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Occupational Risk of Technostress Related to the Use of ICT among Teachers in Spain

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Abstract: Teachers are frequently exposed to several occupational risks. The continuous use of Information and Communication Technologies (ICT) represents a potential source of technostress among teachers. The aim of the current research is to evaluate the technostress levels of school and high school teachers in Spain. The methodology applied in the manuscript, namely the staticized group technique was based on an expert panel. Results showed high levels of technostress in both dimensions (techno-anxiety and techno-fatigue). Experts highlighted the relationship between administrative tasks and technostress. More rational and efficient distribution of the workload associated with administrative obligations of the teachers, could reduce the level of technostress in the education sector. Results from the current research can help to improve working conditions of teachers considering the findings to design preventive strategies adapted to the profile of teachers and their organization. Some policy interventions such as occupational safety training, institutional technical support, and computer training programs could reduce the levels of technostress and mitigate associated negative impacts concerning the occupational health of teachers.

Keywords: teacher; education; technostress; occupational risk

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1. Introduction

Education is typically not considered a hazardous sector particularly when compared with traditionally risky sectors such as construction, manufacturing or mining. This is because fatal accident rates are lower in education [1] than in the cited sectors [2]. However, teachers are commonly exposed to several occupational risks associated with their daily tasks. Consequently, many of them are affected by occupational accidents [3,4] and occupational diseases [5,6].

On one hand, occupational injuries suffered by teachers have been previously studied in the literature [7]. Some authors identified risk factors for repetitive strain injuries [8], gender differences in their occupational accidents [3], and injury trends related to frequency and severity in urban schools [9]. On the other hand, occupational diseases among teachers have also been analyzed by previous authors. These studies have investigated diseases such as burnout [10,11], depression [12,13] and voice disorders [6,14]. These accidents and diseases are associated with multiple factors [7]. In order to identify these factors, some researchers found that working conditions such as stress, job demand, and poor sleep quality were associated with musculoskeletal pain in public school teachers [7,15].

Specific characteristics of the teaching profession are potential sources of stress and psychosocial damage [16] and current teachers' working conditions are clearly influenced by the presence of Information and Communication Technologies (ICT) [17,18]. The implementation of ICT can provide benefits to users. However, it can also produce negative

consequences in job satisfaction, productivity, and well-being of workers [19]. One of these possible negative effects is technostress.

The concept of technostress can be defined as a personal condition resulting from the inability to healthily adapt to ICT use [20]. Other authors defined it as any negative impact on attitudes, behaviors, or body physiology produced by technology [21]. Technostress can be associated with different stressors such as overload, job insecurity, and role ambiguity [22,23]. The negative consequences for organizations with high levels of technostress are: decrease of organizational commitment and job performance, low satisfaction with technologies, and high turnover rates [24]. Moreover, other authors pointed out that technostress increased the number of workers affected by burnout, anxiety and depression at work [25–27]. However, the negative consequences caused by technostress, are not limited to the work-environment, and frequently their effects are related with family matters such as work–family conflict and greater family burnout [28]. It is demonstrated that receiving messages or emails after the working day interferes with family issues [29] and contributes to work–family conflicts [30].

The negative impact of technostress in the workforce can be influenced by different factors such as age, gender, training on ICT, working environment, and workload [31]. In this sense, previous research found that older and more experienced workers reported greater difficulties with the increase of IT complexity for completing their tasks [32]. In a similar study, women presented higher levels of techno-uncertainty, while men reported greater effects from techno-invasion. In contrast, there were no differences detected associated with education levels of the workers [33].

The problem of technostress among teachers is increasing with the fast integration of ICT in schools, especially in many developed countries. Consequently, research that focuses on the problem can be found in the literature [34–36]. Previous authors identified levels of technostress among teachers from schools and high schools. Their results pointed out that female teachers presented lower incidence of techno-fatigue and techno-anxiety than male teachers [34]. Other authors concluded that causes of technostress are the same in different regions, but suitable solutions can be different [36].

In addition, motivated by circumstances of the COVID-19 pandemic, the ICT tools grew exponentially in importance, and technostress issues emerged as an important cause of concern. As a result, researchers investigated the problem in the pandemic period [37–40]. Some results found a significant and negative relationship between technostress and the teachers' willingness to use online modalities [38] while another study pointed out higher levels of fatigue and anxiety factors among female teachers during the health crisis [37].

