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Research Mapping of Teacher Stress from a Cognitive Perspective: A Systematic Review and Bibliometric Analysis of Metacognition and Cognitive Flexibility

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Abstract
This study adopted a systematic literature review and bibliometric analysis to explore the cognitive mechanism of teacher stress, with a particular focus on the theoretical significance and empirical role of metacognition and cognitive flexibility. Based on the PRISMA 2020 guidelines, the English empirical literature from the Web of Science database from 2004 to 2024 was retrieved, and 20 articles were finally included in the analysis. Bibliometric analysis shows that teacher stress and cognition research have been increasing yearly since 2012. Still, higher-order cognitive variables such as "metacognition" and "cognitive flexibility" have not yet formed a mainstream cluster. The systematic review found that cognitive reappraisal strategies, cognitive behavioural therapy (CBT) and cognitive flexibility have been preliminarily proven to significantly alleviate teacher stress and burnout, but the existing studies mostly stay at the stage of superficial cognitive strategy validation, and the direct measurement and pathway validation of deep cognitive mechanisms are still insufficient. This study emphasises the importance of systematically exploring metacognition and cognitive flexibility and suggests that future research should strengthen the empirical measurement of higher-order cognitive variables to promote teachers' mental health and professional development more scientifically and effectively.
Keywords: teacher stress, metacognition, cognitive flexibility, systematic literature review, bibliometric analysis

1. INTRODUCTION

Teacher stress has become an extremely important topic in international education research (Brady et al., 2023), and in the wake of the pandemic, teachers are experiencing an especially high level of stress due to the changing educational policies, the need to support diverse groups of students (Anton & Van Ryzin, 2024), and the difficulties caused by complex educational information technology (Gabbiadini et al., 2023). In view of the whole education system, the shortage of teachers and job stress has been increasing globally. According to UNESCO's 2024 report, there is an urgent need for 44 million teachers by 2030 to achieve the Sustainable Development Goals. The shortage of teachers has led to the expansion of class sizes and the overburden of teachers, further exacerbating the work stress of teachers (United Nations, 2024). Moreover, the high turnover rate of teachers also poses new challenges to the current education system. Latest research found that the turnover of teachers not only affects the quality of education but also increases the workload and psychological pressure of the remaining teachers, especially in the post-COVID-19 Pandemic period (Reinke et al., 2025).

According to a recent systematic literature analysis of teacher stress, related research has increased significantly in recent years, especially in teacher burnout, self-efficacy, and mental health (Zhang et al., 2024). Despite the abundant research results, there is still a lack of sufficient discussion on the cognitive mechanism of teacher stress and its dynamic changes in specific contexts. Within teacher cognition, metacognition refers to an individual's ability to monitor and regulate their cognitive activities (Flavell, 1987), and it is an important part of the field of psychology and education. In educational research, metacognitive ability is regarded as one of the core drivers of teachers' professional development, helping teachers to adapt more effectively to complex teaching scenarios. Recent studies have shown that metacognition not only has a direct impact on the optimisation of teaching strategies but also enhances teachers' ability to cope with high-pressure environments. For example, teachers' metacognitive ability, that is, teachers' ability to reflect on and regulate their own cognitive processes, can effectively help

teachers identify the teaching stressors they face and adopt adaptive strategies in time to alleviate negative emotions and burnout. Teachers with high metacognition are usually better at regulating their emotional experiences and cognitive states, which can effectively reduce stress responses (Iacolino et al., 2023). In addition, cognitive flexibility, the ability of teachers to quickly adjust their cognitive strategies and thinking styles in the face of change or challenges (S. Li, 2023), is also strongly associated with teacher stress. Teachers with high cognitive flexibility are able to respond to uncertainties and emergencies in teaching in a more positive and adaptive way, thereby reducing teaching stress and improving their self-efficacy in coping with professional challenges (Harel et al., 2023a). In conclusion, teachers' metacognitive ability and cognitive flexibility are important cognitive factors affecting teachers' stress, and in-depth exploration of these factors can help formulate effective interventions to promote teachers' professional development and mental health. Through this study, we aim to achieve the following goals:

1. To map the overall development trends and research hotspots in the field of teacher stress and cognition, and to identify how cognitive variables are distributed and represented across existing studies.
2. To analyse the commonly used instruments for measuring teacher stress and cognitive factors, focusing on their types, applicability, and functional characteristics.
3. To synthesize existing research involving relevant cognitive variables, focusing on two higher-order cognitive mechanisms—cognitive flexibility and metacognition—and examining their theoretical significance and empirical roles in regulating teacher stress.

2. METHODOLOGY

In this study, we primarily used a Systematic Literature Review (SLR) approach, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). Additionally, to comprehensively explore the relationship between teachers' stress and their cognitive factors, we complemented our review with a Bibliometric Analysis. Initially, bibliometric analysis helped us identify overall research trends, hotspots, and key influential studies in this field. We selected Web of Science (Wos) as our data sources due to its reliability, extensive coverage, and strong recognition within educational psychology research. To ensure quality and relevance, the study focused on peer-reviewed journal articles published in English between 2004 and 2024, with a limited literature type to published journal articles.

The search strategy adopts a Boolean logical structure and focuses on the following three types of keyword combinations: TS stands for Title, Abstract, and Keywords, to ensure that the retrieved literature involves keywords such as "teacher", "stress" and "cognition/metacognition" in the core fields. Use the "*" wildcard to capture stemming variants (e.g. cognit, cognitive, cognition, etc.). The initial number of articles obtained by this search strategy was 800. In order to ensure that the review focused on the stress mechanisms of individual teachers and their cognitive resources, the following criteria were used for inclusion and exclusion:

Inclusion Criteria: 1. The study subjects were school teachers or educators (including kindergarten, primary, secondary, and higher education teachers); 2. The core variables included the characteristics of teacher stress, burnout, or work stress; 3. Examine cognitive-related variables, in particular cognitive flexibility and metacognitive ability, and employ empirical research methods to provide comparable findings; 4. The articles are officially published and peer-reviewed journal papers in English. Exclusion Criteria: 1. The study was conducted by students, administrators, or other non-faculty groups; 2. Studies that did not involve any cognitive factors (e.g., only discussed emotions, organisational structure, family background, etc.); 3. Non-empirical research, such as theoretical reviews, opinion articles, conference abstracts, book chapters, and systematic reviews; 4 Studies that are not in English or have not been formally published. After excluding duplicate records and non-eligible literature, a total of 20 empirical studies were included in the systematic review analysis that met all the inclusion criteria.

