

## Multivariate statistical analysis of the work stress phenomenon in schoolteachers during the current pandemic context in Chile

### Análisis estadístico multivariante al fenómeno de estrés laboral presente en los docentes escolares durante el reciente contexto de pandemia en Chile

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**Abstract.** Job stress in teachers has been a reality evidenced in qualitative terms in Chile. In fact, studies have shown that stress levels in the world population have increased due to health restrictions and the reformulation of the working day caused by COVID-19. Consequently, this research focuses on the perception of stress in school education teachers during the pandemic context in Santiago, Chile. Its objective is to analyze teacher stress using multivariate analysis techniques. The analysis of the ED-06 teacher stress survey sought to establish general trends and connections between different social phenomena related to the perception of stress in teachers. The results showed that a significant group of teachers expressed discomfort with their current work situation and felt overwhelmed by the excessive workload associated with the transition from classroom teaching to teleworking. The work overload affects the physical and mental functioning of the teachers, so it can be deduced that, as the days go by and with little improvement in the pandemic, greater mental exhaustion could appear. The study concluded that a significant sample of teachers reported that work overload and fatigue were related to a pre-pandemic tendency linked to the so-called "historical debt" and to the precarious work situation suffered by a segment of the national teaching profession. Thus, stress would not be a variable determined only by the pandemic but is a long-standing phenomenon.

**Keywords:** educational work contexts, stress, teachers, pandemics, multivariate statistical analysis

**Resumen.** El estrés laboral en los profesores ha sido una realidad evidenciada en términos cualitativos en Chile. De hecho, estudios han demostrado que los niveles de estrés en la población mundial han aumentado debido a las restricciones sanitarias y a la reformulación de la jornada laboral provocada por el COVID-19. En consecuencia, esta investigación se centra en la percepción de estrés en profesores de educación escolar durante el contexto de pandemia en Santiago de Chile. Su objetivo es analizar el estrés docente empleando técnicas de análisis multivariante. El análisis de la encuesta de estrés docente ED-06 buscó establecer tendencias generales y conexiones entre distintos fenómenos sociales relacionados con la percepción de estrés en los docentes. Los resultados mostraron que un grupo significativo de profesores expresaba su malestar por su situación laboral actual y se sentía desbordado por la excesiva carga de trabajo asociada al paso del presencialismo al teletrabajo. La sobrecarga de trabajo afecta el funcionamiento físico y mental de los profesores, por lo que se puede deducir que, con el paso de los días y las escasas mejoras de la pandemia, podría aparecer un mayor agotamiento mental. El estudio concluyó que una muestra significativa de docentes refirió que la sobrecarga de trabajo y el cansancio se relacionan con una tendencia prepandémica vinculada a la llamada "deuda histórica" y a la precariedad laboral que sufre un segmento del magisterio nacional. Así, el estrés no sería una variable determinada solo por la pandemia, sino que es un fenómeno de larga data.

**Palabras clave:** contextos laborales educativos; estrés; profesores; pandemias; análisis estadístico multivariante.

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## Introduction

This section will examine a series of theoretical perspectives oriented towards the definition of stress and its relation to teaching during the current pandemic context. According to neurobiologist Alon Chen, the levels of stress and depression in the population have risen alarmingly during the COVID-19 pandemic because confinement and social distancing have diminished the instances of socialization of the population (Chen, 2019).

In the same way as Chen, the philosopher Byung-Chul Han has stated that COVID-19 has generated in the population the need to confine themselves to their homes to resist the pandemic. However, voluntary reclusion has imposed a new form of reality and daily life, which is removed from a meaningful life. Thus, because of the fear of death and contagion, individuals have sacrificed their well-being for the sake of ensuring their own survival (Chul-Han, 2020).

The absolutization of survival has introduced extreme levels of self-care in individuals that have broken the social bonds that were previously constitutive of life in society, such as sociability in school. As Chen has argued, socialization is one of the methods to alleviate anxiety, depression, and stress. If we do not have socialization contexts, individuals tend to become self-absorbed and, therefore, increase the risk of suffering from a mental health problem.

