of the user from the monitor and camera was kept at a distance of 4 feet.	In a decision-making group meeting, artificially tall people were more influential than their artificially short counterparts. It was concluded that the physical placement of video cameras, zoom angles, and monitor distance can distort people's perceptions of closeness and height. These factors affect behavior in both conversation and Decision-making.
53. Joiner et al., 2002	Experimental Research Design. Two experiments, namely running in the rain and gameshow, were done to determine whether eye	The study found that technological-mediated communication did affect the interaction pattern among people. It was also found that eye

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	contact mattered in videoconferencing.	contact influenced problem-solving and conceptual understanding.
54. Horn, 2001	N=42 Experimental Research Design Participants were made to watch six interviews, 2 High-Quality videos, 2 Audio, and 2 Choppy Videos indicating their judgments of deception for each set of questions.	Results show that a reduced video framework makes it difficult for people to detect deception. Understanding and focussing on subtle communicative cues in videoconferencing meetings are essential in sensitive or high-stakes interactions in which detecting lies is required.
55.Yoo and Alavi,2001	N=135 A laboratory experiment in which media (audio conferencing desktop v.s videoconferencing desktops) were manipulated in two group history environments (zero-history vs. established). Both were between-subject manipulations.	Results showed that group cohesion influenced the group members' perceptions of communication media in established groups. Further, it was found that group cohesion did not reduce the absolute direct influence of media conditions on the social impact.Group cohesion over social presence was found to b additive rather than substitutive to media conditions.
56. MuÈhlfelder².et al, 1999	N=32 Experimental research employing between-subjects designed with two groups .alf of the subjects contacted their partner directly (`Face-to-Face` condition: FtF), and the other half got to know their partner via video conference (`Video-Mediated-Communication` state: VMC).	It was found that people perceive the situation differently in the videoconferencing environment than ftf environment. Video conferencing was seen to harm the origin of trust.
57. Grayson & Coventry,1998	N =30 Experimental Research Design. Participants were asked to do the role of a customer (C) seeking advice on investment from a financial advisor (FA). The appearance of the financial advisor was varied by either appearing very close (close condition) or far away (far state), while the FA's view of the customer was kept constant. The FA attempted to give sound investment advice to the C and tried to persuade the C to take a particular option.	It was concluded that proxemic information was preserved in videoconferencing only to a certain extent. It was also seen that the effects that videoconferencing produces are generally in line with those of face-to-face interactions but on a lower level - most likely due to the unimodal proxemic information available compared to the multimodal information available in co-present exchange.

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58.Colston & Schiano,1995	N=40 Experimental Research Design. Participants were seated at a video display unit and given tasks.Instructions. Subjects viewed the videotape and rated each actor's difficulty in solving the word.Problem on each card, on a 7-point scale (from (1) "no difficulty at all" to (7) "many difficulties"). After initial practice trials, a total of 48 ratings (8 actors x 3 card problems x 2 conditions, "look only" or "look + linger")Were obtained. All subjects were debriefed upon completing the task.	Results indicate a positive relationship between gaze duration and rated difficulty, with lingering as an added significant factor.

RESULTS

A total of 58 research articles and literature were included in the review. Four significant themes with sub-themes emerged after conceptual content analysis. These themes indicate various factors that negatively affect the effectiveness of videoconferencing meetings and contribute to Zoom fatigue. The four themes are as follows-

Theme 1 Meeting characteristics

Meeting characteristics play a vital role in predicting videoconference effectiveness. Meeting features like duration, group size, the purpose of the meeting, and the nature of the session all contribute to the development of Zoom fatigue. (Fauville et al.,2021, George et al.,2022, Kara and Esroy 2022, Oducado 2021, Peper and Yang 2021, Rößler et al., 2021)

Small group meetings were seen as less distracting than large group meetings as there is less turn-taking for conversations and people are more attentive because anyone from the group can be called out and asked questions.

The duration of meetings also contributes to the development of fatigue. Small-duration panels were seen as more effective than large-duration meetings. In a similar vein, after monitoring the brain waves in the human factors lab, it was found that participants felt fatigued within 30 to 40 minutes of the virtual meeting. (Microsoft, 2018).

Responsive meetings were less stressful as they required all attendees' participation, making the forum less mundane and boring.

Further, meetings with specific agendas and purposes were well received by the participants than meetings without specific agendas or meetings. A specified schedule helps the meeting keep the conference participants focused, promoting group collaboration.

Timings of the meeting also play a crucial role in avoiding zoom fatigue. For instance, scheduling recurrent sessions at the same time help every attendee to be on the same page, regardless of where they are from and attending from different time zones.

