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Symptoms networks in teachers suffering from burnout

Ana María Ruiz-Ruano García[1], Javier Rodríguez Fragoso[2], Enrique Javier Garcés de los Fayos Ruiz[3], Dyana Muñoz[2], Jorge López Puga[1] & Francisco José Moya-Faz[2]

[1] *Universidad de Granada, Granada (Spain)*
[2] *Universidad Católica de Murcia, Murcia (Spain)*
[3] *Universidad de Murcia, Murcia (Spain)*

Keywords

Burnout
Depression
Anxiety
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Network analysis

Abstract

Teacher psychological wellbeing is a key component to understand the educational system. The burnout is considered one of the most destructive disorders affecting teachers. In this research, a sample of 257 teachers (186 women, age ranging from 24 to 64 years, M = 42.58, SD = 9.8) was cluster analysed to find groups of teachers differing in burnout profiles. Symptoms networks (no directed and directed) for stress, depression, and anxiety were then estimated for each cluster. Results show that self-deprecation and devaluation of life are central symptoms of depression for teachers suffering from burnout. The subjective experience of anxiety is observed to be the central symptom for anxiety, whereas irritability/over-reactivity is the central symptom of stress in teachers suffering from burnout. Those results are useful to enhance our understanding of teaching burnout as well as to design interventions to minimize the negative impact of psychological symptoms in teachers. Intervention programs are suggested to be designed to prevent burnout in older teachers who show higher risk of suffering from occupational exhaustion. It is also suggested to increase the flows of compassion to reduce depression among those teachers scoring hight in burnout. Interventions based on cognitive-behavioural therapy or mindfulness are proposed to be effective in those cases.

Redes de síntomas en docentes que sufren síndrome de desgaste ocupacional

Palabras clave

Burnout
Depresión
Ansiedad
Estrés
Análisis de redes

Resumen

La salud psicológica de los docentes es una pieza fundamental del sistema educativo. El *burnout* es considerado como una de las dolencias más destructivas que afecta a docentes. Este trabajo tomó una muestra de 257 docentes (186 mujeres) con edades comprendidas entre los 24 y los 64 años (M = 42.58, DT = 9.8) que fue sometida a un análisis cluster para identificar grupos que diferían en su patrón de *burnout*. Se estimaron redes de síntomas (no-dirigidas y dirigidas) para estrés, ansiedad y depresión segmentadas por conglomerado. Los resultados para los docentes con *burnout* ponen de manifiesto que el autodesprecio y la devaluación de la vida son síntomas centrales en la depresión, mientras que la experiencia subjetiva de ansiedad y la irritabilidad/sobre-reactividad lo son para la ansiedad y el estrés, respectivamente. Estos resultados son útiles para comprender el *burnout* en docentes y para intervenir al respecto. Se sugiere que se diseñen programas para prevenir el *burnout* en docentes que muestran alto riesgo de sufrir agotamiento ocupacional. También se sugiere que se incrementen los niveles de compasión para reducir la depresión entre docentes que puntúan alto en *burnout*. Se propone que las intervenciones basadas en terapia cognitivo-conductual o *mindfulness* podrían ser efectivas en estos casos.

* *Corresponding author:* Jorge López Puga. Department of Personality, Evaluation and Psychological Treatment, Faculty of Psychology, University of Granada, Campus de Cartuja s/n, 18071, Granada, Spain. jlpuga@ugr.es
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The educational phenomenon is complex, involving the constant interaction of numerous interrelated elements evolving over time (Ladyman et al., 2013). Family and school dynamics unfold within a society that is subjected to ongoing economic, political, sociological, or other pressures, shaping the entire teaching-learning process. Thus, more sophisticated and innovative methodologies are increasingly advocated to evaluate various components of the educational system. For example, Álvarez-Díaz et al. (2022) used network analysis to study how psychological variables (academic self-concept, attitude towards mathematics, and academic expectancy), performance (reading competence), and sociological factors (family support) affect the teaching-and-learning process.

Teachers are key elements of the educational system, and they experience significant health challenges due to various factors. These include work environment, workload, job security or stability, available resources, role conflicts, age, family circumstances, and professional expectations (see, for example, Liu et al., 2024; Oliver et al., 2024; Wang et al., 2025). Burnout syndrome (QD85 code in the World Health Organization's International Classification of Diseases, 2022) is considered one of the most destructive phenomena affecting teachers (Schoeps et al., 2021). This condition is characterized by feelings of exhaustion (both physical and psychological), mental detachment, or indifference toward work activities, and a sense of inefficiency accompanied by perceived professional failure (Maslach, 2017; Maslach & Leiter, 2016, 2017; Schaufeli, 2017). Burnout arises from prolonged exposure to workplace-related issues, leading to thought patterns marked by low work enthusiasm, high psychological fatigue, cynicism or apathy, and negative feelings toward students (Gil-Monte et al., 2009).