The closure of the main schools in Chile and the confinement of the children were factors that aggravated the situation of stress and depression suffered (and still suffers) by a significant percentage of children. In this respect, according to international studies, one out of every seven children in the world has been at risk of suffering mental health problems due to confinement (Robinet & Pérez, 2020). Moreover, stress and depression have not only affected students; on the contrary, teachers have been one of the professional groups that have suffered the most stress. According to a study conducted by the University

del Desarrollo (UDD) (Santiago of Chile) in conjunction with University Andres Bello (UNAB) (Santiago of Chile) and “Fundación para el Liderazgo de Chile” (FLICH), 84.7% of the teachers surveyed said they felt overwhelmed and stressed by their work overload. In addition to this reality, during the pandemic, teleworking has de-regulated working hours since, according to certain studies, working hours have increased during telematic and distance work (since, in many cases, the hours are not correlative). Furthermore, the working day overlaps with other activities, such as child and elder care, or a second job, leading to added stress (ECLA, 2020).

It is noteworthy that the effects of confinement have radicalized the levels of fatigue and work stress among teachers. Nevertheless, fatigue and stress have not been phenomena initiated exclusively by the pandemic, as they were already causing havoc in teachers' mental health several decades ago and without confinement. In fact, the writer and Nobel Prize winner, Peter Handke, has referred to fatigue and stress as an inherent effect of contemporary life (Handke, 2006).

Handke differentiates between two types of tiredness: on the one hand, there is the tiredness produced by enriching activities based on the creative will of individuals (the good tiredness). On the other hand, there are the negative tiredness produced by the anguish caused by the uncertainties of contemporary life, such as labor exploitation, unemployment, poverty, loneliness, and social exclusion.

Influenced by Handke, Han himself wrote *The Society of Tiredness* (Chul-Han, 2012) a book in which Han argued that the increase in mental illnesses such as stress, depression, and anxiety is caused by the irrepressible pursuit of economic and social success imposed by the narratives of economic advancement and social triumph. Hence, stress would not only be a biological condition (produced by the human organism in circumstances of danger), but a perverse effect of the effort made by individuals on their way to achieving success, sumptuousness, and glamour of current models of virtuousness.

Concerning the above, the tiredness and stress produced by exhausting working hours are linked to the de-regulation of the work regime. Continuing with the ideas of Byung-Chul-Han, the freedom that individuals have to work and enrich themselves through their exclusive labor capacity has generated that the burden of work itself falls exclusively on individuals, which generates tiredness and stress (Han, 2012).

Quantitative studies carried out in Brazil and Spain on the phenomenon of stress in teachers have shown that work overload and a high number of students induce teachers to generate stress and burnout (Krapp et al, 2021). Likewise, vocational dissatisfaction, job insecurity or high levels of school violence also have an impact on teacher stress (Valero et al, 2022). That said, this paper seeks to reflect on the phenomenon of teacher stress based on quantitative data collected through interviews with teachers from schools in the city of Santiago de Chile.

## Materials and Methods

Therefore, this paper aims to statistically analyze the perception of teachers regarding stress in their own work context. In order to achieve this objective, semi-structured interviews were conducted, as well as the databases constructed by the institution Elige Educar [Choose to Educate] were used. Subsequently, the data were examined through statistical techniques of multivariate analysis.

The study was conducted in schools in the Santiago Centro District [Santiago Centro], in the Metropolitan region. The interviews were conducted in June 2021. For the purpose of our research, the investigation was carried out through the ED-06 teacher stress survey, which consists of 76 questions. The survey was applied to 30 teachers from the school “España” [Spain] (15 women and 15 men).

They are teachers from the following disciplines: social, educational, mathematical a health science. The answers were formalized to the Likert scale. The ED-6 teacher stress scale has enough qualities to be used for at least three purposes: stress problems in teachers, level of teacher discomfort, possible causes and consequences, and, finally, to provide information for research (Gutierrez, Mora & Sanz, 2005).

This quantitative research is based on a positivist paradigm, which is defined as an attitude or a way of thinking that focuses on the quality inherent only to those facts that can be directly captured by the senses and submitted to empirical verification (Quivy, 2005) Furthermore, it has a descriptive and correlational scope and a non-experimental design (Hernández-Sampieri, 2014; Pérez, 2015).

