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"ZOOM FATIGUE" IN HIGHER EDUCATION: VIDEOCONFERENCING IMPACT ON STUDENTS' FATIGUE

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Abstract

Our study analyses the zoom fatigue level of last-year bachelor students and their perceptions regarding the online learning experience from the academic year 2020-2021. Measuring the students' fatigue level, we noticed that, even if not all five fatigue dimensions are high, the general Zoom fatigue level is relatively up ($\mu = 3.43$, $M = 3.60$), especially for the general, visual, and motivational fatigue dimensions. Students' cover topics such as time consume, access, portability, workload, repetitiveness, meaning, and pedagogical approaches. Educators need to include pedagogical approaches and innovations when designing, developing, and implementing digital courses and meetings, and equity for all needs to become continuous priorities so that no student is left behind because of digital discriminations and lack of resources. Access and portability are the key features for the online meetings educational set-up, but technical issues, numerous complementary tasks and dull teaching methods are constantly decreasing interest and attractiveness for students to take part in online synchronous learning as time goes by, and successful learning chances are constantly lowering. Hybridisation is identified as an ideal way of inserting online meetings in the following period, transforming videoconferences into alternative ways of teaching, adding up to face-to-face educational contexts and offering supplementary learning opportunities. Given the growing presence of videoconferences in higher education, more research is needed to identify the related factors influencing the zoom fatigue levels among students and academics.

Keywords: COVID impact, fatigue, higher education, online education, videoconferences

1. Introduction

The paradigm shifts brought about by the COVID-19 pandemic are being felt in almost all areas of our society and education is a key point where such measures and changes converge. Moving educational activities online (Botnariuc et al., 2020; Griffin & Denholm, 2020; Lowenthal et al., 2020), from campus to Zoom (Chawla, 2020; Iqbal, 2021), Meet, Teams or other specific applications, has brought a high degree of learning flexibility (Denstadli et al., 2012; Lantz, 2001; Reaburn & McDonald, 2017; Rosetti & Surynt, 1985), portability, and easy access from anywhere (Dwivedi et al., 2020; Nguyen et al., 2022), but this mechanism has not been relieved of problems, especially with the passage of time (Hodges et al., 2020). Technical failures, lack of adequate digital equipment and skills, difficult personal and family contexts, high exposure to online meetings, disruption of classical work schedule, mental overload, and low efficiency are some of the great research topics that can create a picture of what did and didn't work well during this period.

The academic landscape, although much more experienced with digital learning contexts, have not been spared by such problems, and reconfiguring teaching and learning in a new, steep environment, without transition and adaptation periods, has subjected universities and academic communities to real challenges. Digital discrimination (Dwivedi et al., 2020, p. 18), "Zoom fatigue" (Bailenson, 2021; Toney et al., 2021), and "Zoombies" (Morris, 2020; Toney et al., 2021) are some of the concepts strongly highlighted at these moments, and recent research focused precisely on the analysis of how the new normal of education influences the various components of the students' and teachers' life. From the "digital mirror" of their own video image, to reduced mobility and attached medical conditions, the pandemic construction of educational activities raises the issue of mental and physical health (Martin, 2020). In this respect, one of the variables is fatigue (Bennett et al., 2021; Luong & Rogelberg, 2005; Spataro, 2020; Wright & Cropanzano, 1998), linked especially to continuous, long-term, high-frequency participation in online videoconferencing meetings (Hinds, 1999).

Our research assesses, through the "Zoom Exhaustion & Fatigue" scale (Fauville et al., 2021), the level of "Zoom fatigue" of the last-year bachelor students in relation with the frequency of their participation in video conference online meetings (Gough, 2006; Wiesemes & Wang, 2010) during the academic year 2020-2021. The aim of the research is to identify the level of fatigue caused by students' participation in online educational meetings and what are the students' behaviours and perceptions (Candarli & Yuksel, 2012) linked with these meetings.