2.1Bibliometric analysis

In order to understand the development trends and study the distribution of the 20 articles that were finally included in the study, this study performed a bibliometric analysis of the final included literature with the help of Biblioshiny (the visual interface of the Bibliometrix R package). As a bibliometric tool tailored for quantitative research, Biblioshiny provides extensive capabilities for visual data analysis. By leveraging this software, researchers can generate a variety of visual outputs, such as charts tracking annual publication trends, citation metrics, and distributions of authors, countries, journals, and research

institutions. Moreover, Biblioshiny enables the examination of research hotspots and emerging trends through the creation of visualisations like word clouds, keyword co-occurrence networks, and thematic maps. In this study, bibliometric analysis supported by Biblioshiny was employed to deliver a thorough and systematic exploration of the field (Wang et al., 2024).

2.2Systematic review

This study further carried out a systematic content analysis. In order to ensure consistency and systematisation, a data extraction form is designed, which covers the following contents:

1. Basic information of the literature; 2. Study design (quantitative/qualitative/mixed methods, sample size, stage of education, country context); 3. Measurement tools for teacher stress and cognitive factors; 4. Core findings (direction, significance, and influencing mechanism of the relationship between teacher stress and cognitive flexibility/metacognition); 5. Whether moderating variables, mediating models, or intervention designs are involved.

After extracting the data, this paper summarises the theoretical framework, empirical support, and intervention suggestions from the existing research on "teachers' cognitive resources and stress regulation mechanism" through thematic induction and comparative analysis. It identifies the shortcomings and future development directions of the current research.

3. RESULT

3.1Result from bibliometric analysis

In this study, we conducted a comprehensive and detailed econometric analysis of the research literature on the relationship between teacher stress and cognitive factors by using the Biblioshiny tool to reveal the research development trend, core theme structure and future direction of this field. It should be noted that in the literature selection process, this study only included the literature that involved both "teacher stress" and "cognition-related variables", mainly focusing on cognitive flexibility and metacognition. Therefore, the correlation between the high-frequency keywords "cognition" and "stress" (Figure 1) in the following measurement results is a direct reflection of the decision of the search strategy in this study, and the correlation between the two is certain rather than accidental.

Figure 1 Word cloud

3.1.1 Research trends, thematic structure and geographical distribution

First of all, it can be seen from the annual scientific output trend chart (Figure 2) that the number of literature on this topic is relatively low between 2004 and 2011, and the research is still in the exploratory stage. Since 2012, the number of publications has increased steadily year by year, especially after 2019, showing a significant increase, reaching a peak in 2023. This trend reflects that "teacher stress" and "cognitive factors" have gradually become an important topic in the interdisciplinary research of educational psychology.

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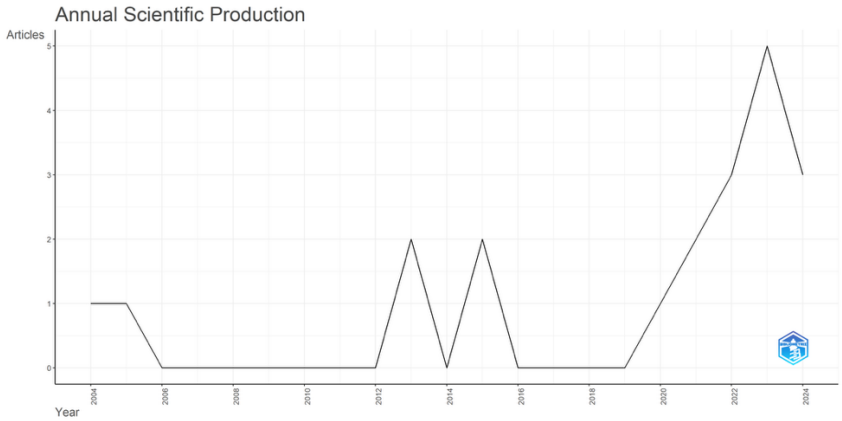

Figure 2 Annual production report

Secondly, based on the thematic map (Figure 3), terms such as "cognitive", "teachers", and "stress" are located in the upper right quadrant (Motor Themes), representing the most mature and core themes in the current research. However, the clustering results also suggest that higher-order cognitive variables such as "cognitive flexibility" and "metacognition" have not yet formed an independent research population. This phenomenon reveals that the field is still based on generalised cognition, and there is still a lack of systematic excavation and theoretical construction of specific cognitive mechanisms.

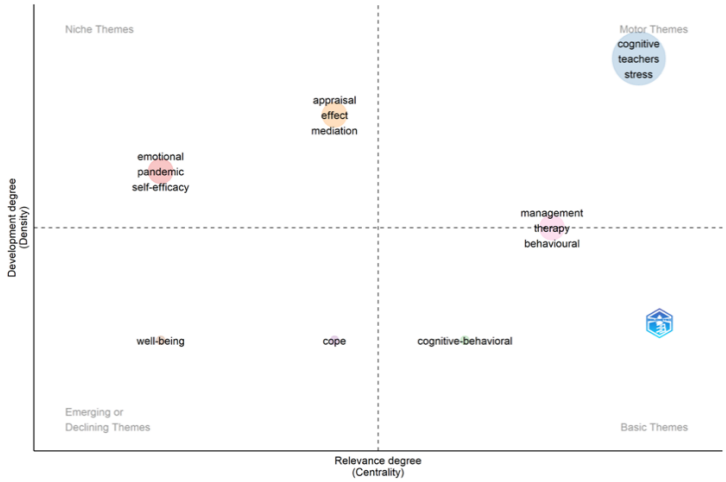

Figure 3 Thematic map result

Thirdly, in the three-field analysis (Figure 4), we observed that contributions on this specific filed were mainly made by countries such as Portugal, Iran, the United States, China and Australia, indicating the wide international interest of the topic. The differences in research backgrounds and education systems in different countries provide a rich soil for multiple perspectives on teachers' stress and cognitive mechanisms. However, this geographical distribution also shows a trend of uneven research activity between regions.