The analysis carried out in this research is based on Cronbach's alpha: a method that is an average of the correlations between the variables that are part of the scale. It can be calculated in two ways: from the variances (Cronbach's alpha) or the item correlations (standardized Cronbach's alpha). Hence, Cronbach's alpha was calculated from the variances under the formula (Ward, 1963; Nieto, Galindo, Leiva & Vicente-Galindo, 2014).

:

$$\alpha = \left( \frac{k}{k-1} \right) \left| 1 - \frac{\sum V_i}{V_t} \right|$$

Likewise, the correlation of variables of the mathematical operation is defined by the following values (Husson, Josse, Mazet, d'agrocampus & Le, 2020):

$$\alpha = \text{Cronbach's Alpha} = \frac{\text{Number de items } V_i}{\text{Variance of each item } V_t} = \text{Total variance}$$

The principal component analysis (PCA) is a technique used to describe a data set in terms of new, uncorrelated variables ("components"). Therefore, the components are ordered by the amount of original variance they describe, making the helpful technique for reducing the dimensionality of a data set. This study used R software, created by Ross Ihaka (New Zealand) and Robert Gentleman (Canadian), and for Principal Component Analysis using the FactoMineR and factoextra libraries (Husson, Josse,

Mazet, d'agrocampus & Le, 2020).

### Results

The results are displayed in a general form. Specifically, the trend of the entire sample is shown for each question under the following legend: (1) Strongly agree (brown) (2) Partially agree (light brown) (3) Neutral (light blue) (4) Partially disagree (light green) and (5) Strongly disagree (green).

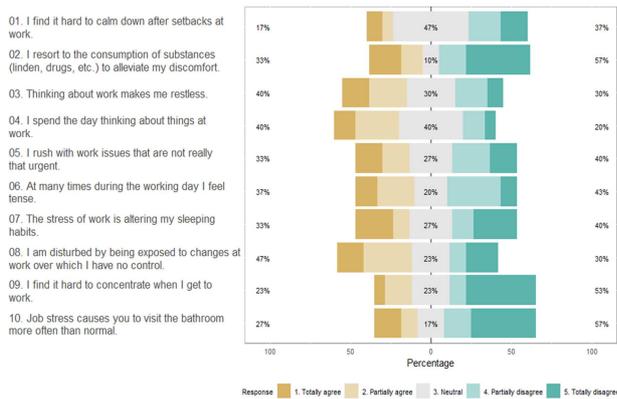


Figure 1. Distribution of the sample block 1. Source: (Elige Educar, 2020).

Figure 1 shows that 33% of respondents use substances to alleviate work overload, 40% show uneasiness when thinking about work, and another 33% say their sleep habits are altered. Finally, 47% say they are disturbed by being exposed to changes in their work over which they have no control.

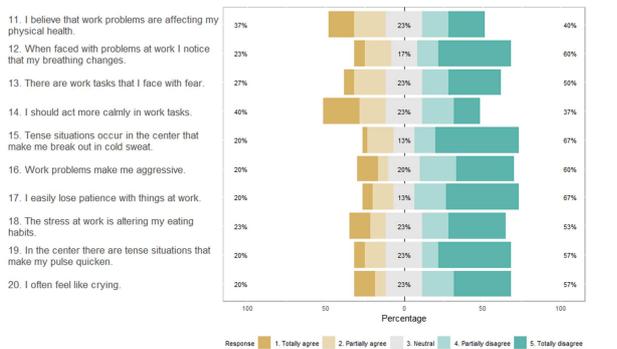


Figure 2. Distribution of sample block 2. Source: (Elige Educar, 2020).

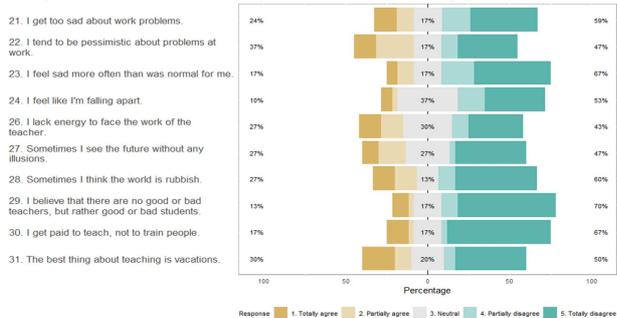


Figure 3. Distribution of sample block 3. Source: ( Elige Educar, 2020).