We believe that analysing the influence of online meetings participation on students is a key point for shaping future teaching-learning approaches in higher education (Lai & Pratt, 2009; Rehn et al., 2016), although the evolution of the sanitary situation could significantly reduce students' exposure to online learning, we consider that post-COVID education will not completely abandon the use of online meetings (Archibald et al., 2019; Barnes, 2020; Fernandes, 2020; Griffin & Denholm, 2020). No student should be left behind, and the access to quality education (Malinovski et al., 2015) and support for learning are priority elements for the educational development (Pan & Zhang, 2020). Inequity (Barnes, 2020; De' et al., 2020; Fahey & Hino, 2020) and low access to digital devices (Dhawan, 2020), low digital literacy levels and few innovations in teaching practices are some of the interest areas in which this research brings relevant information and data.

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2. Problem Statement

Fatigue is present in various forms in the university community, especially linked to extensive presence in online meetings assisted by videoconference platforms. The high exposure of students to videoconference meetings during the pandemic period for online learning activities bring up a series of aspects that need to be considered for designing future educational activities in a post-COVID context, starting with analysing the impact of these practices on the general health and wellbeing of students and academics all the like.

3. Research Questions

Starting from the five fatigue dimensions included in the "Zoom Exhaustion & Fatigue" scale (Fauville et al., 2021), we conducted our research starting from the following two research questions:

i.   What is the students' fatigue level determined by participating in videoconference meetings used for developing online learning activities due to the COVID-19 pandemic?

ii.   What is the relationship between the students' fatigue level and the exposure level at videoconference meetings?

4. Purpose of the Study

Our study analyses the fatigue level of last-year bachelor students determined by their participation at videoconference meetings during the online learning activities developed in the 2020-2021 academic year, due to the COVID-19 pandemic impact on educational activities implementation in higher education. Also, the conducted research brings up the potential relation between the students' fatigue levels and the rate of exposure to videoconference meetings across the academic year. By this approach, we propose a series of discussions regarding the possible impact of online learning activities and the general health and wellbeing of students.

5. Research Methods

The methodological approach for the present research is developed in a quantitative manner, assessing the impact of students' participation in online videoconference meetings on their fatigue level, built on the five dimensions proposed by Fauville et al. (2021) in the "Zoom Exhaustion & Fatigue" scale. The information was collected using an online questionnaire, in which the mentioned scale has been integrated and adapted. The sample size was calculated a priori through a power analysis performed by the Sample Size Calculator (Creative Research Systems, F.D.) application. With a confidence level of 99 % and a confidence interval of ± 3, the sample required for this research has been calculated at 52 respondents. The "Zoom Exhaustion & Fatigue" scale (Fauville et al., 2021), used for designing the questionnaire used to collect data for our research, aims to assess the degree of fatigue on five dimensions (general fatigue, visual fatigue, social fatigue, motivational fatigue, emotional fatigue). The scale was validated through four studies with more than 700 participants (Fauville et al., 2021, p. 17), leading to the

development of a scale built on 15 items. For analysing the data, we used descriptive statistics, assessing aspects such as central tendency, variability, standard deviation, as well as the Pearson correlation.

