Remote Work in Public Educational Institutions: An Ergonomic and Organizational Assessment of Its Impacts on Health, Well-Being, and Labor Relations

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Abstract

This study examines the impacts of remote work on the physical health, mental well-being, and social relationships of administrative staff at a public educational institution in southern Brazil. Combining ergonomic principles and multivariate analysis, the research employs the k-modes clustering technique to identify patterns in remote work experiences based on structured questionnaire data. The analysis revealed four distinct experience profiles with significant differences in infrastructure, organizational communication, cognitive load, and interpersonal relationships. Although remote work presented benefits such as schedule flexibility and improved quality of life, challenges emerged, including increased stress, reduced concentration, and ergonomic inadequacies. The findings highlight the need for institutional policies that ensure technical support, adequate infrastructure, and strategies for time management and mental health. This study contributes to the development of sustainable hybrid work models through an interdisciplinary and data-driven approach.

Keywords
Remote work; Ergonomics; Occupational health; Multivariate analysis; Home office

1. Introduction
The advancement of digital technologies, combined with the need for social distancing during the COVID-19 pandemic, significantly accelerated the adoption of remote work across various sectors. This modality brought substantial transformations to work dynamics, enabling the performance of professional activities outside the traditional corporate environment and fostering changes in working conditions and organizational processes, with notable impacts on workers' health. In particular, administrative and student support staff at public educational institutions underwent abrupt transitions in their work models, frequently without adequate ergonomic or structural planning. These rapid changes have raised concerns regarding the effects of remote work on physical health, mental well-being, and interpersonal relationships.Remote work presents notable benefits, including reduced commuting time, greater autonomy, and potential improvements in work-life balance. However, it also introduces important challenges. Extended periods of remote work may lead to social isolation, cognitive overload, and inadequate working conditions, particularly when institutional support is lacking. Over time, the absence of clear boundaries between

professional and personal life, combined with limited interpersonal interaction, can contribute to elevated stress levels, decreased motivation, and reduced overall job satisfaction.

1.1 Objectives

The objective of this study is to analyze the impacts of remote work across ergonomic, organizational, cognitive, and relational dimensions. The research focuses on public employees at a higher education institution in southern Brazil, aiming to identify response patterns and propose evidence-based interventions to improve remote working conditions. This goal is achieved through the integration of macroergonomic principles and multivariate analysis, particularly the application of the k-modes clustering algorithm. The study's relevance lies in its contribution to institutional policy design that promotes occupational health, productivity, and well-being in remote or hybrid work contexts.,.

2. Literature Review

Remote work—also referred to as telework or home office—designates the execution of professional activities outside conventional corporate settings, predominantly from the worker's residence, facilitated by Information and Communication Technologies (ICTs). Although similar practices were observed in the 1970s and 1980s, the widespread adoption of remote work was significantly accelerated by the COVID-19 pandemic, which imposed social distancing measures and compelled organizations to ensure operational continuity (Burton et al. 2021; Oliveira and Junior 2021).

From an ergonomic standpoint, remote work introduces distinct challenges involving physical, cognitive, and organizational dimensions. As noted by Mancebo (2020), the home office model diverges from other flexible work arrangements, such as coworking or hybrid systems, primarily due to its reliance on domestic spaces and personal resources for professional purposes. This transition frequently occurred without prior ergonomic planning, resulting in suboptimal working conditions (Platts et al. 2022).

Ergonomics, as an interdisciplinary science dedicated to aligning work systems with human capabilities and limitations, is fundamental in evaluating the implications of remote work. According to Beckel and Fisher (2022), this modality is characterized by flexible working hours, the intensive use of digital technologies, and increasingly diffusing boundaries between professional and personal life - factors that may generate both beneficial and adverse effects on worker well-being. On the positive side, reported advantages include the elimination of commuting time, increased autonomy, and perceived improvements in quality of life (Filardi et al. 2020). Conversely, numerous studies have highlighted risks such as musculoskeletal disorders, cognitive overload, social isolation, and elevated stress levels (Choudhury et al. 2021; Kowalski and Ślebarska 2022).

With respect to physical health, the absence of appropriate ergonomic infrastructure in domestic settings—such as adjustable chairs, properly aligned desks, and correctly positioned monitors—has been associated with a growing prevalence of musculoskeletal complaints, especially in the cervical spine, lumbar region, and upper limbs (Beckel and Fisher (2022). Evidence suggests that many individuals resorted to improvised furniture and non-specialized household items, thereby increasing exposure to ergonomic hazards and discomfort (Macedo 2020).