From Figure 2, it can be concluded that 37% of the respondents believe that their physical health is affected by

work problems, and another 27% claim to act with fear after some work tasks.

It can be concluded from Figure 3 that 37% of the respondents tend to be pessimistic in dealing with the work problems that arise, while only 10% tend to fall apart and suffer from Burnout.

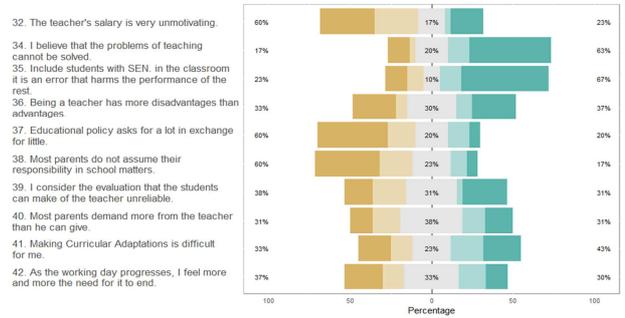


Figure 4. Distribution of sample block 4. Source: (Elige Educar, 2020).

Figure 4 shows that 60% of teachers say that their salary is not very motivating, and that the educational policy asks for a lot in exchange for very little for the work they do. On the other hand, 60% of those surveyed say that parents do not assume their school responsibilities with their children, leaving all responsibility to the teachers.

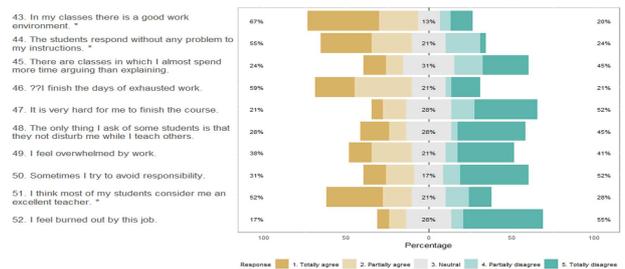


Figure 5. Distribution of sample block 5. Source: (Elige Educar, 2020).

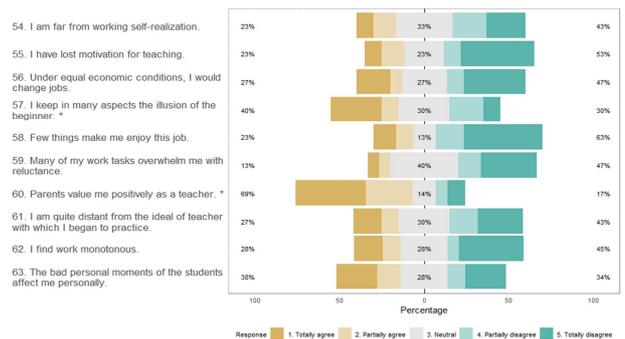


Figure 6. Distribution of sample block 6. Source (Elige Educar, 2020).

Figure 5 shows that 59% of respondents say they feel exhausted after the end of the workday, and another 38% say they feel overwhelmed by work; however, 67% of respondents say they have an excellent working environment in their classrooms.

In Figure 6, it can be seen that 23% of the respondents say that they have lost their motivation for teaching, and 13% say that they are discouraged because it is not what they had planned to work for.

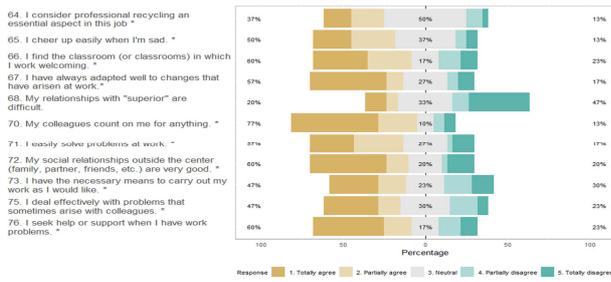


Figure 7. Distribution of sample block 7. Source: (Elige Educar, 2020).