6. Findings

Our research findings show that students' participation in videoconference meetings during the 2020-2021 academic year is rather high, since more than half of them (53%) attended such meetings more times a day, and another 13.5% of the students attending at least once per day. 69.3% of the students attend videoconference meetings daily. Figure 1 shows that only less than 10% of the students manifest a lower exposure rate, this being under discussion due to the general frequency of online learning activities during the 2020-2021 academic year.
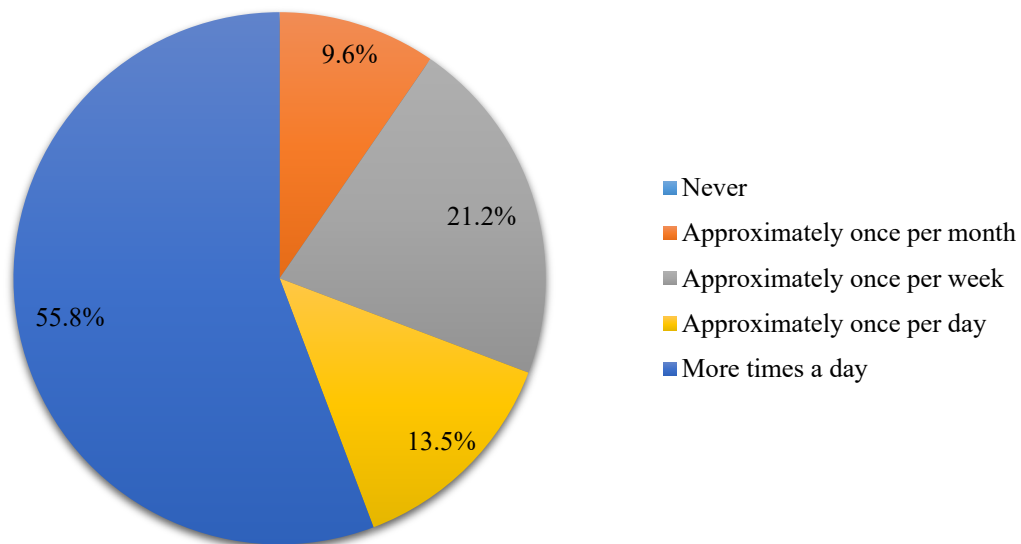

Figure 1. Frequency of participation to videoconference meetings

Interesting to notice are also the number of meetings students attend to on a normal day. The data shows that more than three quarters of them attend between 1 and 3 meetings, whence 15.4% of them even at 4 meetings in a regular day. Worryingly, 7.6% of the students mention that they attend to 5 to 6 meetings in a normal day. Even though the percentage is not at an alarming rate, this reality can also raise some questions and reflections. An interesting aspect of our analysis is that there is a significant correlation between the frequency of participation to videoconference meetings and the regular number of meetings in a normal day ($r = 0.421$, $p < .01$). In this regard, we can consider that higher frequencies of participation are more present in cases of students more engaged in online meetings during the day.

Some of the findings show that 75% of the students have maximum 30 minutes break time between the online meetings. In relation with the previous information, this shows that students manifest a high exposure rate to videoconference meetings, with small breaks between them. As for the meetings' duration, almost half of the students (46.2%) state that meetings duration is at least 45 minutes long. Analysing the device used for connecting to these meetings, more than half of the students (57.7%) prefer

PC / laptop devices rather than mobile ones, whereas only 9.6% use only mobile devices when connecting to online meetings.

Students do not have a general negative attitude towards videoconference meetings, since, on a 1 to 5 scale (where "1" means "Not at all" and "5" means "Very much"), 53.8% of the students manifest a relative attitude towards positive feelings linked with participating in videoconference meetings, and 25% of them even state that they enjoy the experience. When discussing about whether students like online meetings or not, 42.3% of them like online meetings and another closed percent (44.2%) have mixed feelings, only few of them not enjoying at all to attend online meetings (13.5%). On the other hand, when considering online meetings as a burden, almost a third of the students (30.7%) consider online meetings as a burden, whereas only 40.4% do not do so. Table 1 shows that significant correlations exists between these variables, such as between the appreciation rate of online meetings (marked as "Aprec_IOSV") and the pleasure of attending these meetings (marked as "Plac_IOSV") (r = .673, p < .001), as well as a negative correlation between considering meetings as a burden (markes as "Pov_IOSV") and the pleasure of attending the meetings (r = .-728, p < .001) and the appreciation rate (r = .-604, p < .001). This shows that students that like online meetings do not necessarily regard them as a burden, whereas those that consider them a burden tend to also manifest a low appreciation rate.