Burnout syndrome is closely linked to symptoms of stress, anxiety, and depression (e.g., Agyapong et al., 2022; Battams et al., 2014; Hester et al., 2020; Mohzana et al., 2023). While the causal relationships between these constructs are not fully clarified (Bianchi et al., 2015; Koutsimani et al., 2019), depressive symptoms are associated with poorer quality of life among teachers (Kidger et al., 2016). Anxiety is linked to a perceived lack of social support (Mahan et al., 2010), and stress remains a phenomenon requiring further study in connection with burnout (Turner & Garvis, 2023). Recent findings by Wu et al. (2023) reveal that relationships among these constructs involve complex direct and indirect associations mediated by phenomena like rumination or self-compassion.

Despite growing resources dedicated to the evaluation and intervention on burnout, stress, anxiety, and depression among teaching staff (Agyapong et al., 2022), these issues remain significant health risks. Given that stress, anxiety, depression, and burnout frequently co-occur within the teaching community, their study can be effectively carried out using network analysis (Cramer et al., 2010). Network analysis has demonstrated that the topological relationships among psychopathological symptoms (Borsboom et al., 2011) are analogous to those observed in other complex natural and artificial systems (Watts & Strogatz, 1998). Network models of psychological disorders enable an understanding of these conditions by analysing the characteristics of graphs representing relationships among symptoms (Ruiz-Ruano & Puga, 2020). These models suggest that psychological disorders are characterized by highly cohesive symptom networks, whereas psychological well-being is associated with networks in which symptoms are relatively disconnected (Borsboom, 2017; Borsboom & Cramer, 2013).

Although psychological symptom networks were initially conceived as undirected (i.e., with links lacking orientation), recent studies have provided insights into estimating and analysing directed symptom networks where the connections among psychological symptoms are oriented (Briganti et al., 2023, 2024). Some authors (e.g., Glymour et al., 2019; Quintana, 2022) have highlighted that conditional dependency (directed) graphical models offer a more parsimonious approach to complex phenomena than classical linear statistical models. Bayesian networks and directed acyclic graphs (DAGs) present a series of advantages, making them suitable for modelling psychopathologies. Among other features, these models can identify key symptoms to target in interventions to mitigate pathological dynamics within identified symptom networks.

Network analysis has recently been used to study psychosocial risk factors associated with increasing levels of burnout (Ruiz-Ruano et al., 2023). However, although the network analysis methodology has been used to study depression, anxiety, and stress among teachers (Cao et al., 2023), symptom networks have not been modelled as a function of burnout profiles. Given that directed networks to model psychological disorders are considered to complement non-directed network analysis (Briganti et al., 2023, 2024), the main aim of this research is to assess symptoms networks (both undirected and directed) for teachers differing in their burn out profiles.

The present study

This work employs symptoms networks (anxiety, stress, and depression) to understand the role of these symptoms in the burnout experienced by teachers. Moreover, this research combines two methodological strategies recently emphasized by Harris et al. (2022) in the context of symptoms cluster research. Thus, both a person-centred clustering strategy and a symptoms-centred analytic methodology will be used to explore the relationship between burnout, anxiety, stress, and depression. Firstly, clusters of teachers will be identified to characterize subgroups displaying different burnout profiles. Secondly, anxiety, depression, and stress symptom networks will be analysed within each detected teacher cluster. The primary hypothesis of this work is that teacher clusters exhibiting burnout syndrome will show more cohesive symptom networks (both directed and undirected) for stress, anxiety, and depression, as posited by network theory (Borsboom, 2017; Borsboom & Cramer, 2013). This implies that symptom networks for depression, anxiety, and stress would have higher link density (both directed and undirected). The results are intended to align with exploratory models (Nosek et al., 2018) with potential clinical relevance (e.g., identifying central symptoms of anxiety, depression, and stress in teachers exhibiting burnout), as well as scientific relevance (deepening the understanding of teacher burnout).

Method

Participants

The sample consisted of 257 teachers from public and private educational institutions in the Region of Murcia, Spain. Of these, 186 were women (72.4%). The average age of participants was 42.58 years (*SD* = 9.8), ranging from 24 to 64 years. Regarding marital status, most participants (57.9%, *n* = 149) reported being married. Among them, 35.4% (*n* = 91) indicated they had no children, while the remaining 64.6% (*n* = 166) reported having one or more children. Most respondents indicated they held a four or five full undergraduate degree programme (37.4%, *n* = 96) or a three-year undergraduate degree programme (36.2%, *n* = 93), while 8.7% (*n* = 21) held a university degree based on the European Credit Transfer System in the context of the European Higher Education Area. Additionally, 15.6% (*n* = 40) reported having a master's degree, and 1.9% (*n* = 5) held a doctoral degree. The primary teaching levels of participants were in primary education (35.4%, *n* = 91) and secondary education (26.5%, *n* = 68). A smaller group (9.3%, *n* = 24) taught in preschool education, and 1.2% (*n* = 3) provided guidance services in their schools. Regarding administrative roles, 9.7% (*n* = 25) served as principals, 7% (*n* = 18) as school secretaries, and 4.3% (*n* = 11) as heads of studies.

Instruments

Data was collected using an electronic form. Sociodemographic questions included age, marital status, number of children, level of education, and the participant's role in their institution. It also comprised questionnaires designed to assess burnout syndrome, anxiety, depression, and stress, utilizing the following scales.