Figure 7 indicates that 30% of the teachers do not have the necessary means to carry out their work, which leads to extra mental exhaustion during each workday.

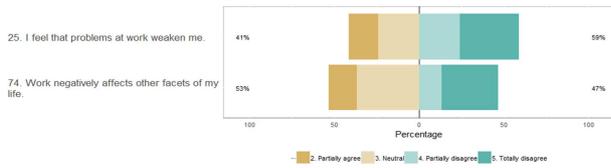


Figure 8. Distribution of the sample questions 25 and 74. Source: (Elige Educar, 2020).

Figures 8 and 9 were individualized since questions 25 and 74, in the case of figure 9, did not present any "Strongly agree" response. On the other hand, questions 33,53,69, corresponding to Figure 10, did not present any

"Partially disagree" answers. Figure 9 stands out firmly that 41% of teachers feel weak due to work problems. Additionally, 53% say that their work negatively affects other aspects of their daily lives.

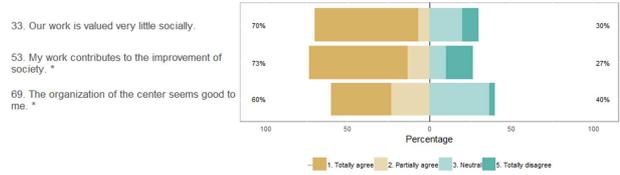


Figure 9. Distribution of the sample questions 33,53 and 69. Source: (Elige Educar, 2020).

Figure 9 shows that 70% of the teachers surveyed state that teaching is not highly valued by society and civil organizations.

Figure 10 provides the chart of the correlation matrix for the ordered set of questions, showing, in a general way, high correlations between certain groups of questions. These correlations are represented in the strong red colors as high inverse correlations, strong blue colors as high direct correlations, and white or faint blue and red colors as zero or low correlations, respectively.