Sensitive topics or emotional content should be avoided since dynamic range via videoconference is hard to decipher and imposes cognitive demands on the attendees as non–verbal cues are not present. In contrast, it was also found that meetings with both high and low emotions were found to be more engaging and less tedious by the participants. It was also seen that when the presenter displayed feelings of happiness, it also led to a sense of joy in the participants and a favorable perception towards the meeting, thereby helping reduce zoom fatigue.

Theme 2 Organizational Factors

This theme deals with organizational values and policies that impact the experiences of video-conferencing meetings. Organizational commitment in employees led to better acceptance of videoconferencing sessions and an effective outcome. Trust among the group members during the discussion led to increased performance and less fatigue during online video meetings. High workload demands by organizations contributed to the emergence of zoom fatigue. Creative tasks were seen as more trust-generating and less stressful in video conferencing. (Abarca et al.,2022, Bennet et al.,2021, Prasetyo et al., 2021, Teoh et al., 2010, Terason et al.,2022, Yoo and Alavi, 2001, Zaharie et al., 2021, Zhang and Zhang, 2009)

Leadership was a significant determinant in developing and promoting trust among the organization's members; therefore, In times of transition, leaders should rise to establish trust and communication in virtual meetings.

Theme 3 Personal /Individual factors

Facial dissatisfaction and mirror among participants were seen to be contributing to the development of zoom fatigue in videoconferencing users. Women were found to have high levels of facial dissatisfaction and mirror anxiety than men. Extroverts were seen to adjust more easily to videoconferencing technologies than introverts. Newer employees were found to have higher levels of videoconferencing fatigue than older employees, as they felt they had to prove themselves to secure jobs. (Abravoma et at., 2021, Doring et al.,2022, Fauville et al.,2021, George et al., 2022, Mamtani et al., 2021, Oducado,2021, Ratan et al.,2022, Shockley et al., 2021)

Body posture during online meetings was found to be affecting the participants' emotions and actions. (Peper and Yang, 2021)

Anticipated ease, usefulness, and openness to videoconferencing technologies contributed to lower stress levels and reduced zoom fatigue among videoconferencing users. (Cambell,2006, Li et al.,2022, Townsend et al., 2008)

Theme 4 Technological factors/Platform Factors

This theme deals with the loopholes in videoconferencing technologies and other technological factors like internet connectivity contributing to zoom fatigue. It is seen that stable and good internet connectivity can significantly lower fatigue levels in remote work employees. Further, the physical placement of video cameras, zoom angles, and monitor distance can distort people's perceptions of closeness and height. (Alkhadi et al.,2012,

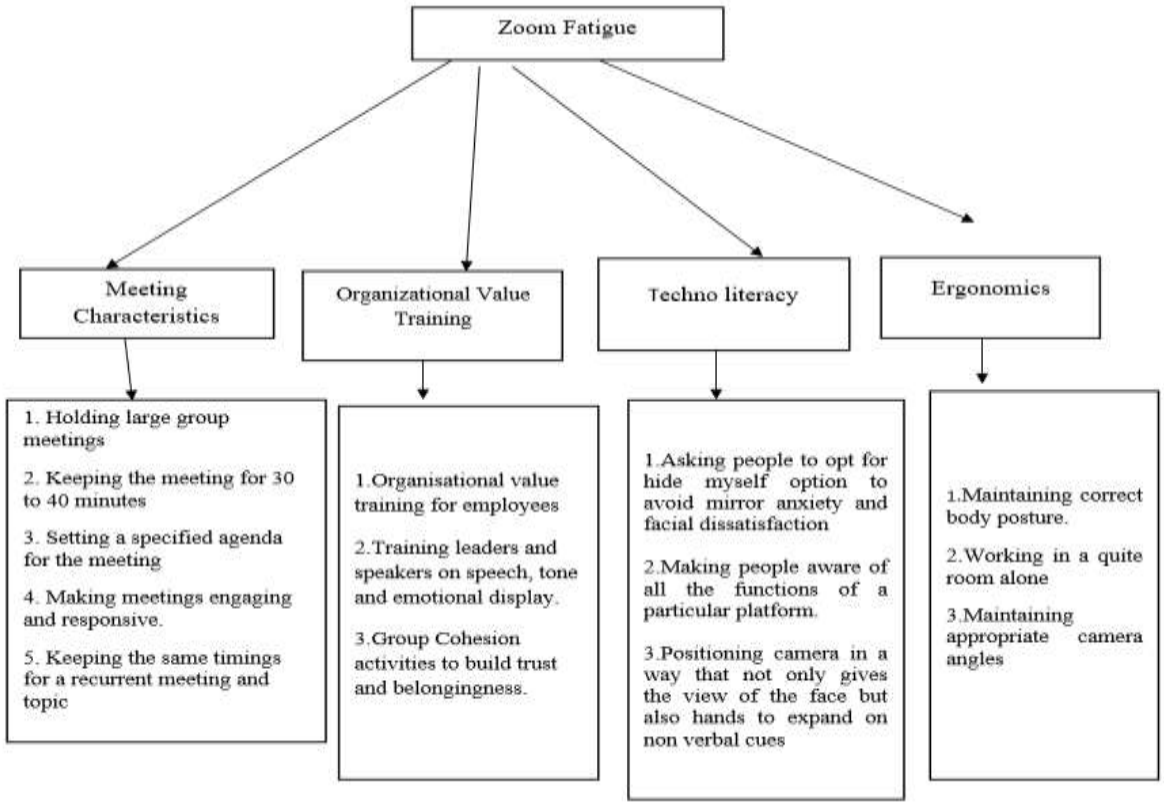
Amponsah, 2021, Delgado et al.,2021, Horn 2001, Huary et al.,2002, Karl et al.,2022, Raake et al.,2022, Rantanem, 2012, Williams et al., 2021)