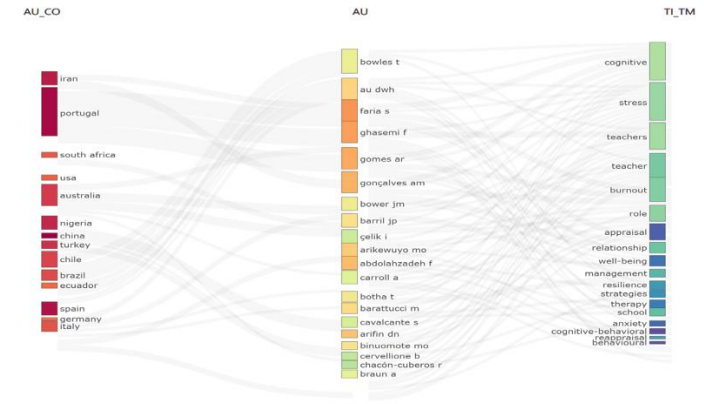

Figure 4 Country, author, title

Finally, the trend topic map further (Figure 5) reveals the development trajectory of keywords over time. "Cognitive" and "stress" have maintained long-term research popularity, while keywords such as "burnout", "emotion regulation" and "reappraisal" have been heating up rapidly in recent years, indicating that the research perspective has gradually shifted from external stressors to individual internal regulation mechanisms. Comparatively speaking, keywords with more in-depth mechanisms, such as "metacognition" and "cognitive flexibility", have not yet formed a significant growth trajectory in the figure, suggesting that there is still room for development in this field at the level of higher-order cognitive mechanisms.

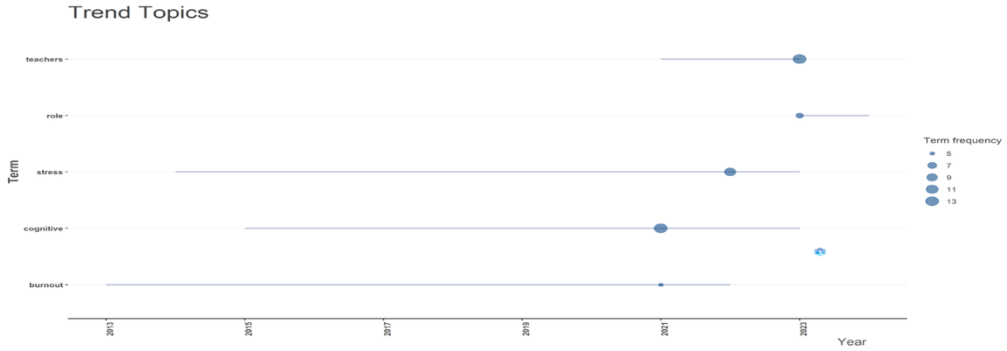

Figure 5 Trend topic in this line of research

3.1.2 Analysis of Keyword Co-occurrence and Term Frequency Distribution

The latest co-occurrence network diagram (Figure 6) further reveals the research cluster structure in this field: the bipolar network structure cantered on "Cognitive", and "Teachers" highlights the importance of cognitive variables in the study of teacher stress. The dense clusters formed around keywords such as "burnout", "reappraisal" and "emotion regulation" reflect that emotion regulation strategies are the mainstream focus of current research. However, metacognition and cognitive flexibility have not formed independent or high-frequency clusters in the network, indicating that the existing research is still in the preliminary exploration stage at the level of higher-order cognitive mechanisms. In addition, the strong connection between "Cognitive" and "Teachers" in the network structure indicates the close coupling relationship between teacher stress and cognitive factors, but there is still an obvious gap in the exploration of in-depth mechanisms.

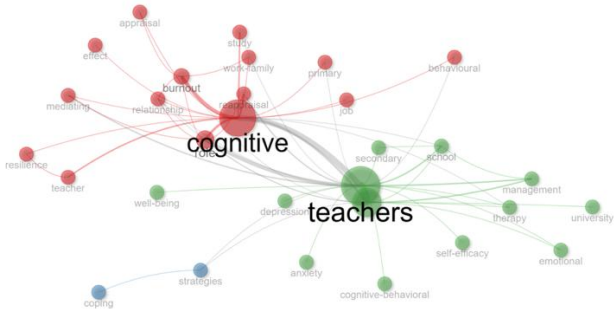

Figure 6 Co-occurrence network

Figure 7 Keyword frequency

A closer look at the keyword frequency analysis (Figure 7) further supports this observation. The research focus is highly concentrated on "burnout" and "teachers", accounting for 14% each, which are the absolute main axis themes. "Cognitive reappraisal" (9%), "resilience" and "stress" (7% each) form the second level of focus, showing a strong correlation between stress-burnout pathways and cognitive regulation strategies. Keywords such as "emotion regulation", "self-efficacy" and "teacher burnout" all appeared twice, reflecting the continuous focus on emotion regulation and self-efficacy. Low-frequency words include "cognitive-behavioural strategies" and "cognitive-behavioural therapy", accounting for only 2%, indicating that intervention strategies are involved but have low weight. It is worth emphasising that the words related to "metacognition" and "cognitive flexibility" do not appear in the tree map, highlighting that the current research is still dominated by cognitive strategies at the emotional and behavioural levels, and higher-order cognitive mechanisms have not yet entered the explicit research framework.

3.2Result from systematic analysis

In appendix 1 (Hansen, 2025),a total of 20 empirical studies from Asia, Europe, Africa and the Americas were included in this systematic review, showing an initial trend towards internationalisation in this field. Among them, the research objects include teachers from primary to higher education levels, showing a wide coverage of education stages. Study sample sizes ranged from a minimum of 37 to a maximum of 3466 people, reflecting significant differences in sample size. In terms of study design, most studies used quantitative methods such as cross-sectional investigations, path analysis, and structural equation models (SEM), and some studies combined experimental design (e.g. randomised controlled trials, quasi-experiments) to examine the effects of interventions. In addition, a few adopted a mixed approach to multi-faceted analysis, combining quantitative and qualitative data, which enhanced the explanatory power of the study. From the perspective of geographical distribution, there are research outputs in East Asia (especially China and Hong Kong), Europe (Spain, Portugal, Romania, etc.), and emerging regions such as Iran, Turkey, South Africa, and Nigeria, showing the cross-cultural nature of teacher stress research. The gender ratio of the teacher sample is generally female, reflecting the gender structure characteristics of the education industry. These literatures show a certain diversity in terms of country region, education stage, sample size and research methodology, which provides multiple perspectives for this review to explore the cognitive mechanism of teacher stress.