In the domain of mental health, sustained engagement in remote work without adequate institutional support has been linked to heightened stress, burnout, and difficulty maintaining boundaries between work and personal life (Platts et al. 2022; Kowalski and Ślebarska 2022). Moreover, the absence of direct supervision and reduced informal interaction among colleagues has contributed to feelings of social disconnection and diminished job satisfaction (Golden and Gajendran 2019).

Organizational factors critically influence the remote work experience. Aspects such as effective communication channels, clear task allocation, and accessible technical support are essential for preserving both productivity and well-being. Nevertheless, empirical findings suggest that many organizations lacked structured protocols to support remote workers, often leaving employees to independently manage their working environments and daily routines (Oliveira & Junior 2021).

To examine the broad impacts of remote work, researchers have employed a combination of qualitative and quantitative methodologies. Qualitative studies commonly involve interviews and focus groups to capture subjective

experiences and perceptions (Bortolan et al. 2021). Quantitative research often utilizes standardized Likert-scale questionnaires, in conjunction with multivariate statistical techniques such as cluster analysis, factor analysis, and logistic regression (Hair et al. 2019). Among these, clustering algorithms - such as *k*-modes - are particularly effective for datasets composed of categorical variables, facilitating the identification of homogeneous profiles based on shared remote work experiences. These analytical approaches enable the mapping of key patterns related to job satisfaction, stress, ergonomic adequacy, and organizational support, thereby informing the design of evidence-based interventions. Finally, the integration of macroergonomic principles with robust analytical tools presents a valuable framework for comprehensively assessing the interplay between individual, organizational, and environmental variables in remote work contexts. This includes evaluating workspace design, time management strategies, and the availability of psychosocial support mechanisms (Macedo 2020; Filardi et al. 2020).

3. Methods

This study adopted a qualitative approach supported by quantitative multivariate analysis techniques, aiming to understand the impacts of remote work from an ergonomic perspective. The research was conducted with administrative staff from a public educational institution in the southern region of Brazil, who worked remotely during the COVID-19 pandemic.

3.1 Data Collection Procedures

Data collection was carried out using an online questionnaire, designed in accordance with regulatory standards and specialized literature on work ergonomics. The instrument was created using the Google Forms platform and distributed by email, with the support of volunteer staff who served as liaisons to various academic departments.

The questionnaire was self-administered and consisted of closed-ended questions organized into thematic sections: working environment conditions, , work schedule technological and ergonomic resources organization, work-life balance, safety, and psychological and emotional aspects. Responses were recorded using a five-point Likert scale. Positive and negative statements were alternated, following methodological recommendations (Chyung et al. 2018), in order to minimize acquiescence bias. A total of 49 respondents took part in the study. Although the sample size is recognized as a limitation - limiting the statistical generalizability of the results - it remains sufficient to reveal meaningful patterns in remote work experiences.

3.2 Data Processing and Analysis

The data were organized into a structured database and processed using the R software environment (R Core Team, 2023). Preliminary procedures included data cleaning, recoding of nominal variables, and the treatment of missing values, in accordance with best practices outlined by Wickham and Grolemund (2017).

Given that the dataset comprises exclusively categorical variables, the analytical approach was tailored to accommodate this characteristic, aiming to extract meaningful insights aligned with the objectives of the study. Suitable methods for the analysis of categorical data include frequency and percentage distributions, contingency tables, Chi-square tests of independence, logistic regression, and cluster analysis using algorithms specifically designed for categorical variables, such as the *k*-modes algorithm (Agresti 2018).

The *k*-modes algorithm is particularly well-suited for clustering categorical data, as it enables the grouping of observations into internally homogeneous clusters based on shared attributes and pedagogical practices. The data analysis and cluster generation were conducted using the KlaR package within the RStudio environment, which offers a functional implementation of the *k*-modes algorithm.Furthermore, integrating macroergonomic principles with robust statistical methods offers a promising approach to understanding the complex interplay between individual, organizational, and environmental factors in remote work settings. This includes analyzing workplace design, time management strategies, and psychosocial support systems (Macedo 2020; Filardi et al. 2020).