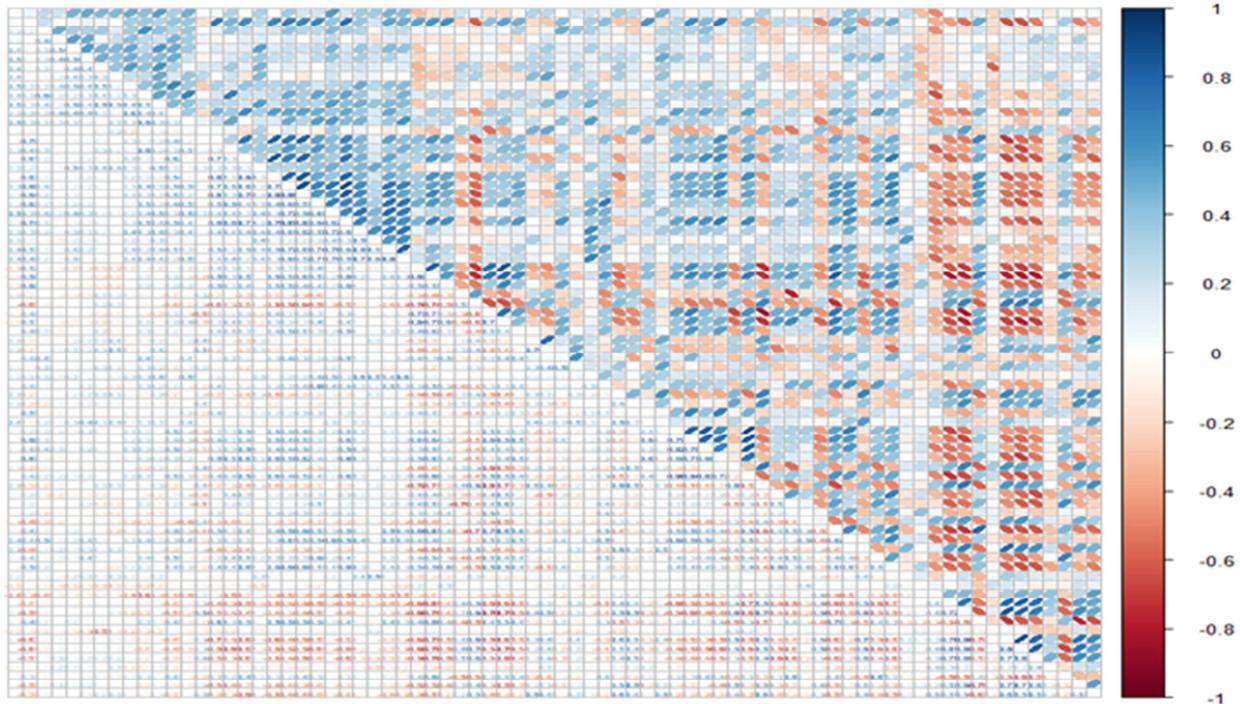


Figure 8. Chart of the correlation matrix. Source: own elaboration

Based on Figure 10, it is evident that under the set of variables corresponding to the ED-6 survey questions, there are strong correlations, either inverse or direct,

between a large number of questions, which suggests conducting a principal component analysis to reduce the dimensions.

In statistics, principal component analysis (PCA) is a technique used to describe a data set in terms of new, uncorrelated variables (components). The components are ordered by the amount of original variance they describe; hence it is a technique for reducing the dimensionality of a data set.

Technically, PCA seeks the projection according to which the data are best represented in terms of least squares. It converts a set of observations of possibly correlated variables into a set of values of non-linearly correlated variables, called principal components.

At this stage, R software was used for principal component analysis using the FactoMireR and factoextra libraries.

Following the observation mentioned, referring to the correlation matrix in Figure 10, in this study, a principal component analysis was performed, for which, in Figure 11, the variance absorbed by each component is shown. It can be concluded that the five components absorb more than 60% of the total variance of the data.

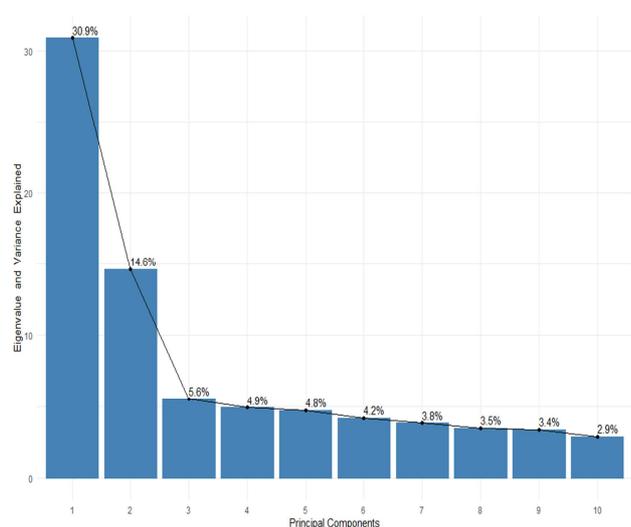


Figure 9. Variance by principal components. Source: own elaboration

Table 1 shows the p-value and its significance, calculated using the R software, for each question, concluding that there are no significant differences between the answers given by the different sexes in each question, except for questions 7, 10, and 14.

Table 1.

Significant differences by sex.

Questions	U Mann-Whitney	p-value	Sign.	Questions	U Mann-Whitney	p-value	Sign.
Q07	165.5	0,0126	Sí	Q10	156.0	0,0316	Sí
Q14	175.5	0,0040	Sí				

Source: own elaboration.

Figure 12 shows the large number of questions in the ED-6 survey that could be grouped into components 1 and 2 of the described PCA, suggesting that the instrument could be improved for more consistent analysis. Regarding the analysis by factors, the responses at the level of sex and subject.