These factors affect behavior in both conversation and decision-making. Videoconferencing platforms should attempt to make non-verbal cues and head movement more evident.

DISCUSSION

The paper aimed to know diverse factors contributing to zoom fatigue and form a conceptual framework to combat it. For this purpose, a scoping review and a total of fifty-eight papers were reviewed. Their results mapped the negative factors affecting videoconferencing and contributing to zoom fatigue. About four significant themes with sub-themes were formed to determine the factors contributing to zoom fatigue. The knowledge of causes and contributing factors to zoom fatigue can enable employees, managers, and academic institutions to control and eliminate those factors to increase educational and work productivity and establish employee well-being simultaneously. This research can also prove beneficial in adding literature to the phenomenon of zoom fatigue and will contribute to developing an intervention model to reduce zoom fatigue, thereby helping organizations increase efficiency and productivity. Technological advancements like videoconferencing were prevalent in western countries. Still, it was only after the pandemic that videoconferencing technology was no longer restricted to IT sectors, but it also penetrated other offices, educational institutions, healthcare industries, etc. To alleviate this problem for educators, online learning platforms, supplemented by video conferencing technologies, stepped into the hole left by the suspension of classroom-based instruction. (Rahul,2020). Since people have now realized that their work can also be done remotely, it is inevitable to think that videoconferencing platforms like zoom, google meet. Microsoft offices are here to stay, and so are their negative consequences like videoconferencing fatigue or what is commonly known as zoom fatigue. With the advent of Generation Z entering the labor force, demand for digital solutions, especially video, will grow. Thus, it is imperative to Upgrade workplace premises and technology to suit the aspirations of Generation Z, which would help businesses compete in a world of fast technological innovation. (Lakshman,2022) Therefore, we can say that this research is one of its kind of an attempt to understand the impacts of videoconferencing technologies and mitigate their negative consequences.

Conceptual framework to Combat Zoom Fatigue



DISCUSSION

The paper aimed to know diverse factors contributing to zoom fatigue and form a conceptual intervention module to combat it. For this purpose, a scoping review and a total of fifty-eight papers were reviewed. Their results mapped the negative factors affecting videoconferencing and contributing to zoom fatigue. About four significant themes with sub-themes were formed to determine the factors contributing to zoom fatigue. The knowledge of causes and contributing factors to zoom fatigue can enable employees, managers, and academic institutions to control and eliminate those factors to increase educational and work productivity and establish employee well-being simultaneously. This research can also prove beneficial in adding literature to the phenomenon of zoom fatigue and will contribute to developing an intervention model to reduce zoom fatigue, thereby helping organizations increase efficiency and productivity. Technological advancements like videoconferencing were prevalent in western countries. Still, it was only after the pandemic that videoconferencing technology was no longer restricted to IT sectors, but it also penetrated other offices, educational institutions, healthcare industries, etc. To alleviate this problem for educators, online learning platforms, supplemented by video conferencing technologies, stepped into the hole left by the suspension of classroom-based instruction. (Rahul,2020). Since people have now realized that their work can also be done remotely, it is inevitable to think that videoconferencing platforms like zoom, google meet. Microsoft offices are here to stay, and so are their negative consequences like videoconferencing fatigue or what is commonly known as zoom fatigue. With the advent of Generation Z entering the labor force, demand for digital solutions, especially video, will grow. Thus, it is imperative to Upgrade workplace premises and technology to suit the aspirations of Generation Z, which would help businesses compete in a world of fast technological innovation. (Lakshman,2022) Therefore, we can say that this research is one of its kind of an attempt to understand the impacts of videoconferencing technologies and mitigate their negative consequences.

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Conflict of Interest

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