3.2.1 The k-modes algorithm

K-mode clustering is an unsupervised machine-learning technique used to group a set of data objects into a specified number of clusters, based on their categorical attributes. The k-modes algorithm was developed by Huang (1997) as an extension of the *k*-means algorithm proposed by MacQueen (1967). This algorithm overcomes the limitations of numeric means and Euclidean distance, which are not applicable to categorical variable datasets, by using modes (a measure of central tendency indicating the most frequent attribute) as centroids and an appropriate dissimilarity measure for categorical variables. Similarity and dissimilarity measurements are used to determine the distance between the data objects in the dataset. In the case of *k*-modes, these distances are calculated using a dissimilarity

measure called the Hamming distance (Hamming, 1950). The Hamming distance between two data objects is the number of categorical attributes that differ between the two objects. Let x and y be two categorical data objects defined by m features or attributes. Then

$$d(x,y) = \sum_{j=1}^{m} \partial(x_j, y_j)$$

Where:

$$\partial(x_j, y_j) = \begin{cases} 0 & if \;\; x_j = y_j \\ 1 & if \;\; x_j \neq y_j \end{cases}$$

Data objects with a smaller Hamming distance are considered more similar, whereas those with a larger Hamming distance are considered less similar.

In contrast to hierarchical clustering, the k-modes algorithm requires the number of clusters k to be specified a priori. The algorithm operates through the following steps:

1. Start by picking clusters: Randomly select k data points from the dataset to act as the starting clusters (these are called "modes").
2. Assign data to clusters: Check how similar each data point is to these clusters (using the total number of mismatches) and assign each data point to the cluster it matches the most.
3. Update the clusters: Find the most common value (the "mode") for each cluster and update the cluster centers based on this.
4. Repeat the process: Keep repeating steps 2 and 3 until no data points are reassigned to different clusters.

A detailed explanation of the algorithm and examples can be found in Geeksforgeeks (2025).

3.3 Interpretation Strategy

The interpretation of the resulting clusters was carried out through the cross-analysis of demographic and qualitative variables, with a focus on identifying homogeneous experience profiles. This approach aims to support the development of tailored intervention proposals, following the methodological guidelines of Hair et al. (2019) for multivariate analysis applied to management.

Based on the systematized data, the study sought to identify patterns and discrepancies that could help elucidate the challenges faced in remote work, their psychosocial and organizational implications, and the potential for sustainable adaptation to remote work within institutional contexts.

4. Results and Discussion

The analysis of the responses allowed for the identification of four distinct remote work experience profiles using clustering techniques. The findings were interpreted through the lens of the ergonomic, organizational, cognitive, and relational dimensions explored in the research instrument.

The sample was predominantly female (61%) and composed mainly of individuals aged between 31 and 45 years (69%). Most respondents lived in houses (77%) with three or more residents (83.7%), a factor that directly impacts exposure to noise and frequent interruptions during the remote workday.

4.1 Identified Clusters

This result was obtained by predefining four clusters ($k=4$) for the application of the algorithm. Initially, values of $k=2$ and $k=3$ were tested, but they did not yield interpretable groupings for the sample of respondents' profiles. The application of the k-modes algorithm, simultaneously considering all the features included in the questionnaire, yielded the results presented in Figure 1.