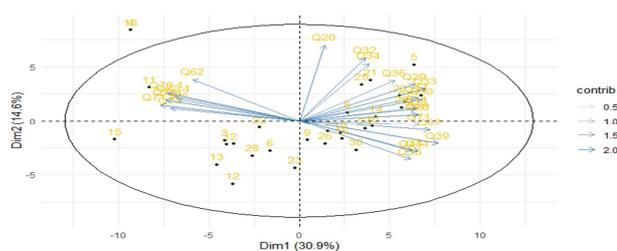


Figure 10. Biplot of components 1 and 2. Source: own elaboration

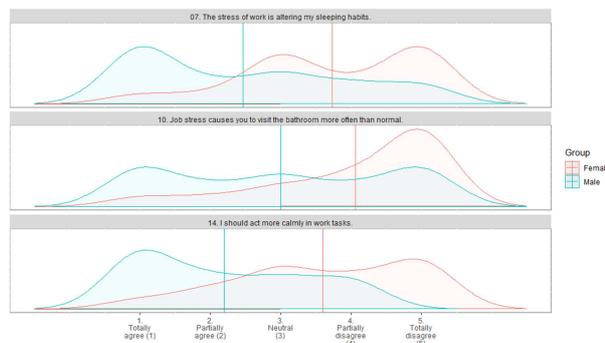


Figure 11. Distribution by sex in questions 7, 10 and 14. Source: own elaboration.

Based on the previous table, Figure 13 shows the difference in responses by sex in questions 7, 10, and 14, showing a clear difference between women and men, with men expressing more agreement than women regarding the physical consequences of job stress, such as recurrent trips to the bathroom, altered sleep habits and loss of calm during work tasks.

Table 2 presents the p-value and its significance, calculated through the R software, for each question, concluding that there are no significant differences between the answers given by teachers of different types of subjects in each question, except for questions 37, 44, 46.

Table 2.

Significant differences by subject area.

Question	U Mann-Whitney	p-value	Sign.	Question	U Mann-Whitney	p-value	Sign.
Q37	151.0	0,0187	Sí	Q44	154.0	0,0028	Sí
				Q46	157.0	0,0037	Sí

Source: own elaboration.

On the other hand, for question 44, which is of the group of questions that has a positive connotation towards the agreement, the teachers of the scientific area tend to indicate that students respond without problem to the indications, unlike the teachers of the humanistic area report the opposite.

Based on the previous table, Figure 14 shows the difference in responses by subject in questions 37, 44, and 46, with a clear difference between scientific and humanistic subjects. In the case of question 37, the teachers of the scientific area consider that the educational policy asks for a lot in exchange for little, unlike the teachers of the Humanistic area, where the distribution is less variable.

Finally, in the case of question 46, both teachers in the

scientific and humanistic areas emphasize that they end their workdays exhausted or partially exhausted, with a strong tendency towards the former for teachers in the scientific area.

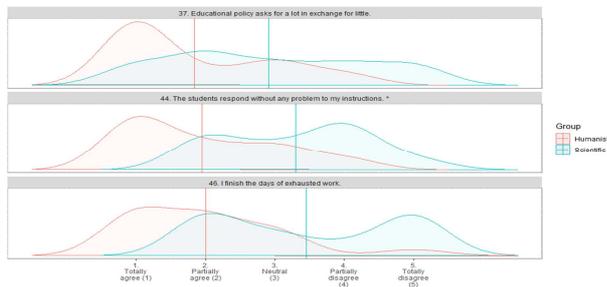


Figure. 14. Distribution by subjects in questions. Source: own elaboration

## Discussion

From the most radical perspectives, work stress is an inherent feature of modern life (Chen, 2019; Chul-Han, 2020). In this sense, some research approaches have stated that teacher stress was already present in the pre-pandemic context, so the pandemic did not generate a new phenomenon but rather aggravated the medical morbidity curve that affected some teachers (Elige Educar, 2020). Regarding this perspective, teacher stress is linked to job insecurity and the excessive work hours teachers must assume in schools. At the same time, the social conflicts triggered within schools (school violence, bullying, and harassment in the workspace) aggravate the teacher's stress.

Nevertheless, the research conducted in this paper suggests that the causes of teacher stress are linked to a reality initiated during the pandemic: teleworking. Within this line of argumentation, the findings of this investigation are related to the research conducted by the International Labor Organization. This institution has defined that work stress has generally increased since teleworking has deregulated the working day before the pandemic (ECLA, 2020). In this sense, teachers have been overburdened in maintaining the workday at home, an intermingled activity that overlaps with other domestic activities (childcare, elder care, among others) that have overburdened workers excessively. This research shows that the effects of the social pandemic continue to be analyzed in retrospect. One of the phenomena that have arisen as one of the most important for many Chilean teachers is pandemic stress, a reality that can be clearly observed in the data collected.