Spanish Burnout Inventory (CESQT). The CESQT (Gil-Monte, 2019) evaluates cognitions, emotions, and attitudes associated with burnout syndrome. The instrument consists of 20 items, each rated on a five-point scale measuring frequency (0 = *Never*; 1 = *Rarely*; 2 = *Sometimes*; 3 = *Frequently*; 4 = *Very frequently*). The items are grouped into four subscales that measure different components of burnout. Firstly, enthusiasm for work (five items) measures the desire to achieve work-related goals and personal fulfilment (e.g., "My job represents a stimulating challenge for me"). Secondly, psychological exhaustion (four items) evaluates emotional and physical exhaustion caused by work (e.g., "I think I am overwhelmed by work"). The factor about indolence (six items) assesses indifference and cynicism toward students (e.g., "I think many students are unbearable"). Finally, guilt (five items) evaluates feelings of guilt related to negative attitudes and behaviours in the workplace (e.g., "I feel guilty about some of my attitudes at work"). Items from the "enthusiasm for work" dimension are reverse-scored. To calculate a global burnout score, these items are inverted before being combined with the others. This study utilized the CESQT-PE version, specifically adapted for assessing emotional exhaustion among teaching professionals (Gil-Monte et al., 2009). Observed global internal consistency for the scale (hierarchical ω = .71, IC 95% [.66, .76]) as well as for the dimensions dimension of enthusiasm for work (ω = .91, IC 95% [.89, .93], α = .91, IC 95% [.89, .93]), indolence (ω = .77, IC 95% [.71, .81], α = .76, IC 95% [.7, .81]), gilt (ω = .81, IC 95% [.76, .85], α =v.8, IC 95% [.75, .85]) and psychological exhaustion (ω = .87, IC 95% [.84, .9], α = .87, IC 95% [.84, .9]) comparable to reliability estimates found in other countries and within the education sector (Gil-Monte et al., 2009).

Depression Anxiety Stress Scales (DASS-21). To evaluate levels of depression, anxiety, and stress among participating teachers, the Spanish short version (Daza et al., 2002) of the *Depression Anxiety Stress Scales* (DASS-21) by Lovibond and Lovibond (1995) was used. The scale consists of 21 items representing negative emotional symptoms, which participants rate based on how often they experienced each symptom over the past week (0 = *Did not apply at all*; 1 = *Applied to some degree*; 2 = *Applied to a considerable degree*; 3 = *Applied most of the time*). These items are divided into three subscales, each one containing seven items. Anxiety subscale measures symptoms related to autonomic nervous system activation, musculoskeletal effects, situational anxiety, and subjective anxiety experiences (e.g., "I felt I was close to panic"). Depression subscale evaluates symptoms like anhedonia, lack of initiative, helplessness, dysphoria, disinterest, self-deprecation, and devaluation of life (e.g., "I felt that life was meaningless"). Stress subscale assesses symptoms such as irritability, difficulty relaxing, nervous arousal, impatience, and proneness to agitation (e.g., "I found it hard to wind down"). Table 1A in Appendix shows the symptom measured by each DASS-21 item. Observed internal consistency for this research was excellent (hierarchical ω = .93, IC 95% [.92, .94]), as well as for the subscales of stress (ω = .88, IC 95% [.85, .9], α = .87, IC 95% [.83, .9]), anxiety (ω = .82, IC 95% [.73, .87], α = .82, IC 95% [.73, .87]), and depression (ω = .86, IC 95% [79., .9], α = .86, IC 95% [.8, .9]), consistent with findings in general (Bados et al., 2005) and educational populations (Martínez-Monteagudo et al., 2019).

Procedure

Data collection was conducted via an electronic form emailed to potential participants. Before emailing, the Regional Ministry of Education of Murcia was informed about the research project and requested to authorize the study. Further contact was made with the General Directorate of Educational Planning and Human Resources to gather data on the region's educational institutions (215 private and 531 public) and estimate the size of the teaching population for sampling purposes. Three invitations were sent to participate in the study over 45 days. General information about the research objectives was provided in these emails, along with assurances of anonymity and a link to the electronic form. The form included an informed consent page and instructions for completing the survey. Participants were not rewarded or compensated for participation. They only received an acknowledgement message after completing the questionnaire.

Sample size estimation was performed before data collection based on a process of stratified sampling with proportional allocation to each stratum based on teacher population size provided by Regional Government. Although this sample size estimation favours representative samples in terms of proportion, complementary estimations were carried out to explore potential concerns about clusters comparisons in terms of statistical power and variance ratio. Thus, sample size estimates were also based on the potential number of latent clusters in data. This *ex ante* consideration of clusters size aimed to guarantee a minimum statistical power ($1-\beta = .8$, intergroup variance was considered six times greater than intra group variance fixing α to .05) when describing clusters profiles in terms of, for example, anxiety or depression levels (Serdar et al., 2021). Data collection began after the Universidad Católica de Murcia Ethics Committee approved the study. All procedures adhered to ethical guidelines from the American Psychological Association's Code of Conduct (2017) and the Helsinki Declaration (World Medical Association, 2013).