Table 1. Correlation matrix between "Plac_IOSV", "Pov_IOSV", and "Aprec_IOSV" variables

		Plac_IOSV	Pov_IOSV	Aprec_IOSV
Plac_IOSV	Pearson's r	---		
	p-value	---		
	95% CI Upper	---		
	95% CI Lower	---		
Pov_IOSV	Pearson's r	-0.728***	---	
	p-value	< .001	---	
	95% CI Upper	-0.569	---	
	95% CI Lower	-0.835	---	
Aprec_IOSV	Pearson's r	0.673***	-0.604***	---
	p-value	< .001	< .001	---
	95% CI Upper	0.799	-0.397	---
	95% CI Lower	0.490	-0.753	---

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

6.1. Students' fatigue level evaluation

The research analyses the five dimensions of Zoom fatigue of based on the "Zoom Exhaustion & Fatigue" scale (Fauville et al., 2021): general fatigue (marked as "OG"), visual fatigue (marked as "OV"), social fatigue (marked as "OS"), motivational fatigue (marked as "OM"), and emotional fatigue (marked as "OE"). All the items have been statistically analysed for validity based on the t-test statistics (p < .001), and for the normality condition through the Shapiro-Wilk test (p < .001), all the items being regarded as valid and fulfilling the normality condition. The items assessing the dimensions of the fatigue level have been measured on a 1 to 5 scale, where "1" means "Not at all" and 5 means "Very much".

6.1.1. General fatigue

Research shows that the general level of fatigue reaches quite high levels, based on the fatigue perceived by the students after meetings is close to the top level ($\mu = 4.13$, SD = 1.01), even though the physical ($\mu = 3.71$, SD = 1.11) and mental ($\mu = 3.73$, SD = 1.09) fatigue levels are more at a medium level. Nevertheless, based on these results, the general fatigue level is quite high above the average ($\mu = 3.86$, SD = 0.96). Interestingly, general fatigue is negatively correlated both with "Aprec_IOSV" ($r = -0.392$, $p < .01$) and with "Plac_IOSV" ($r = -0.327$, $p < .05$), showing that positive attitudes towards online meetings can lower the fatigue level at the end of the day. This is enforced also by the significant correlation between "Pov_IOSV" and the general fatigue level ($r = 0.491$, $p < .001$), showing that students that consider online meetings as burdens tend to be more exhausted at the end of the day.

6.2. Visual fatigue

Our analysis shows that visual fatigue meets lower levels than the general one ($\mu = 3.62$, SD = 1.18), but still higher than the average level of fatigue included in the measurement scale. Whence vision blurring is not so present among students ($\mu = 3.38$, SD = 1.29), the other two variables are still at high levels. In this aspect, students manifest both different levels of pain at the eyes level ($\mu = 3.75$, SD = 1.27) and eyes irritation ($\mu = 3.73$, SD = 1.25) after attending videoconference meetings. On the other hand, our analysis did not find any significant correlations between these variables and the students' attitudes towards participating in videoconference meetings, as was the case for the general fatigue dimension.

6.3. Social fatigue

On a different manner, the social fatigue variables are at a lower lever than the other, whereas even though students consider that they need to allow themselves more time ($\mu = 3.46$, SD = 0.979), they do not tend to avoid social contexts ($\mu = 2.52$, SD = 1.18) or to isolate themselves ($\mu = 2.56$, SD = 1.29) after attending videoconference meetings. On a statistical basis, we encountered a significant correlation between social fatigue and considering meetings as a burden ($r = 0.327$, $p < .05$), as well as of the need of students to spend some time alone and considering meetings as a burden ($r = 0.371$, $p < .01$), which shows that students who manifest negative attitudes towards online meetings tend to have also higher levels of social fatigue.