Although no studies have been found that quantitatively measure work stress in contexts prior to the COVID-19 pandemic, it was possible to access investigations that examined the presence of burnout syndrome in Chilean teachers during the first decade of the 21<sup>st</sup> century. Specifically, the study by Darrigrande et al. (2009) showed that not a significant number of teachers suffered from burnout symptoms on a quantitative scale, both in public and private schools. However, the low numbers of burnout in quantitative terms to date were not a factor that allowed

us to conclude the non-existence of burnout among teachers; on the contrary, the minority presence in particular cases shows us that the presence of burnout is not an extensive syndrome but rather a localized one that demanded qualitative studies.

On the other hand, in Spain and Brazil, it has been shown that the risk of suffering stress or emotional exhaustion in physical education teachers is aggravated in social contexts with high workload and massiveness of the student body (Krapp et al., 2021; Valero et al., 2022). Thus, and in line with the results in the international context, it is possible to suggest that the stress suffered by teachers in contexts prior to 2019 was at normal levels and was not visible in the public sphere until the occurrence of the COVID-19 pandemic, which aggravated and increased the levels of stress that were already present, making them extremely serious (Bravo et al., 2023; Cabezas et al., 2023). In this sense, it is pertinent to emphasize that the social revolt in 2019 in Chile introduced a dimension of uncertainty in the national society that affected the general levels of well-being in the population.

As described in the cited studies, the risk of burnout is linked to dissatisfaction with job expectations. However, no particular studies linked to the physical education teachers' guild were found in the Chilean case. Therefore, the hypotheses that had been applied to the case of the entire Chilean labor market regarding the impact of the pandemic on the levels of well-being of the population were projected (Cortés, 2021; Quilindo, 2023). Therefore, it is possible to state that the fear of losing their job or the labor precariousness that teachers and workers suffer today is a reality of which physical education teachers are not entirely unaware. Also, according to current figures compiled by the "Centro de Estudios" of the Education Ministry, school dropout levels increased during the pandemic. This questioned the supposed success of telematic teaching and learning modalities since they were inefficient and ineffective in vulnerable social contexts where children did not have the material means or the facilities to access online classes (Acevedo et al., 2022).

## Conclusions

Based on the multivariate quantitative analysis carried out in this study, significant differences between men and women were found regarding the influence of job stress generated by online classes, specifically in terms of the physical distress of the teacher. Accordingly, and contrary to popular belief, men are more physically affected by job stress.

As for the analysis segregated by subject area, a factor in which two levels were included, scientific and humanistic, it should be noted that the responses of these two groups do not match among the questions that presented significant differences. However, it can be concluded that the teachers of the scientific area feel dissatisfied with the educational policies, present greater exhaustion in relation

to the working hours, but consider that the students are much more receptive to the instructions they indicate. In the same way, it is interpreted that the workload and exhaustion are more significant in teachers of the scientific area, even when they have a better experience in the development of classes.

Responding to the general objective of this study, from the quantitative analysis, there is a clear tendency of teachers towards fatigue and exhaustion due to the new remote education system, in which most of them state that they feel more exhausted and must dedicate more time and resources to their work as teachers than in the normal period. On the other hand, many teachers state that there is a deficit in educational policies and incentives for teaching. This result exposes that a large proportion of the teachers surveyed agree that, concerning online education, parents and tutors have not taken responsibility for their children's education to complement the work that teachers have not been able to do remotely.

It should be noted that, in the great majority of the questions, the one with a positive connotation (marked as "agreement"), the teachers showed a clear tendency towards the latter; on the contrary, in the questions in which "agreement" did not have a positive connotation, there was no clear tendency. Thus, it can be concluded that teachers do not present more significant work stress after the development of online classes in the pandemic, but they do present greater exhaustion due to the increased workload that they perceive.

As epilogue, the vast majority of Chilean teachers returned to the classroom. Although there are statistical data on teacher stress during the teleworking period, there are no data to measure the stress of teachers today, which generates the need to build future research, in a transversal way, regarding the behavior of teacher stress in Chile.

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