Although the current trend of the pandemic is facilitating a return to face-to-face education, many ICT tools integrated during online teaching, have been maintained in face-to-face courses.

For a better understanding of the technostress problems among teachers, some researchers identified different factors that act as creators of technostress, such as techno-insecurity, techno-overload, or techno-complexity [41]. Aligned with this, relationships among specific technostress inhibitors (literacy facilitation, technical support provision, and involvement facilitation) and creators (techno-overload, techno-complexity, techno-insecurity, and techno-uncertainty) and their impacts on teachers' work performance were identified [42]. The authors concluded that technical support provision might have significant curbing effects on three technostress creators.

Workload is another important factor related with technostress. It was found that several teachers feel overwhelmed by the high demand for ICT-related tasks, seeing an extension of their working hours with updates for students and administrative tasks, from their own home [43]. Aligned with this finding, other authors identified work overload as a strong precursor of technostress [44].

Although a moderate and controlled level of stress is necessary for the successful performance of some teaching tasks, excessive stress bears negative impacts on individual

well-being. In order to avoid the negative consequences of stress, some researchers tried to define the limit at which new technologies become a source of technostress [45].

Based on the existing literature, the importance of technostress in the education sector can not be denied. Thus, the aim of the current research is to analyze the occupational risk of technostress among teachers in Spain.

2. Methodology

The methodology applied in the manuscript was the staticized group technique. It is a Delphi group technique with only one single round. The Delphi technique [46], can be defined as a systematic and interactive research method for obtaining the judgement of a panel of independent experts on a specific topic. Members of the expert panel are selected according to predefined guidelines and they are asked to participate in one or more rounds of structured surveys in a collaborative approach. An anonymized summary of participants' results is provided, following each round. In the next round, experts are encouraged to review the anonymous opinion of the other experts and revise their previous inputs according to the results obtained in the previous round. The aim of this review after each round is to decrease the variability of the results and achieve a consensus of a correct value. Once the consensus is achieved or a number of predefined rounds are completed, the Delphi method is concluded.

The staticized group technique and the Delphi Method are considered very similar. The only methodological difference is the absence of feedback or additional rounds in the staticized group technique. In fields such as Information Systems [47], or worker's safety [48] the Delphi method has been applied successfully. Some studies have presented different opinions about the accuracy of consensus in Delphi method. Some authors did not report important differences in the accuracy of the results between Delphi and staticized groups [49,50]. In contrast, other researchers [51] are more receptive to the use of staticized groups because the participants are not led to reach a consensus on a value that is not shown to be the best value. This is the main reason for using staticized groups in the present study.

2.1. Participants Selection

In the staticized groups technique, the expert selection is a very important step. The expertise of a panel member is another key aspect [46]. To ensure adequate levels of expertise, guidelines for the selection of experts with a flexible point system were defined. The adaptation of the suggested point system to the specific aim of our research are detailed in the experts' requirements included in Table 1.

Table 1. Flexible point system for teacher selection.

Achievements or Experience	Code	Points
Habitual user of ICT at work	A1	4
Year of experience	A2	1
Training in OHS	A3	2
Training in ICT	A4	3

The authors contacted 25 potential participants from 5 different schools and high schools, in the Region of Andalusia, Spain. Finally, 16 teachers fulfilled the expertise requirements and completed the technostress questionnaire provided [52]. Half of the selected experts were men and the other half were women. All members of the panel scored at least 12 points in the addition of the four achievements (Table 2).

Table 2. Expert scores in the flexible point system.

Expert	A1	A2	A3	A4	TOTAL
1	4	17	2	3	26
2	4	10	2	3	19
3	4	25	2	3	34
4	4	15	2	3	24
5	4	16	2	3	25
6	4	6	2	3	15
7	4	11	2	3	20
8	4	15	2	3	24
9	4	33	2	3	42
10	4	14	2	3	23
11	4	4	2	3	13
12	4	15	2	3	24
13	4	5	2	3	14
14	4	11	2	3	20
15	4	9	2	3	18
16	4	12	2	3	21

2.2. Technostress Questionnaire

The questionnaire chosen after a literature review was the Technostress questionnaire (Table 3) included in NTP-730 (Technical Note of Prevention) [52]. The questionnaire has successfully been used in previous research [34,35]. It comprises 16 items, divided in 4 different dimensions: fatigue, anxiety, skepticism, and inefficiency. Each item was evaluated according to the following scale: (0) Never; (1) Near never; (2) Rarely; (3) Sometimes; (4) Often; (5) Very often; (6) Always.