3.2.1 Measures of teacher stress and cognitive factors

Regarding teacher stress measurement, a total of 8 scales were used in the included studies, showing the characteristics of consistency and diversity. Among them, the Maslach Burnout Inventory (MBI, including variants such as MBI-ES, MBI-GS) is the most commonly used tool, used in a total of 6 studies, to measure the level of teacher burnout. It is an international standardised tool for studying teacher stress. The Perceived Stress Scale (PSS) was used in three studies to assess teachers' subjective perception of stress. Other scales, such as DASS-21, Spanish Burnout Inventory (SBI), Copenhagen Burnout Inventory (CBI), and SQAS, were mostly used as supplementary measures and were used in one or two studies each. Overall, most studies tend to opt for a more standardised burnout scale, but in some regions or study contexts, they are also measured with localised tools to meet the needs of a particular culture or study participant.

In terms of measuring cognitive variables, the most commonly used tool is the Emotion Regulation Questionnaire (ERQ), which was used in five studies to evaluate teachers' cognitive reappraisal and emotion inhibition strategies, highlighting the central position of cognitive regulation mechanisms in teacher stress research. Two studies each used the Cognitive Appraisal Scale (CAS) and the Cognitive Flexibility Scale, focusing on two key coping mechanisms: cognitive evaluation and cognitive flexibility. Only one study used the Metacognitive Awareness Inventory (MAI) to measure teachers' metacognitive abilities, suggesting that direct measures of metacognitive abilities in this area are still in their infancy. On the whole, the measurement tools of cognitive variables show the characteristics of "emotion regulation and less cognitive mechanism measurement", and there is still a lot of room for development in the in-depth measurement of higher-order cognitive mechanisms such as metacognition and cognitive flexibility in the future.

3.2.2 Evaluation literature quality

Two authors independently evaluated the quality of the included studies, applying eight indicators for non-intervention research and 14 indicators for intervention-based research (adapted from Hwang et al. (2017); refer to Appendix 2 and 3 (Hansen, 2025). When discrepancies arose between reviewers,

differences were resolved through in-depth discussion until consensus was achieved. Notably, no studies were excluded solely due to their quality scores; instead, these assessments were used to provide a general picture of the methodological rigour across the reviewed literature. The corresponding evaluation results show (Figure 8 & Figure 9): On the whole, the included literature performed well in the formulation of research objectives, sample information presentation, ethical review description and paper structure standardisation, and most of the studies could present the research design and implementation process, meeting the basic quality requirements in the field of educational psychology. Interventional studies generally achieved a high level in indicators such as intervention design and baseline comparability, while non-intervention studies performed well in terms of consistency between research questions and data analysis and sample information integrity. However, the evaluation also showed that some of the literature had some deficiencies in the reliability and validity of the measurement tools for stress and cognitive variables, a few studies did not elaborate on the ethical review process, and the information on the details of the comparison group and the consistency of intervention implementation in individual intervention studies still needs to be improved.

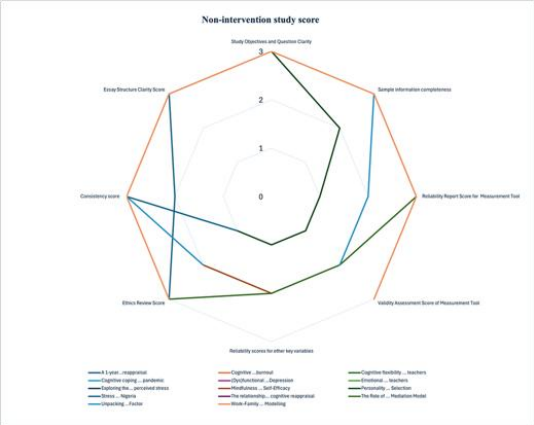

Figure 8 Quality score for non-intervention studies

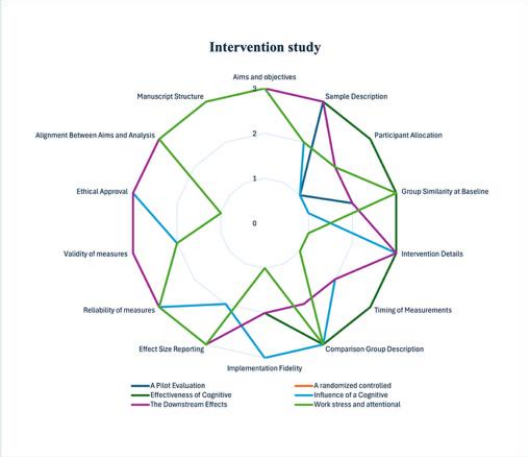

Figure 9 Quality score for intervention studies

3.2.3 Thematic synthesis

The systematic integration of 20 empirical studies shows that there is important theoretical and practical value in understanding teacher stress from the cognitive level. There is a complex and close interaction between cognitive factors and teachers' stress, especially in the process of emotion regulation and stress adaptation, among which cognitive reappraisal and cognitive flexibility play the most prominent role. Although a large number of previous studies have focused on behavioural interventions, the improvement of behaviour depends on the effective regulation of cognitive processes, such as cognitive evaluation and strategy use. Cognitive evaluation especially shows a clear mediating function in the psychological transformation from stress to burnout. In addition, the cognitive behavioural therapy (CBT) intervention further confirmed the practical value of cognitive strategies. However, studies have also shown that teachers who lack effective cognitive strategies may experience more stress when faced with challenging cognitive tasks. These results suggest that clarifying the specific role of higher-order cognitive mechanisms

such as cognitive flexibility and metacognition in stress coping is of key significance for refining the understanding of teachers' stress and developing effective intervention programs.