Data analysis

Data from the CESQT-PE scale was employed to identify clusters of participants. Following Hair et al.'s (2014) recommendations, item scores on the scale were standardized before applying the *k*-means clustering algorithm (Hartigan & Wong, 1979) using Euclidean distances as the similarity measure. The optimal number of clusters was determined using version 3.0.1 of the *NbClust* package (Charrad et al., 2014) in R. Undirected network models were estimated by using the EBICglasso algorithm implemented in version 1.9.2 of the *qgraph* package (Epskamp et al., 2012) in R. This package was also used to compute centrality statistics (degree, closeness, betweenness) and expected node influence within the estimated networks. Node or vertex degree (also known as valency) refers to the number of connections a vertex has. From a mathematical point of view, node degree is a measure of the vertex neighbourhood size because it specifies the number of adjacent nodes to a vertex (Bollobás, 2013; Diestel, 2025; Kumar Yadav, 2023). The more connections a vertex has, the more it is a central or relevant node in the network. In psychopathological terms, central nodes in networks of symptoms are considered critical for understanding psychological disorders and targets in psychological interventions (Borsboom & Cramer, 2013). Closeness centrality was conceived to measure how much a node is "close" to the rest of the nodes in a network. Node closeness is based on the concept of "shortest path lengths" (SPLs) and it is typically defined as the inverse of the node distance to the rest of nodes in the model. Betweenness indices are designed to assess the number of times a vertex is in the middle of other pair of vertices SPLs. Thus, the higher closeness and betweenness, the more central is a node in a network. Expected influence is probably the most important centrality statistics from the psychopathological perspective because it is a measure of the node centrality based on adjacency, link strength, as well as sign (when edges are allowed to have positive and negative value) relationship (Rocco et al., 2024). As a result, expected influence is considered a pondered measure of the centrality of a node. The higher the expected influence of a node, the higher impact this node has on the dynamics in a network of symptoms.

Local clustering coefficients for each network node were calculated using the statistic proposed by Watts and Strogatz (1998). Local clustering coefficients are thought to estimate the extent to which a node neighbours are also connected between them. The Watts and Strogatz (1998) clustering coefficients compute the proportion of edges between a node and its neighbours out of the maximum possible links between them (i. e., when all the networks are totally connected forming a complete graph). The higher the clustering coefficient, the more a node is embedded in a cluster of closely related nodes in a network. Graph density and transitivity statistics were computed using version 1.2.11 of the *igraph* package (Kolaczyk & Csárdi, 2020) in R. Density is the proportion of links in a network compared to the maximum possible edges (when the graph is complete) and transitivity is a measure of global clustering for the whole network. Higher values of density and transitivity are typical for networks in which nodes are frequently interconnected. Non-directed graphs were visualized using the Fruchterman and Reingold (1991) algorithm, which ensures an even distribution of nodes across the plane, minimizes edge crossings, and adjusts edge lengths proportional to the strength of the association between nodes. Directed acyclic graphs (DAGs) were estimated to explore the directional relationships among symptoms of anxiety, depression, and stress, using version 4.7 of the *bnlearn* package (Scutari, 2010) in R. DAG models were estimated following the recommendations outlined by Briganti et al. (2023, 2024) for analysing psychological symptom networks. Raw and processed data, coding scripts, tables, figures, and supporting metadata are openly accessible through the Open Science Framework (OSF) project hosted at https://osf.io/4cbsz.

Results

The cluster analysis identified two groups of teachers. As shown in Table 1, the first group of participants (Cluster 1, $n = 138$) scored significantly lower than the second group (Cluster 2, $n = 119$) on the total CESQT-PE score, the indolence dimension, the guilt dimension, and the psychological exhaustion dimension. However, the first group scored significantly higher in the "enthusiasm for work" dimension compared to the second group. This scoring pattern observed in the second group aligns with a profile of teachers displaying occupational burnout syndrome. As seen in Table 1, the second group also scored significantly higher on the overall DASS-21 scale, as well as on the stress, anxiety, and depression dimensions. Additionally, individuals in the second group were significantly older ($M = 44.38$, $SD = 9.39$) than those in the first group ($M = 41.02$, $SD = 9.91$), $t(252.74) = -2.78$, $p = .006$, $d = 0.35$, $r = .17$, two-tailed test). However, no differences were observed between the two groups in terms of the number of children ($t(253.43) = -0.81$, $p = .48$, $d = 0.1$, $r = .05$, two-tailed test), income level ($t(180.18) = 0.3$, $p = .76$, $d = 0.05$, $r = .02$, two-tai-