	Feature	Cluster 1 (14)	Cluster 2 (6)	Cluster 3 (19)	Cluster 4 (10)
Profile	Gender	Female	Female	Male	Female
	Age	31–45	46–55	31–45	31–45
	Role	Administrative	Administrative	Administrative	Administrative
	Number of people	3	2	3	3
	Housing	House	House	House	House
Simultaneous Tasks	Takes care of children	Yes	No	No	Yes
	Cooking	Yes	Yes	Yes	Yes
	House cleaning	Yes	Yes	Yes	Yes
	Takes care of plants/pets	No	Yes	Yes	Yes
	Shared permanent workspace	Yes	No	No	No
	Private permanent workspace	No	Yes	Yes	No
	Adapted workspace	No	No	No	Yes
Interruptions	Family members	Frequently	Rarely	Occasionally	Frequently
	Visit from friends	Rarely	Never	Never	Rarely
	Pets	Never	Frequently	Occasionally	Occasionally
	Noise from neighbors	Occasionally	Never	Rarely	Occasionally
	Traffic noise	Occasionally	Never	Rarely	Rarely
	Domestic chores	Frequently	Never	Occasionally	Very frequently
	Desire to eat or drink	Frequently	Occasionally	Frequently	Frequently
	Desire to shop/change environment	Occasionally	Never	Rarely	Frequently
	Watch/listen to something interesting	Occasionally	Never	Rarely	Frequently
Maintaining Focus	Start work earlier	Frequently	Frequently	Rarely	Sometimes
	Nighttime work	Frequently	Sometimes	Frequently	Sometimes
	Use of headphones	Very often	Never	Rarely	Frequently
	Work during holidays/rest days	Very often	Never	Never	Sometimes
	Change of routine	Very often	Never	Never	Very often
	Multitasking	Frequently	Never	Sometimes	Sometimes
Remote Work Provided	Quality of life	Improved	Improved	Improved	Decreased
	Physical activities	No change	Increased	Improved	No change
	Relationship with neighbors	No change	Increased	No change	No change
	Food quality	No change	Increased	Improved	No change
	Family bonds	No change	Increased	Improved	No change
	Circle of friendships	No change	No change	No change	No change
Task Combination	Insomnia	Very often	Never	Never	Very often
	Anxiety	Very often	Never	Sometimes	Very often
	Strengthening family ties	Very often	Never	Very often	Rarely
	Depression	Never	Never	Never	Never
	Stress	Very often	Never	Sometimes	Very often
	Lack of concentration	Very often	Never	Sometimes	Very often
	Irritability	Very often	Never	Sometimes	Very often
	Exhaustion	Very often	Never	Sometimes	Very often
Organizational Factors	Working hours	No change	Increased	Increased	Increased
	Internet quality	No change	Increased	No change	Decreased
	Communication with colleagues	No change	Increased	Decreased	Decreased
	Communication with management	No change	Increased	No change	Decreased
	Relationship with other departments	No change	Increased	Decreased	Decreased
	Teamwork	No change	Increased	Decreased	Decreased
	Task distribution within the sector	No change	No change	No change	Decreased
	Information exchange within the sector	No change	No change	No change	Decreased
	Information exchange within the team	No change	No change	Decreased	Decreased
	Information exchange between departments	No change	Increased	Decreased	Decreased
Cognitive Issues	Concentration on activities	Increased	Increased	Increased	Decreased
	Interference from others	Increased	Increased	Increased	Decreased
	Motivated by flexible schedules	Increased	Increased	Increased	Increased
	Simultaneous task performance	Increased	Increased	Increased	Increased
	Work overload	No change	No change	No change	Increased

Figure 1. Cluster comparison by profile and questionnaire features

This segmentation reinforces the hypothesis that remote work constitutes a multifaceted experience, strongly influenced by socioeconomic conditions, housing infrastructure, and organizational support.

4.2 Cluster Analysis

The results obtained through the application of the *k*-modes clustering algorithm highlight the existence of distinct patterns in the way respondents experienced remote work. These patterns reflect differences not only in sociodemographic characteristics and domestic responsibilities but also in the subjective perception of work-life balance, institutional support, and cognitive well-being.

Cluster 1 is characterized by a high engagement in simultaneous domestic tasks, particularly among women aged 31–45, living in households with three members. Despite having improved cognitive indicators such as concentration and motivation, this group reported a significant cognitive load, with frequent occurrences of stress, irritability, insomnia, and exhaustion. The coexistence of perceived improvement in focus with high psychological strain suggests an adaptation under pressure, possibly supported by coping strategies such as routine adjustments and increased use of tools (e.g., headphones). However, the absence of changes in organizational factors indicates a lack of institutional support, which may limit the sustainability of this adaptation over time.
In contrast,

Cluster 2 represents the most favorable remote work experience among the groups analyzed. Composed of older female respondents with fewer domestic obligations and access to a private workspace, this group reported improvements across several dimensions—including internet quality, communication, and physical and relational well-being. The absence of cognitive or emotional distress, combined with the perception of organizational improvements, suggests a context where remote work aligns well with personal and institutional conditions. This cluster can be interpreted as a benchmark for successful remote work adaptation, underscoring the importance of both infrastructure and reduced home interference.

Cluster 3 is predominantly male and exhibits a moderate profile in terms of domestic responsibilities and perceived impacts. While respondents in this group experienced improvements in family bonding and cognitive outcomes, they reported few adaptive behaviors and noted reductions in interpersonal communication within the workplace. The absence of significant emotional strain may suggest a stable experience; however, the reduced perception of organizational support - particularly regarding teamwork and interdepartmental exchange - could signal latent challenges in collaborative performance.