Table 3. Technostress questionnaire [52].

Dimension	Item/Question
Fatigue	I1-With the passage of time, technologies interest me less and less.
Fatigue	I2-I feel less and less involved in the use of ICT
Fatigue	I3-I am more cynical about the contribution of technologies in my work
Fatigue	I4-I doubt the meaning of working with these technologies
Anxiety	I5-I find it difficult to relax after a day's work using them
Anxiety	I6-When I finish working with ICT, I feel exhausted
Anxiety	I7-I am so tired when I finish working with them that I can't do anything else
Anxiety	I8-It's hard to concentrate after working with technologies
Skepticism	I9-I feel tense and anxious when working with technologies
Skepticism	I10-It scares me to think that I can destroy a large amount of information by improper use of it
Skepticism	I11-I hesitate to use technologies for fear of making mistakes
Skepticism	I12-Working with them makes me feel uncomfortable, irritable and impatient
Inefficiency	I13-In my opinion, I am ineffective using technologies
Inefficiency	I14-It is difficult to work with information and communication technologies
Inefficiency	I15-People say I am ineffective using technologies
Inefficiency	I16-I am unsure of finishing my tasks well when I use ICT

2.3. Data Collection

The next step after the selection of the experts and the most suitable questionnaire, was to provide the questionnaire to participants. The questionnaire was delivered using strategies to reduce the following judgment-based bias.

- Dominance: Anonymity of the experts was maintained to avoid the influence of one member over the ratings of other members.
- Primacy effect: To avoid the unconscious assignment of more importance to the initial questions, the order of the questions were randomized before providing them to the expert.

- Contrast effect: This bias occurs when the perception of an item is enhanced or diminished by the value of the immediately preceding item. This was resolved by randomizing the order of items for each expert.

Once the results were collected, feedback was provided to the experts. Then, experts were asked to comment on the results, and to identify potential causes associated with technostress, and to propose possible solutions.

3. Results

Based on the opinion of the experts, different results were obtained and classified in the four categories of the questionnaires collected (Table 4).

Despite no consensus requirement for the staticized groups methodology, variance was calculated in order to compare the results obtained with the Delphi method approach with additional rounds of feedback. The majority of items obtained values of under 10% variance. Only one item obtained a higher value (12%). Reliability of the questionnaire was calculated with Cronbach's Alpha value. All items together obtained a Cronbach's Alpha = 0.77. This value is considered as a satisfactory and fairly high level of consistency [53]. The separated Cronbach's Alpha value calculated per category also obtained acceptable values of reliability (fatigue = 0.63, anxiety = 0.70, skepticism = 0.56, and inefficiency 0.54). Two dimensions of technostress were analyzed:

- Techno-anxiety dimension is composed by scores in anxiety, skepticism, and inefficiency.
- Techno-fatigue dimension is the result of combination of scores in fatigue, skepticism and inefficiency.

A high score in only one subscale of the dimension, is insufficient to conclude high values of the dimension. In the following subsections, scores obtained for techno-anxiety and techno-fatigue are described and discussed.

3.1. Techno-Anxiety

Techno-anxiety has been defined by previous authors as an unpleasant physiological activation and discomfort due to the present or future use of ICT [54]. Based on the opinion of the experts, teachers in schools and high schools are exposed to high levels of techno-anxiety (Anxiety = 4.828, Skepticism = 3.719; Inefficiency = 2.938). The majority of experts scored high-frequency values regarding the statement *When I finish working with ICT, I feel exhausted*. Similarly, they found it difficult to relax after a day's work using ICT.

Table 4. Results from panelists based on technostress questionnaire.