3.2.3.1 Buffering effect of cognitive reappraisal on emotion

As a core emotion regulation strategy, cognitive reappraisal shows a significant buffering effect in the process of teachers' coping with work stress and burnout (Chang, 2020), which is embodied in its inhibitory effect on negative emotional responses and the interference effect of stress transmission pathway. In a number of structural equation modelling studies, cognitive reappraisal has been shown to be effective in reducing emotional exhaustion and psychological burden caused by work-family conflict (Li et al., 2024). For example, in a cross-sectional study of 2184 Chinese teachers, cognitive reappraisal significantly moderated the intensity of depression's effect on the work-family conflict → burnout pathway, and high levels of cognitive revaluation attenuated the predictive effect of depression on burnout (β = 0.055, $p < .001$), thus constituting a protective mechanism for resilience. In addition, in another SEM study conducted by Fallah et al. (2023) focusing on foreign language teachers in Iran, cognitive reappraisal did not have a mediating effect on teaching anxiety alone but indirectly weakened the link between mindfulness and anxiety by enhancing teachers' self-efficacy, which further emphasised the reciprocal role of cognitive reappraisal in multiple emotion regulation pathways. In addition, longitudinal studies have also confirmed the buffering effect of cognitive reappraisal. In a one-year follow-up study of 587 Finnish teachers, WCB (cyberbullying) significantly weakened the level of cognitive appraisal, and the decline in cognitive reappraisal further led to a decrease in teachers' job engagement, especially in the "absorption" dimension (the indirect path was significant). This indicates that when teachers lack cognitive resources, the impact of negative events will continue to accumulate at the level of work motivation. Thus, cognitive reappraisal directly reduces negative mood, indirectly modulates the burnout pathway, and has a protective effect by enhancing self-efficacy or reducing the effects of stress or depression.

3.2.3.2 Cognitive Flexibility as a Mechanism for Regulating Teacher Stress

Cognitive flexibility, as an individual's ability to flexibly switch between thinking strategies and behavioural responses in complex situations (Ionescu, 2012), is gradually being recognised as a key psychological mechanism in the process of stress regulation for teachers (Harel et al., 2023). In particular, in intervention studies, the improvement effect is highly correlated with stress relief, although its mediating role in the cross-layer pathway model is still controversial.

In an intervention experiment with teachers in mindfulness and health enhancement sessions, the researchers measured teachers' cognitive flexibility using the Attention Switching Task (AST) in the CANTAB system. The results showed that teachers experienced a significant increase in cognitive flexibility (increased AST accuracy and shorter reaction time) after the intervention. This was accompanied by a significant decrease in the DASS-21 stress scale score and the personal burnout dimension in the Copenhagen Burnout Inventory. This suggests that cognitive flexibility may play a moderating role in teachers' stress recovery process. However, the multi-level mediation model further constructed in this study found that cognitive flexibility did not significantly mediate the impact of teacher changes on students' level (academic self-perception and classroom support), suggesting that the influence was mainly focused on the teacher's own stress regulation dimension, rather than the cross-level influence mechanism. In addition, complementing the intervention pathway is another large-sample cross-sectional study from Turkey. The results showed that cognitive flexibility significantly mediated teachers' well-being through positive humour style (β significant indirect effect, $P < .001$), although the study did not directly introduce stress variables, the results reflected that cognitive flexibility may regulate emotional responses in the context of teacher stress, thereby transforming negative emotions and forming positive emotional resources.

There is a positive relationship between the improvement of teachers' cognitive flexibility and the decrease of stress level, especially in the intervention study, which was reflected in the synchronous path of "improvement of cognitive response speed and decrease of stress experience". Although cognitive flexibility has not yet shown a stable mediating effect in many models, as an important component of teachers' psychological resources, its mechanism in individual stress regulation and functional recovery has been preliminarily empirically supported.

3.2.3.3 Cognitive Appraisal as a Mediator in the Stress–Burnout Link

In the study of teacher stress, cognitive appraisal, as an individual's judgment mechanism on the subjective meaning of stress situations (Ma et al., 2021), is gradually regarded as an important mediating variable

connecting work conflict and psychological burnout. According to Lazarus and Folkman's transactional stress theory, the primary appraisal (e.g., "threat perception" and "challenge perception") and secondary appraisal (e.g., "coping ability" and "control perception") of an individual in the face of potential stressors will directly affect their stress response and emotional exhaustion.

The most representative of the cognitive evaluation pathway is a structural equation model study of 425 Portuguese teachers. Based on the PSCA scale, the researchers measured four cognitive evaluation dimensions (threat, challenge, coping ability, and sense of control) and verified their mediating role between work-family conflict and burnout. The results showed that "threat evaluation" had a significant positive predictive effect on burnout ($\beta = .448$), while "challenge evaluation" ($\beta = -.223$) and "coping ability" ($\beta = -.271$) had a significant negative effect on burnout, constituting a dual-path mediating structure. It is worth noting that "control perception" did not show a significant effect in this model, suggesting that even if teachers have a sense of control, if they lack a specific coping confidence and positive cognitive framework, the stress buffering effect is still limited. In addition, the multigroup SEM test was also carried out in this study, and it was found that the above-mentioned cognitive evaluation pathways maintained structural invariance between gender and age groups, suggesting that the mechanism has a certain population robustness. Besides, From the perspective of intervention, a study of teachers' stress management intervention combining CBT and CAM techniques, although it did not use a complete cognitive assessment scale, reported changes in teachers' interpretation of stressors and coping beliefs after receiving the intervention, which indirectly supported the trainable and adjustable characteristics of cognitive appraisal.

3.2.3.4 The Efficacy of Cognitive–Behavioural Interventions in Reducing Teacher Stress

Cognitive-behavioural intervention (CBT) is widely recognised as one of the evidence-based strategies for alleviating occupational stress and emotional exhaustion (Yasmin et al., 2022), especially for high-pressure occupational groups such as teachers (Akanaeme et al., 2021). In the study of teacher stress, the effectiveness of CBT intervention is mainly reflected in three aspects: first, the significant alleviation of emotional distress, second, the functional reconstruction of stress coping style, and third, the improvement of cognitive regulation mechanism in some studies.