Table 1

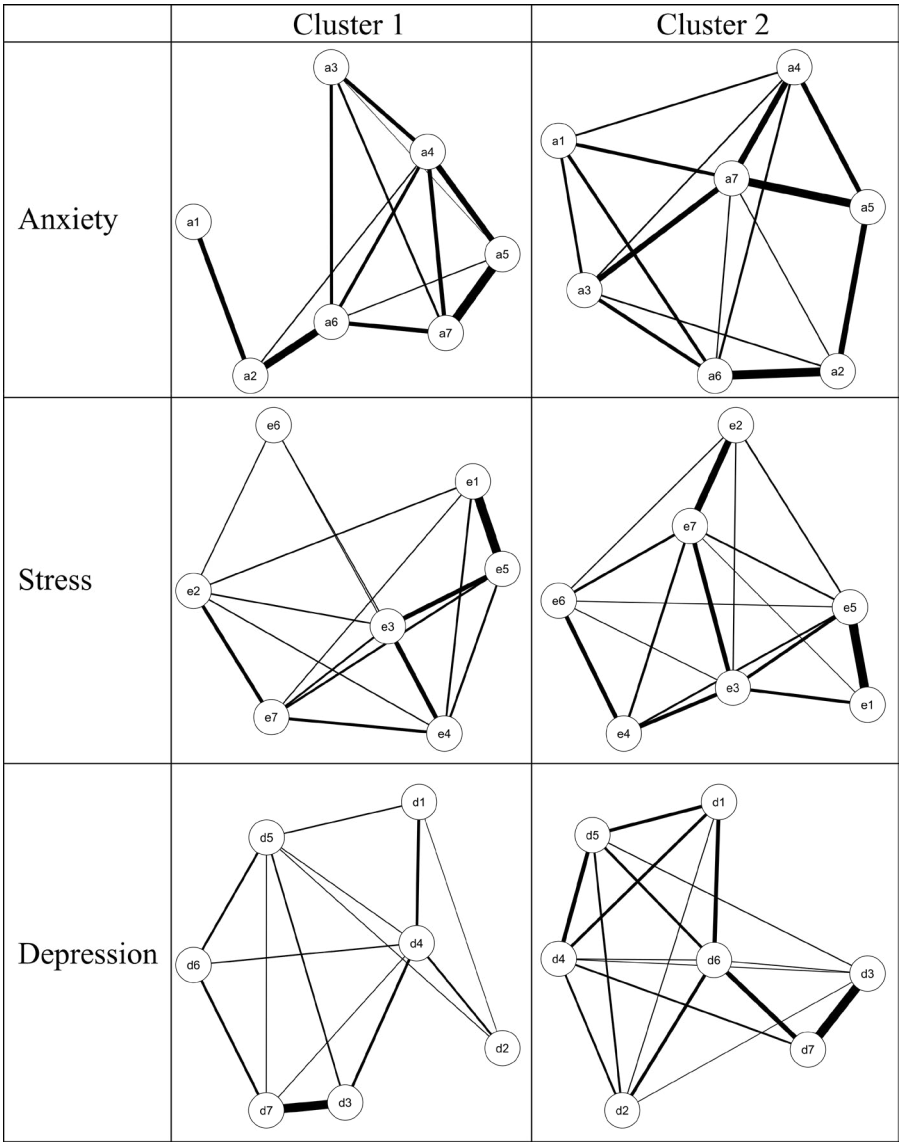
CESQT-PE and DASS-21 scores comparison between first (1) and second (2) clusters

	M_1 (SD_1)	M_2 (SD_2)	*t*	*gl*	*P*	*d*	*r*
CESQT-PA	15.57 (5.21)	30.53 (6.8)	-19.56	219.26	< .001	2.64	.8
EW	24.4 (3.95)	16.41 (5.61)	13	207.55	< .001	1.8	.67
IN	4.54 (2.46)	9.03 (3.43)	-11.89	210.35	< .001	1.64	.63
GU	3.73 (2.52)	6.02 (2.63)	-7.09	245.97	< .001	0.9	.41
PE	5.46 (2.59)	9.39 (3.06)	-11	232.32	< .001	1.44	.59
DASS-21	6.96 (6.02)	13.55 (10.84)	-5.9	178.16	< .001	0.88	.4
Stress	3.92 (3.35)	6.71 (4.28)	-5.76	222.14	< .001	0.77	.36
Anxiety	1.89 (2.06)	3.41 (4.01)	-3.73	170.36	< .001	0.57	.27
Depression	1.15 (1.65)	3.43 (3.69)	-6.22	158.32	< .001	0.99	.44

Note. All contrasts are bilateral. *EW*: Enthusiasm for work, *IN*: Indolence, *GU*: Guilt, *PE*: Psychological exhaustion.

Figure 1

Symptom networks for DASS-21 dimensions based on clustering observed in the data



Note. The thickness of the links is proportional to the strength of the association established between the nodes. The letters a, d, and e refer to anxiety, depression, and stress items respectively, while the number indicates the item position on the DASS-21 scale.