Exp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
I1	4	4	5	5	6	5	4	3	3	4	4	3	3	3	5	4
I2	3	2	3	5	5	4	3	3	4	3	5	3	3	3	4	5
I3	4	5	4	4	5	5	4	4	3	4	5	3	4	3	5	4
I4	4	5	4	4	5	5	4	4	4	5	4	4	5	5	5	5
I5	5	6	4	6	4	4	3	4	4	5	4	4	4	3	5	5
I6	5	6	6	6	5	5	4	5	5	6	5	5	4	3	5	5
I7	5	6	6	5	6	5	4	5	4	5	5	5	5	4	5	6
I8	5	5	5	4	5	5	5	5	4	5	5	6	5	4	5	5
I9	4	4	5	5	4	4	4	4	5	4	4	5	4	4	5	5
I10	3	3	4	4	5	3	3	4	5	6	3	4	3	4	4	3
I11	2	2	4	3	4	3	3	4	4	5	4	3	3	4	4	3
I12	3	2	3	3	4	3	4	3	4	3	4	3	3	3	3	4
I13	3	3	4	5	5	4	2	4	3	4	3	3	2	2	3	4
I14	3	3	4	3	3	4	3	4	3	4	3	3	3	2	4	4
I15	1	1	3	3	3	2	0	3	2	4	3	3	2	2	4	3
I16	2	2	3	3	2	2	3	2	2	2	3	3	3	3	4	3

3.2. Techno-Fatigue

With regard to techno-fatigue, it can be defined as mental and cognitive exhaustion associated with the use of ICT. Techno-fatigue is commonly linked with skeptical attitudes and feelings of inefficiency concerning the use of ICT. Results obtained for techno-fatigue (Fatigue = 4.078, Skepticism = 3.719; Inefficiency = 2.938) showed high values associated with the cited dimension. Similarly, recent studies detected levels of techno-fatigue among teachers before the pandemic [34], and after the health crisis [35].

4. Discussion

Techno-anxiety results are aligned with previous studies which pointed out the negative effects of techno-anxiety [34]. These high levels of anxiety can be motivated by different reasons, e.g., lack of digital training, low institutional support or pressure to use emerging technologies without adequate training.

A lack of digital skills demotivates teachers who are unable to help students develop competence in an area that they themselves do not possess proficiency in [55]. Previous authors pointed out that older and experienced workers presented more difficulties with the increase of technological complexity [33]. As a consequence, more experience is not necessarily associated with more training related with technological skills. In contrast, other authors did not find association between age and technostress [56].

Although significant differences were not detected in the level of ICT competence based on the gender of the teachers [57], male teachers tend to be less stressed and nervous when they have to integrate ICT in their classrooms [58]. In contrast, in a study developed among Chilean teachers it was found that that male teachers were more techno-anxious than their female peers [34]. Therefore, gender might be a risk factor for techno-anxiety problems.

Inadequate training programs in new technologies, and an excessive implementation of new digital resources, may be some of the causes that generate levels of techno-anxiety that are higher than recommended.

Previous authors demonstrated that teachers' techno-anxiety could be mitigated by increasing their skills to solve technological problems [59]. These authors were unable to identify specific training for ICT focused on teachers to increase their technolgical skills and capability of resolving technological problems, and subsequently designed a specific course for this objective. Their findings demonstrated the success of the training when it comes to increasing ICT problem-solving skills and reducing techno-anxiety. Similar results were obtained for aligned experiences focused on teachers' training [60].

Influence factors in techno-fatigue among teachers such as age or gender have been studied in previous research works [34]. Their results did not show a statistically positive relationship between teachers' age groups and the techno-fatigue levels measured.

In this sense, techno-fatigue seems to be more aligned with organizational factors such as workload and the number of tasks to be performed than with personal factors such as gender, age or experience.

Aligned with these results, other authors did not find linear trends between age and technostress [61].

A summary of the main additional comments from experts is shown in Table 5. Some experts pointed out that work overload is very common among teachers. In line with this finding, previous authors detected a relevant association between work overload, chronic stress, and burnout among teachers [62,63]. Similarly, other authors found overload as a factor of occupational stress among high school teachers [64,65].