At least four empirical studies adopted an intervention design based on the CBT framework, with samples covering primary school teachers, university lecturers, and high burnout groups, including randomised controlled trials (RCTs), quasi-experimental designs, and physiological measures, reflecting a certain diversity of interventions and experimental control. In a classic RCT study, 70 burnout teachers were randomly assigned to group therapy for adaptive CBT versus a waiting group. The results showed that the CBT group significantly reduced the level of emotional exhaustion and dehumanisation after intervention ($p < .01$) and showed a positive improvement in life satisfaction and psychological symptoms, with a moderate to large effect size. The study used intention-to-treat analysis and controlled for baseline differences, enhancing the causal inference of its conclusions. In addition, similar effects have been demonstrated in non-university settings. A CBT combined with complementary medicine (CAM) program in 40 Japanese elementary school teachers found that the intervention group had significant improvements in the functionality of stress symptoms and coping strategies ($p < .05$, and the researchers specifically pointed out that teachers were more inclined to use positive strategies such as problem-orientation and cognitive reappraisal after the intervention, suggesting that CBT mechanisms not only affect emotional state, but also reconstruct stress interpretation and coping behaviour at the cognitive level. Further, a study that combined CBT with meditation practice focused on university lecturers and found a significant decrease in the subjective occupational stress index ($p < .001$). The study highlights that "cognitive restructuring" training in CBT enables teachers to more actively identify irrational stressors and form more resilient thinking patterns.

3.2.3.5 The double-edged effect of cognitive strategy deficit and challenging cognitive demand

The teaching profession naturally carries a large number of tasks with high cognitive complexity, including multi-tasking, real-time teaching control, and differentiated management of students (Alquizar, 2018). These tasks put forward extremely high requirements for teachers' ability to exercise executive control, attention maintenance and cognitive strategy allocation. However, when teachers lack the necessary cognitive coping strategies, or when cognitive resources are depleted in stressful states, cognitive work tasks themselves may also change from "stimulating resources" to "aggravating the load", posing an implicit threat to mental health.

The problem of the lack of cognitive strategies was confirmed in a large cross-sectional survey. In a survey of 3,466 secondary school teachers in Nigeria, more than 90% of teachers "never" used positive cognitive coping strategies (e.g., positive reassessment, planned thinking, etc.), preferring instead to use non-functional methods such as passive coping and avoidance behaviours. The study combined gender and regional differences and pointed out that teachers' cognitive response to stress is severely under-resourced, which may be an important reason for the generalisation of professional exhaustion. Interestingly, some studies also provide the opposite perspective, that is, cognitive tasks have their own potentially activating functions, and the key is whether teachers can mobilise their own cognitive resources to respond. For example, the Unpacking the Role of Work Demands in Teacher Burnout paper uses the "cognitive demands" scale in COPSOQ-II to measure the cognitive complexity of work, and the results show that teachers show lower emotional exhaustion ($\beta = -.32$) and higher fulfilment ($\beta = .30$) when the demands of cognitive tasks are higher. This means that cognitive tasks do not necessarily constitute stressors, and the direction of their effects depends on whether teachers have the corresponding coping resources and adjustment mechanisms.

Therefore, there is a relationship between the availability of cognitive resources and the cognitive work requirements faced by teachers: when cognitive strategies are abundant, challenging tasks may be transformed into positive resources that stimulate the professional self; Conversely, it may lead to attention control collapse and functional exhaustion.

4. DISCUSSION

4.1 Empirical Findings of Teacher Stress and Cognitive Variables: A Summary of Existing Research

The 20 empirical studies systematically integrated in this study reveal that the current research on teacher stress has gradually incorporated "cognition" into the explanatory path, especially in the three aspects of cognitive appraisal strategy, CBT intervention and cognitive flexibility.

First, cognitive appraisal, as a core emotion regulation strategy, has been shown to have a significant buffering effect on teacher stress in multiple studies. Relevant studies show that cognitive appraisal can not only directly reduce teachers' negative emotional experience but also play a mediating and moderating effect in the "work stress-burnout" pathway. For example, a study of 2184 Chinese teachers showed that cognitive reappraisal significantly weakened the predictive effect of work-family conflict on burnout ($\beta = 0.055$, $p < .001$), thus constructing a cognitive-emotional dual moderation mechanism. This suggests that teachers' cognitive regulation strategies play a crucial role in stress adaptation. Secondly, CBT (Cognitive Behavioural Therapy) intervention has become a commonly used intervention in stress relief research for teachers. At least four empirical studies significantly reduced teachers' levels of emotional exhaustion and subjective stress perception through CBT intervention. For example, in a classic randomised controlled trial (RCT) in which 70 burnout teachers were randomly assigned to a CBT group for treatment and a wait-list group, the intervention showed significant improvements in emotional exhaustion, psychological symptoms, and life satisfaction in the CBT group. These studies not only validated the effectiveness of CBT in teachers' stress management but also suggested its potential as a structured cognitive intervention.

In addition, cognitive flexibility as a teacher's ability to switch cognitive strategies and adjust thinking in complex environments has also received attention in some studies. Interventional experiments found that teachers trained in mindfulness and health promotion had significantly improved cognitive flexibility (e.g., increased accuracy of AST tasks and shortened response time), accompanied by a simultaneous decrease in DASS-21 stress scores. Although its mediating role in the cross-layer model is still controversial, it has shown a specific empirical basis in the dimension of individual teachers' stress management. In summary, although the current research has made preliminary progress at the strategic level (e.g., cognitive reappraisal), intervention level (e.g., CBT), and some cognitive mechanisms (e.g., cognitive flexibility), the overall focus is still on the verification of the effect of superficial cognitive strategies, and the cognitive mechanisms behind these strategies have not been deeply explored.

4.2 Implicit Mechanisms in Cognitive Interventions: The Intrinsic Supporting Role of Metacognition and Cognitive Flexibility

Further analysis of the content of existing studies shows that although few studies directly measure metacognitive ability or systematically explore cognitive flexibility, the connotations of both have been implicitly embedded in existing research on cognitive intervention and emotion regulation. The core idea

of cognitive reappraisal is altering the cognitive interpretation of a specific situation, thereby influencing the individual's emotional experience (Gross & John, 2003).