Cluster 4 is the most negatively affected group, despite reporting access to an adapted workspace. These respondents - mostly women in the same age group as Cluster 1 - face intense domestic workloads, high levels of interruption, and frequent multitasking. This group reported a decline in quality of life, increased workload, and reductions in almost all dimensions of organizational support. Additionally, concentration levels decreased, and emotional strain was the highest among all clusters. These findings suggest that physical infrastructure alone is insufficient to ensure successful remote work experiences, especially when combined with weak institutional responses and unequal distribution of household tasks.

Table 1 presents a summary of the main strengths and weaknesses identified for each cluster, based on the integrated analysis of emotional, organizational, and cognitive dimensions. The classification highlights patterns of advantage and vulnerability among remote workers, considering both individual experiences and contextual workplace factors.

Table 1. Cluster Summary

Cluster	Key Strengths	Key Weaknesses
Cluster 1 (High domestic load, cognitive strain)	Adaptive focus strategies (e.g., early work, headphone use). Increased concentration and motivation	High levels of stress, irritability, and exhaustion. Frequent domestic interruptions. Lack of organizational support
Cluster 2 (Low interference, high organizational gain)	Improved organizational conditions (e.g., internet, communication). No signs of cognitive overload. Improved physical and social well-being	Limited emotional connection or change in social interactions (e.g., friendships remained unchanged)
Cluster 3 (Moderate load, low adaptation)	Improved family relationships. Cognitive performance remained stable. Moderate emotional impact	Few adaptive behaviors (e.g., rare use of tools). Decreased communication and teamwork. Perceived organizational detachmen
Cluster 4 (High workload, low support)	Motivated by flexibility. Active in simultaneous tasks	Decreased quality of life and concentration High emotional strain (stress, insomnia, exhaustion). Decline in nearly all organizational indicators

5. Conclusions

This study investigated the impacts of remote work from both ergonomic and organizational perspectives, emphasizing the diversity of experiences reported by public employees at a higher education institution in southern Brazil. Through the application of clustering techniques, four distinct remote work experience profiles were identified, revealing that variables such as infrastructure quality, institutional communication, and domestic task distribution play a decisive role in shaping work performance and employee well-being.

The key findings of this research include:

- Positive effects of flexible working hours, which enhanced employees' autonomy and contributed to improved quality of life.
- Negative consequences of cognitive overload, often associated with the ergonomic inadequacy of home-based work environments.
- Detrimental impacts of constant interruptions and the blurred boundaries between personal and professional domains.
- The critical importance of clear organizational policies to mitigate the psychosocial risks associated with extended remote work.

From a practical perspective, the findings highlight the need for institutional investment in both technological infrastructure and ergonomic resources, including the provision of suitable furniture and workstations. In parallel, training programs for employees and managers should be implemented to disseminate best practices for managing remote work. Moreover, the study stresses the urgency of improving interdepartmental communication, promoting effective time management strategies, and strengthening mental health support mechanisms.

While the limited sample size restricts the generalizability of the findings, the patterns observed offer relevant insights that can inform the development of targeted organizational policies in both hybrid and fully remote work contexts. The integration of statistical clustering methods with ergonomic criteria proved to be a valuable methodological approach for capturing complex dimensions of remote work experiences.

The presence of heterogeneous experiences within a relatively homogeneous professional group - composed largely of administrative staff - underscores the need for personalized and context-sensitive approaches to remote work management. Merely providing technical tools is insufficient; effective strategies must also incorporate organizational flexibility, psychosocial support, and the equitable distribution of domestic responsibilities.

The cluster-based typology developed in this study offers a strategic framework for targeted interventions. Cluster 2, representing the most favorable scenario, may serve as a reference for good practices. Conversely, Clusters 1 and 4 reveal vulnerable worker profiles that require urgent attention through institutional policies aimed at ensuring flexible

work arrangements, expanding access to mental health resources, and promoting gender-equitable support for domestic tasks.