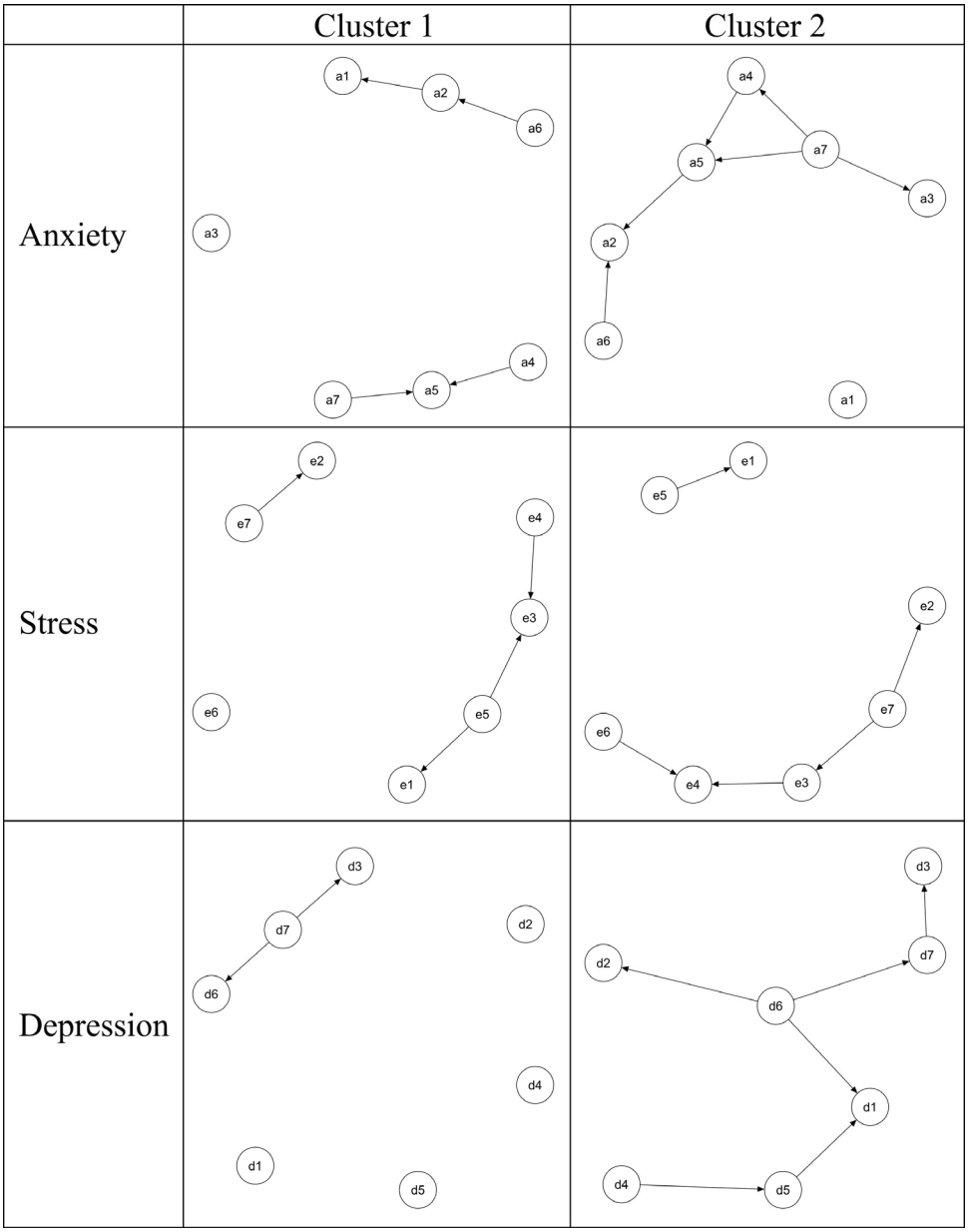
led test), gender ($\chi^2 = 0.89$, $p = .34$, $V = .07$), marital status ($\chi^2 = 3.53$, $p = .62$, $V = .12$), education level ($\chi^2 = 7.67$, $p = .18$, $V = .17$), completion of the teaching master's degree ($\chi^2 = 0.12$, $p = .72$, $V = .03$), the teacher's role at the institution ($\chi^2 = 9.8$, $p = .2$, $V = .2$), or the teaching body to which the participant belonged ($\chi^2 = 11.21$, $p = .13$, $V = .21$).

As can be seen in Figure 1, the undirected networks observed in the second group for symptoms of anxiety, stress, and depression contained more connections (16, 17, and 17, respectively) compared to the networks observed for the first group (13, 16, and 14, respectively). This implies that the density of connections in the networks for the second group was higher for anxiety items (.76 vs. .62), stress items (.8 vs. .76), and depression items (.81 vs. .67). Meanwhile, the clustering coefficient for anxiety items was higher in the first group (.8 vs. .75). However, the clustering coefficient was higher for the second group in the stress (.81 vs. .76) and depression (.81 vs. .67) networks. This suggests that symptoms of stress and depression tend to be more interconnected in the group characterized by a profile of teachers experiencing emotional exhaustion.

As shown in Table 2A in the Appendix, the network estimated for the stress items in the second group had higher average values for degree, closeness, betweenness, and expected influence compared to the network estimated for the first group. This suggests

Figure 2

Directed acyclic symptom networks for DASS-21 dimensions based on clustering observed in the data



Note. The letters a, d, and e refer to anxiety, depression, and stress items respectively, while the number indicates the item position on the DASS-21 scale.

that teachers with a profile compatible with occupational burnout syndrome exhibited stress symptoms that were more interconnected, closer to one another, and more influential on other symptoms within the observed network. The fact that the clustering coefficient was higher in the second group also indicates that stress symptoms tend to form highly related symptom clusters. Similarly, the depression network in the second group showed higher averages for degree, closeness, expected influence, and clustering than the network estimated for the first group.