The expert participants highlighted that a majority of work overload is not associated with teaching in the classroom. Rather, they are associated with administrative tasks which are largely considered as a waste of time by the teachers. An expert commented "*I feel more like an office worker, or a clerk than a teacher*". Another expert remarked "*I spend too much time filling forms and formal requests. They do not improve the quality of my teaching, and they steal my time for updating my lessons*". In this regard, an experienced teacher commented "*When I started to teach, we had no computers at the school, and my administrative*

workload was lower. Have my teaching and working conditions really improved with computers? I cannot say yes". The problem of administrative tasks as a source of stress has been studied in the case of secondary principals [66], and it was reported that inadequate school facilities, work overload and poor conditions of service generated administrative stress for principals. The administrative overload is not very different for the rest of the teachers [67]. A preventive measure suggested in the literature is the limitation of the amount of extra work teachers are required to complete [68,69].

These considerations exposed by teachers should be considered by educational institutions in order to reflect on the working load of teachers. Administrative tasks should be redesigned and useless obligations should be removed from the teachers' scheduling.

Table 5. Expert comments about some concerns associated with ICT.

Problems	Experts Opinion
Workload and ICT	*I feel more like an office worker, or a clerk than a teacher.*
	I spend too much time filling forms and formal requests. They don't improve the quality of my teaching, and they steal my time for updating my lessons.
	When I started to teach, we had no computers at the school, and my administrative workload was lower. Have my teaching and working conditions really improved with computers? I cannot say yes.
ICT support	*I don´t know who can officially help me with my doubts. Finally I ask my colleagues only.*
	Some platform interfaces are not easy to use.
ICT training	*Software updates are faster than ICT training received.*

5. Conclusions

This research disclosed the levels of technostress among teachers in Spain, based on the opinion of a group of expert teachers. Findings of the current study strengthen knowledge on the issue. Key information is obtained regarding the design and integration of the strategies and preventive measures for the appropriate and sustainable use of ICT among teachers.

Results showed high levels of techno-anxiety and techno-fatigue in schools and high schools. Items related with techno-anxiety obtained the highest scores. Therefore, preventive measures to mitigate their negative consequences should be implemented in the workplace. Specific ICT training designed for better integration of ICT in the daily tasks of teachers would improve their technological skills and reduce levels of techno-anxiety. However, it is difficult to find validated and specific training in the literature that focuses on this issue.

Although results might be influenced by recent pandemic circumstances with several online courses, all teachers selected were teaching face-to-face. Thus, their opinions were focused on face-to-face courses. Experts highlighted the relationship between administrative tasks and technostress. In this regard, a more rational and efficient distribution of the workload associated with administrative obligations of the teachers, could reduce the level of technostress in the education sector.

Despite the importance of technostress in the education sector, teachers pointed out the absence of specific preventive measures to prevent the associated psychosocial risks, and their negative consequences on the well-being of the teachers.

Results from the current research can help to improve working conditions of the teachers considering this information to design preventive strategies adapted to the teachers' profiles and their organization.

An analysis of the administrative tasks carried out by teachers should be conducted in order to identify useless workload and reduce mental fatigue of the teachers associated with their administrative roles.

Some policy interventions such as occupational safety training, institutional technical support, specific ICT training, and organizational commitment, could reduce the levels of technostress and mitigate the negative health impacts of teachers.

5.1. Limitations

The selection of the experts was limited to a local environment, in only one country. In order to obtain more global and comparable results, the future research should include teachers from additional countries.

The preventive measures proposed by the experts were not applied and tested in schools and high schools. It would be interesting to test the efficiency of the training programs or technical support among different groups of workers, with different levels of experience with ICT.

In future research, experts could be separated in different categories based on their age, gender, or computer skills. It would be interesting to compare the opinions of additional groups of experts selected and classified according to relevant personal and organizational variables identified as potential influence factors of technostress.

5.2. Future Research

Results obtained can be applied in future research in different ways.

On one hand, the design of specific training programs focused on ICT technologies should be a priority to improve teachers' working conditions. Lack of adapted training to mitigate technostress was detected in the development of the current research. The design and validation of these programs should consider the results collected from the experts in the items with higher scores. Additionally, the effectiveness of the programs could be tested and compared with the current research results.

On the other hand, the administrative overload highlighted by the experts is another remarkable result. This finding should be the first step to evaluating the existing administrative tasks developed by teachers and generating conditions that optimize this work.

Educational authorities and organizations should reflect on the reasonable and sustainable use of ICT in relation to teachers' administrative and teaching tasks, in order to mitigate inadequate levels of occupational risk associated with technostress.

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Abbreviations

The following abbreviations are used in this manuscript:

A Achievement
I Item

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