Future studies should seek to expand the sample size, include a broader range of occupational profiles, and conduct longitudinal assessments to monitor the sustained effects of remote work overtime. Additionally, further investigation is encouraged into the effectiveness of specific institutional interventions - such as the implementation of flexible scheduling, provision of ergonomic kits, and adoption of digital disconnection protocols - and their respective impacts on productivity, health, and organizational culture.Remote work can constitute an effective model for work organization, provided that it is supported by appropriate institutional policies and infrastructure. Its success, however, hinges on the recognition of workers' real working conditions and the adoption of measures that ensure physical, mental, and social well-being within the professional environment. By identifying differentiated worker experiences and organizational responses, this study contributes to the ongoing discourse on the future of work in post-pandemic contexts.

References

Agresti, A., *An Introduction to Categorical Data Analysis*, 2nd ed., Wiley-Interscience, John Wiley & Sons, Inc., 2007.

Beckel, J. L.O. and Fisher, G.G., Telework and Worker Health and Well-Being: A Review and Recommendations for Research and Practice, *International Journal Environmental Research Public Health*, vol. 19, no. 7, 3879, 2022.

Bortolan, G. M. Z., Santos, F. A. N. V. dos, Domenech, S. C., Ferreira, M. G. G., Análise da Experiência do Trabalho Remoto em Home Office de Professores do Ensino Superior, *Revista Ergodesign & HCI*, vol. 9, no. 2, pp. 141-157, 2021.

Burton, E., Edwards, D. J., Roberts, C., Chileshe, N. and Lai, J. H. K., Delineating the Implications of Dispersing Teams and Teleworking in an Agile UK Construction Sector, *Sustainability*, vol. 13, no. 17, 9981, 2021.

Choudhury, P., Foroughi, C. and Larson, B., Work-from-anywhere: The productivity effects of geographic flexibility, *Strategic Management Journal*, vol. 42, no. 4, pp. 655-68, 2021.

Chyung, S. Y. Y., Barkin, J. R. and Shamsy, J. A., Evidence-based survey design: The use of negatively worded items in surveys, *Performance Improvement*, vol. 57, no. 3, pp. 16–25, 2018.

Filardi, F., Castro, R. M. P. de and Zanini, M. T. F., Vantagens e desvantagens do teletrabalho na administração pública: Análise das experiências do Serpro e da Receita Federal, *Cadernos EBAPE.BR*, vol. 18, no. 1, pp. 28–46, 2020.

GEEKSFORGEEKS, K-Mode Clustering in Python, Available: https://www.geeksforgeeks.org/k-mode-clustering-in-python/, Accessed on Apr 21, 2025.

Hair, J. F., Black, W. C., Babin, B. J. and Anderson, R. E., *Multivariate Data Analysis*. 8th ed., Prentice Hall, 2018.

Hamming, R. W., Error detecting and error correcting codes, *Bell System Technical Journal*, vol. 29, no. 2, p. 147–160, 1950.

Kowalski, M., and Ślebarska, B., Psychological effects of remote work during the pandemic in Poland, *International Journal of Environmental Research and Public Health*, vol. 19, no. 22: 15326, 2022.

Huang, Z., A Fast Clustering Algorithm to Cluster Very Large Categorical Data Sets in Data Mining, in *KDD: Techniques and Applications* (H. Lu, H. Motoda and H. Luu, Eds.), pp. 21-34, World Scientific, Singapore, 1997.

Macedo, Y. M., Ornellas, J. L. and Bomfim, H. F. do., COVID-19 no Brasil: O que se espera para população subalternizada? *Revista Encantar*, vol. 2, pp. 1–10, 2020.

MacQueen, J., Some methods for classification and analysis of multivariate observations. In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, eds L. M. Le Cam and J. Neyman, 1, pp. 281-297, Berkeley, CA: University of California Press, 1967.

Mancebo, D., Trabalho remoto na Educação Superior brasileira: efeitos e possibilidades no contexto da pandemia, *Revista da USP*, no. 127, pp. 106-116, 2020.

Oliveira, D. A. and Pereira Jr., E. A., Trabalho docente em tempos de pandemia: mais um retrato da desigualdade educacional brasileira, *Retratos da escola*, vol. 14, no. 30, pp. 719-734, 2021.

Platts, K., Breckon, J. and Marshall, E., Enforced home-working under lockdown and its impact on employee wellbeing: a cross-sectional study, *BMC Public Health*, vol. 22, 199, 2022.

R Core Team, *R:A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, 2023.

Wickham, H., Cetinkaya-Rundel, M. and Grolemund, G., *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*, 2nd ed., O'Reilly Media, 2023.

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