6.4. Motivational fatigue

Motivational fatigue is also at a relatively high level, both on a general basis ($\mu = 3.71$, SD = 0.933), but also considering the variables that compose this dimension: lack of energy for other activities ($\mu = 3.77$, SD = 1.10) and the burden of needing to do other tasks after meetings ($\mu = 3.60$, SD = 1.24). A significant correlation is also encountered between the motivational fatigue level and regarding online meetings as a burden ($r = 0.344$, $p < .05$), as well as a negative correlation between this fatigue dimension and the level of appreciation ($r = -0.314$, $p < .05$).

6.5. Emotional fatigue

Emotional fatigue level of the students is at an average rate (μ = 3.12, SD = 0.883), placing this dimension at a medium level in the fatigue level measurement. On a statistical basis, there still are some correlations that can be of interest for our research. There is a significant correlation between the level of emotional fatigue and considering meetings as a burden (r = 0.421, p < .01), this dimension also influencing some of the other components of the fatigue level.

One general statistical observation that appeared in our research is that the students' positive attitudes towards online meetings, such as Plac_IOSV (r = 0.305, p < .05) and Aprec_IOSV (r = 0.285, p < .05) are significantly correlated with the number of online meetings students attend to. We would tend to consider that this is because highly engaged and involved students (with high number of daily meetings and activities) valorise these experiences and manifest positive attitudes towards the meetings.

7. Conclusions

The special contexts determined by the health situation, correlated with the prevention measures adopted throughout the international educational area, moved educational activities from the classroom and amphitheatres to the small windows of online meetings in videoconferencing systems. Concepts such as "Zooming", "Zoom Fatigue" and "Zoombies" redefine the new issues, and the need for a continuous pedagogical adjustment of online education transcends the pandemic period in what is called the post-COVID era, strongly changed by the customs now formed (Griffin & Denholm, 2020). However, with the new normal of digitalised education, development directions must ensure a minimum level of digital discrimination (Dwivedi et al., 2020) so that no student is left behind for reasons of this nature (Pan & Zhang, 2020).

Using the ZEF scale (Fauville et al., 2021) to measure student fatigue from attending online meetings in videoconferencing, several interesting issues have been identified and, even more challenging, the data collected and analysed do not confirm some of the hypotheses of our research. Of course, this aspect, as mentioned before, discovers new directions of research, especially referring to student motivation and contextual factors that can influence the level of fatigue. Moreover, one of the limits of research, as in the case of the limits of the measurement scale, is precisely that not all the factors that can influence the level of fatigue of students are covered and mediation models that provide further explanations have not been developed. Regardless of the motivational elements specific for each student, exposure over a long period of time to videoconference meetings influence certain dimensions of the "zoom fatigue".

Our research shows that the students' general fatigue level is quite high on at least three of the five dimensions (OG = 3.86, OV = 3.62, OM = 3.71), whereas the overall fatigue is at a relatively high level (μ = 3.43, M = 3.60). Nevertheless, students manifest different fatigue levels due to participation in videoconference meetings, whereas different positive and negative attitudes can influence the level of fatigue at the end of the day. Educational practices need to further consider these indicators and address the most suitable manners in which alternations between onsite and online learning activities and

implemented, as well as considering the importance of health and wellbeing in the overall educational process.

Education in the post-COVID era will certainly know many of the practices learned during the pandemic, and education will no longer fully return to its former form. The online forms of carrying out some of the educational activities of the future cause us to use all the information from this period and, above all, to understand what are the elements that do not work satisfactorily. Pedagogical design and meaningful online activities are some of the prerequisites for success, and the opinions of students and students are highly relevant to any future educational construction. After all, any successful analysis must consider the opinion of its beneficiaries, and in this case, the lessons learnt by pupils and students are especially valuable in understanding what is not working properly and needs to be changed. Moreover, by ensuring a high motivational level, many of the technical and social barriers can be overcome, and the time invested with meaning and the establishment of digital learning communities can fundamentally contribute to the development of good practices in digital education, with a focus on inclusion, equity and equal access for all pupils and students.

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