In the depression network for the second group, two symptoms stand out as central: self-deprecation (item 6) and devaluation of life (item 7). Although items 4 and 6 have the same degree value, items 6 and 7 exhibited the highest values for expected influence, betweenness, and closeness. In the anxiety network of the second group, the most central symptom (in terms of degree, closeness, betweenness, and expected influence) was the subjective experience of anxiety (item 7). The items 3, 5 and 7 have the same degree value, whereas item 3 shows higher closeness and betweenness in the stress network. However, irritability/over-reactivity symptom (item 7) was the most central attending to expected influence. As shown in Figure 1, these items can be considered the most central symptoms in the networks of teachers grouped in the second cluster. The importance of these symptoms is further demonstrated in the directed acyclic graph models, as shown in Figure 2.

As illustrated in Figure 2 and Table 3A in the Appendix, the directed acyclic graphs estimated for the second group contained more directed edges. This finding is consistent with the results from the undirected network models (Figure 1 and Table 2A in Appendix), highlighting that anxiety, depression, and stress symptoms are more cohesive in the group of teachers with a psychological profile compatible with occupational burnout syndrome. The directed graphs impose more statistical assumptions on the estimated networks, resulting in less connected symptom networks. However, Table 2 in Appendix demonstrates that the average number of adjacent nodes, the average Markov blanket, and the average branching factor were also higher for the networks estimated in the second group. This suggests that anxiety, stress, and depression symptoms were more interconnected for the group of teachers with a profile compatible with occupational burnout syndrome.

Discussion

Results showed that, as hypothesized, anxiety, depression, and stress symptom networks were more cohesive (in terms of both directed and undirected edge densities) for teachers suffering from burnout. Observed clustering coefficients and centrality metrics in the undirected networks (degree, closeness, betweenness, and expected influence) further supported this hypothesis. The directed graphs revealed significant differences in the number of directed edges, the average number of adjacent nodes, the average Markov blanket, and the average branching factor when comparing teachers suffering and not suffering from burnout. These results suggest that symptom networks are more interconnected for teachers with a burnout-compatible psychological profile. These results are aligned with existing theories trying to provide an account of psychopathology from the network analysis perspective (Borsboom, 2017; Borsboom et al., 2011; Borsboom & Cramer, 2013; Cramer et al., 2010; Schmittmann et al., 2013). Teachers showing a profile compatible with burnout syndrome were characterized by, as theoretically expected, low enthusiasm for work, high levels of indolence, significant scores in the guilt dimension, and substantial psychological exhaustion (Gil-Monte, 2019; Gil-Monte et al., 2009; Maslach, 2017; Maslach & Leiter, 2016, 2017; Schaufeli, 2017).

The undirected networks highlighted self-deprecation and devaluation of life as the most central symptoms in the depression network. Directed graphs also identified self-deprecation as a critical symptom, suggesting that anhedonia, lack of initiative, and life devaluation stem from self-deprecation. This finding is critical for understanding the role of depressive symptoms in burnout (Battams et al., 2014; Capone & Petrillo, 2020; Ma et al., 2022). For anxiety and stress models, the directed networks identified subjective anxiety (item 7) and irritability/over-reactivity (item 7) as the most central symptoms, respectively. These findings are critical not only for understanding the anxiety and stress associated with teaching but also for guiding strategic psychological interventions for teachers suffering from burnout (Agyapong et al., 2024; Manley et al., 2023).

Limitations and practical implications

These findings should be interpreted cautiously. Although methodological considerations such as statistical power and latent cluster sizes were addressed, future studies should verify whether the estimated networks are comparable across larger samples drawn from different populations. Although two different types of networks (undirected and directed) have converged identifying critical symptoms of anxiety, stress, and depression in teachers showing a compatible profile with burnout syndrome, directed links between symptoms (Figure 2) should be carefully interpreted. Directed acyclic graphs are used to build causal models (Puga et al, 2015), but this was not the purpose of the current study. Rather, as suggested by Briganti et al. (2023, 2024), DAGs were used to explore the direction of symptoms influence in order to shed light on the nature of teachers' burnout. This study is exploratory, and future research should adopt a confirmatory approach (Nosek et al., 2018) to generate socially useful knowledge for mitigating the detrimental consequences of depressive, anxious, and stress-related symptoms experienced by teachers. Additionally, the tool used to evaluate anxiety, stress, and depression symptoms (DASS-21; Lovibond & Lovibond, 1995) is a screening instrument. Although widely used in clinical and non-clinical contexts with robust psychometric properties (Medvedev, 2023), alternative instruments could be employed to model the networks of the studied symptoms.

Conclusions

The findings of this study are useful for designing intervention programs to reduce the risk of occupational burnout

among teachers. Results indicate that age is a sociodemographic factor associated with burnout. Results also suggest that teachers scoring high in burnout are also at risk of suffering from stress, anxiety and depression. Given that results suggest self-deprecation and devaluation of life are central symptoms to understand teachers' burnout, intervention programs should target them. Additionally, given that irritability and subjective anxiety have been identified as central symptoms for stress and anxiety, intervention programs should be also oriented to reduce those symptoms.

Author contributions

Conceptualization: J.R.F., E.J.G.F.R., J.L.P., F.J.M.F.
Methodology: A.M.R.R.G., J.L.P.
Software: A.M.R.R.G., J.L.P.
Validation: A.M.R.R.G., J.R.F., J.L.P.
Formal analysis: A.M.R.R.G., J.L.P.
Research: J.R.F.
Data curation: A.M.R.R.G., J.L.P.
Supervision: A.M.R.R.G., E.J.G.F.R., J.L.P., F.J.M.F.
Visualization: A.M.R.R.G., J.L.P.
Project administration: E.J.G.F.R., J.L.P., F.J.M.F.
Writing – Original draft: A.M.R.R.G., J.R.F., D.M., J.L.P.
Writing – Review and edition: A.M.R.R.G., J.R.F., D.M., E.J.G.F.R., J.L.P., F.J.M.F.