First, although cognitive reappraisal is defined as an emotional regulation strategy, its essence is a typical metacognitive process (Merkebu et al., 2023). It consists of three key steps: first, teachers need to have sufficient metacognitive awareness to be able to identify and be aware of their own stress or negative emotional state (Efklides, 2008; Flavell, 1979); secondly, metacognitive monitoring was carried out to actively analyse the current cognitive biases and their causes (Joormann & Gotlib, 2010). Thirdly, through metacognitive regulation, the interpretive framework of events is reconstructed to achieve emotional transformation (Gross, 2015). Therefore, the effectiveness of cognitive reappraisal actually depends on whether teachers have sufficient metacognitive ability.

Secondly, although CBT intervention is mainly presented as a "therapeutic technique" in existing research, its core contents, such as "thought recording", "automatic thought identification", and "cognitive restructuring ", are typical manifestations of metacognitive training (Moritz et al., 2019). These interventions not only helped teachers adjust their thinking, but more importantly, they developed the ability to actively monitor and reflect on their own cognitive responses and strengthened their cognitive flexibility (Oishi et al., 2018). For example, the "multiple-choice strategy" and "situational alternative thinking" sessions in CBT not only improve the diversity of teachers' strategies but also reflect the practical significance of cognitive flexibility by improving their ability to quickly adjust their thinking patterns in changing situations. It is worth mentioning that some of the feedback from teachers in the intervention study has indirectly reflected the existence of metacognition and cognitive flexibility. For example, studies have reported that teachers are "more aware of stressors and try to revisit problems from different perspectives" after CBT. This phenomenon is a direct manifestation of increased metacognitive awareness and cognitive flexibility. Although the existing studies have not explicitly identified metacognition and cognitive flexibility as independent variables, they have actually formed the deep foundation of cognitive reappraisal strategies and CBT intervention mechanisms, which provides a clear theoretical direction for future research.

4.3Future Research on Higher-Order Cognitive Mechanisms: Research Gaps And Prospects for Metacognition And Cognitive Flexibility

One of the most important findings of this review is that although metacognition and cognitive flexibility are theoretically widely recognised as key mechanisms of stress regulation among teachers, they are still seriously insufficient in empirical research, forming a clear research gap. In particular, among the 20 empirical studies included, there are almost no studies on the mechanism model of systematically constructing metacognition or cognitive flexibility in the "stress-emotional exhaustion" pathway, which significantly restricts the in-depth development of the theory. However, the existing studies on student stress provide valuable theoretical reference for the study of teacher stress. Some studies, a study conducted by Sarıçam et al. (2017) in particular, have shown that metacognition has been proven to have a stable mediating role in students' "stress-anxiety" pathway, suggesting that metacognition not only plays a role in the implementation of cognitive strategies, but also plays a central role in the psychological mechanism of stress generation and relief. Teachers and students are in different ecological environments, but both faces highly complex cognitive and emotional challenges, so it is reasonable to speculate that this mechanism is equally applicable to teachers.

Future research in this field should focus on the following directions: first, metacognition and cognitive flexibility should be systematically introduced as core variables to test their mediating and moderating role in teachers' stress pathways, and promote the transformation from "strategy-level research" to "mechanism-level research"; The second is longitudinal design and cross-cultural research, which investigates the stability and dynamic changes of higher-order cognitive mechanisms in different cultural contexts and time dimensions. The third is to optimise the intervention strategy, embedding systematic metacognition and cognitive flexibility training modules in teachers' mental health promotion projects, and promoting the transformation of cognitive empowerment from "short-term adjustment" to "long-term internalisation".

5. Limitation And Suggestion for Future Study

Although this study comprehensively sorted out and analysed the relationship between teachers' stress and cognitive mechanisms, there are still some limitations that cannot be ignored and need to be reconsidered. First of all, in terms of data sources, this study only integrates the Web of Science (WoS)

database, although it is authoritative and has high coverage, the use of a single database inevitably leads to limited literature scope, and may omit empirical studies that are not included in WoS in other databases, especially international databases such as Scopus and ERIC and some regional resources, thus affecting the comprehensiveness and representativeness of the review results. In addition, although this study emphasises the importance of metacognition and cognitive flexibility, due to the small number of existing empirical studies that directly measure these two types of higher-order cognitive mechanisms, the analysis in this paper relies largely on mechanistic inferences and lacks empirical support from path models or longitudinal data, which limits the strength of theoretical explanatory power to a certain extent. Finally, in terms of scientometric analysis methods, this review combines a number of common bibliometric modules, such as keyword co-occurrence network, topic evolution, and three-field analysis, to systematically reveal the research hotspots and development context in this field. These already cover the core aspects from structural analysis to dynamic evolution. However, there is still some room for expansion, for example, co-citation network analysis has not been carried out to reveal the network structure of theoretical core literature in this field.

Therefore, future research should first expand the coverage of databases, combine Scopus, ERIC, PsycINFO and regional databases to achieve multi-channel data integration, so as to improve the comprehensiveness and international representativeness of literature collection. In terms of variable integration, it is necessary to promote empirical research to incorporate metacognition and cognitive flexibility into the core measurement indicators, explore and verify their mechanism in the stress pathway, and make up for the current shortcomings of "mechanism interpretation is greater than empirical support". Finally, it is suggested that more advanced visualization and network analysis techniques should be used at the scientometric level, such as co-citation clustering, emergent word analysis, topic evolution path recognition, etc., to reveal more complex knowledge network structure and dynamic evolution trends in this field.