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Declaration of interests

The authors declare that there is no conflict of interest.

Data availability statement

The data that support the findings of this study are openly available in the Open Science Framework repository "sidoNet: Sindrome de Desgaste Ocupacional Docente modelado con grafos" at https://doi.org/10.17605/OSF.IO/4CBSZ.

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Appendix

Table 1A

Symptoms measured by DASS-21 scale (Lovibond & Lovibond, 1995)

Label	*PS*	*Symptom*
a1	2	Autonomic arousal
a2	4	Autonomic arousal
a3	7	Skeletal musculature effects
a4	9	Situational anxiety
a5	15	Subjective experience of anxious affect
a6	19	Autonomic arousal
a7	20	Subjective experience of anxious affect
d1	3	Anhedonia
d2	5	Inertia
d3	10	Hopelessness
d4	13	Dysphoria
d5	16	Lack of interest/involvement
d6	17	Self-deprecation
d7	21	Devaluation of life
e1	1	Difficulty relaxing
e2	6	Irritable/over-reactive
e3	8	Nervous arousal
e4	11	Easily upset/agitated
e5	12	Difficulty relaxing
e6	14	Impatient
e7	18	Irritable/over-reactive

Note. *Label*: is the label used in the current study (a = anxiety, d = depression, e = stress), *PS:* item position in scale.

Table 2A

Centrality statistics for non-directed symptom networks in both clusters

		Item								
		1	2	3	4	5	6	7	*M*	*SD*
Cluster 1										
Anxiety	D	1	3	4	5	4	5	4	3.71	1.38
	C	1.27	1.9	1.49	1.91	1.80	2.33	1.99	1.81	0.35
	B	0	10	0	2	0	16	6	4.86	6.2
	EI	0.19	0.54	0.36	0.72	0.64	0.76	0.78	0.57	.22
	WS	-	.33	1	.7	1	.7	1	.79	.27
Stress	D	4	5	5	6	4	3	5	4.57	0.98
	C	1.66	1.5	1.92	1.75	1.87	0.78	1.78	1.61	0.39
	B	0	2	10	0	8	0	4	3.43	4.12
	EI	0.87	0.52	0.84	0.82	1.18	0.15	0.71	0.73	0.32
	WS	.83	.70	.70	.67	.83	1	.80	.79	0.12
Depression	D	3	3	3	6	6	3	4	4	1.41
	C	1.58	1.54	2.35	2.11	1.44	1.58	2.15	1.78	0.42
	B	0	0	18	16	0	0	8	6	8.08
	EI	0.33	0.21	1.08	0.74	0.51	0.44	1.04	0.62	0.34
	WS	1	1	1	.53	.53	1	.83	.84	.22
Cluster 2										
Anxiety	D	4	4	5	5	3	5	6	4.57	0.98
	C	2.02	2.60	2.45	2.28	3.11	2.46	3.21	2.59	0.43
	B	0	4	0	0	6	4	8	3.14	3.24
	EI	0.51	0.8	0.67	0.75	0.88	0.88	1.2	0.81	0.21
	WS	1	.67	.8	.7	.67	.8	.67	0.76	.12
Stress	D	3	4	6	4	6	5	6	4.86	1.21
	C	1.93	2	3.01	2.24	2.03	1.81	2.60	2.23	0.43
	B	0	0	12	6	0	0	10	4	5.29
	EI	0.77	0.63	0.97	0.72	1.08	0.53	1.11	0.83	0.22
	WS	1	1	.73	1	.73	.9	.73	.87	.13
Depression	D	4	5	5	6	5	6	3	4.86	1.07
	C	2.79	2.24	2.31	2.31	2.46	3.35	2.8	2.61	0.4
	B	2	0	0	0	0	14	10	3.71	5.82
	EI	0.74	0.55	0.81	0.80	0.86	1.1	1.11	0.85	0.2
	WS	1	.9	.8	.73	.90	.73	1	.87	.11

Note. D: degree, C: closeness, B: betweenness, EI: expected influence, and WS: clustering coefficient. Betweenness is expressed one hundred times larger than original value to facilitate interpretation.

Table 3A

Non-directed networks statistics for each cluster

	DA	*AMS*	*ANA*	*ABF*	*DG*	*DN*
Cluster 1						
Anxiety	4	1.43	1.14	0.57	3	1
Stress	4	1.43	1.14	0.57	3	1
Depression	2	0.57	0.57	0.29	5	4
Cluster 2						
Anxiety	6	2	1.71	0.86	2	1
Stress	5	1.71	1.43	0.71	2	0
Depression	6	2	1.71	0.86	0	0

Note. *DA*: directed arcs, *AMS*: average Markov blanket size, *ANA*: adjacent node average, *ABF*: average branching factor, *DG*: number of disconnected graphs, *DN*: number of disconnected nodes.