6. CONCLUSION

Based on a systematic literature review combined with bibliometric methods, this study systematically reviews the research status of the topic of "cognitive mechanisms" in the field of teacher stress, especially focusing on the theoretical and empirical research progress of two higher-order cognitive mechanisms, metacognitive ability and cognitive flexibility. Through the analysis of 20 empirical literatures, the study reveals that the current research on teacher stress has gradually incorporated "cognitive factors" into the explanatory path, especially in the three aspects of cognitive appraisal strategy, CBT intervention and cognitive flexibility, which has formed a preliminary empirical accumulation, which verifies the positive role of cognitive strategies in alleviating teacher stress. However, further analysis shows that the existing research mainly stays at the surface verification of cognitive strategies, and the direct measurement and system construction of deep mechanisms such as metacognition and cognitive flexibility are still seriously insufficient. At present, although most studies indirectly involve metacognitive processes (such as the metacognitive core of cognitive reappraisal, cognitive monitoring and regulation in CBT intervention), metacognition or cognitive flexibility has not been used as the core variable for path verification, which limits the theoretical explanatory power of cognitive mechanisms. This review not only summarises the empirical relationship between teachers' stress and cognitive mechanisms but also reveals the theoretical potential of metacognition and cognitive flexibility as the "supporting mechanisms" behind emotion regulation strategies, and points out that there are significant research gaps in this field in terms of theory construction, variable measurement, and cross-cultural comparison. The bibliometric results further confirm that higher-order cognitive mechanisms have not yet formed a systematic growth trend in mainstream research, which points out a breakthrough direction for future research. In summary, this study provides a necessary empirical summary for the study of the cognitive mechanism of teacher stress, emphasises the importance of incorporating metacognition and cognitive flexibility into the teacher stress path model, and calls for future research to strengthen the measurement and verification of higher-order cognitive mechanisms at the empirical level, and promote the transformation from "superficial strategy research" to "deep mechanism deconstruction", so as to provide more scientific theoretical support for teachers' mental health promotion and intervention practice.

REFERENCE

1. Akanaeme, I. N., Ekwealor, F. N., Ifeluni, C. N., Onyishi, C. N., Obikwelu, C. L., Ohia, N. C., Obayi, L. N., Nwaoga, C. T., Okafor, A. E., Victor-Aigbodion, V., Ejiofor, T. E., Afiaenyi, I. C., Ekomaru, C. I., & Dike, I. C. (2021). Managing job stress among teachers of children with autism spectrum disorders. Medicine, 100(46), e27312. https://doi.org/10.1097/MD.0000000000027312
2. Alquizar, J. (2018). Multitasking of Teachers in the Contemporary Settings: Boon or Bane? SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3283601
3. Anton, J., & Van Ryzin, M. J. (2024). Reducing teacher stress and burnout and enhancing self-efficacy through technology-supported small-group instruction. Social and Emotional Learning: Research, Practice, and Policy, 4, 100053. https://doi.org/10.1016/j.sel.2024.100053
4. Brady, L. L., McDaniel, S. C., & Choi, Y. (2023). Teacher stress and burnout: The role of psychological work resources and implications for practitioners. Psychology in the Schools, 60(6), 1706–1726. https://doi.org/10.1002/pits.22805
5. Chang, M.-L. (2020). Emotion Display Rules, Emotion Regulation, and Teacher Burnout. Frontiers in Education, 5. https://doi.org/10.3389/feduc.2020.00090
6. Efklides, A. (2008). Metacognition. European Psychologist, 13(4), 277–287. https://doi.org/10.1027/1016-9040.13.4.277
7. Fallah, N., Abdolahzadeh, F., & Yaaghobi, M. (2023). Mindfulness and Anxiety Among Foreign Language Teachers: The Role of Cognitive Reappraisal and Self-Efficacy. Mindfulness, 14(12), 3020–3032. https://doi.org/10.1007/s12671-023-02259-5
8. Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist, 34(10), 906–911. https://doi.org/10.1037/0003-066X.34.10.906
9. Flavell, J. H. (1987). Speculations about the nature and development of metacognition. https://api.semanticscholar.org/CorpusID:141147750
10.Gabbiadini, A., Paganin, G., & Simbula, S. (2023). Teaching after the pandemic: The role of technostress and organizational support on intentions to adopt remote teaching technologies. Acta Psychologica, 236, 103936. https://doi.org/10.1016/j.actpsy.2023.103936
11.Gross, J. J. (2015). Emotion Regulation: Current Status and Future Prospects. Psychological Inquiry, 26(1), 1–26. https://doi.org/10.1080/1047840X.2014.940781
12.Hansen, Z. (2025). Appendix for Research Mapping of Teacher Stress from a Cognitive Perspective: A Systematic Review and Bibliometric Analysis of Metacognition and Cognitive Flexibility. https://doi.org/10.17605/OSF.IO/F2NWZ
13.Harel, O., Hemi, A., & Levy-Gigi, E. (2023a). The role of cognitive flexibility in moderating the effect of school-related stress exposure. Scientific Reports, 13(1), 5241. https://doi.org/10.1038/s41598-023-31743-0
14.Harel, O., Hemi, A., & Levy-Gigi, E. (2023b). The role of cognitive flexibility in moderating the effect of school-related stress exposure. Scientific Reports, 13(1), 5241. https://doi.org/10.1038/s41598-023-31743-0
15.Hwang, Y.-S., Bartlett, B., Greben, M., & Hand, K. (2017). A systematic review of mindfulness interventions for in-service teachers: A tool to enhance teacher wellbeing and performance. Teaching and Teacher Education, 64, 26–42. https://doi.org/10.1016/j.tate.2017.01.015
16.Iacolino, C., Cervellione, B., Isgrò, R., Lombardo, E. M. C., Ferracane, G., Barattucci, M., & Ramaci, T. (2023). The role of emotional intelligence and metacognition in teachers' stress during pandemic remote working: A moderated mediation model. European Journal of Investigation in Health, Psychology and Education, 13(1), 81–95. https://doi.org/10.3390/ejihpe13010006
17.Ionescu, T. (2012). Exploring the nature of cognitive flexibility. New Ideas in Psychology, 30(2), 190–200. https://doi.org/10.1016/j.newideapsych.2011.11.001
18.Joormann, J., & Gotlib, I. H. (2010). Emotion regulation in depression: Relation to cognitive inhibition. Cognition & Emotion, 24(2), 281–298. https://doi.org/10.1080/02699930903407948
19.Li, S. (2023). Enhancing professional success: Chinese EFL teachers' workplace buoyancy and cognitive flexibility. Heliyon, 9(2), e13394. https://doi.org/10.1016/j.heliyon.2023.e13394
20.Li, Y., Ni, X., Zhang, W., Wang, J., Yu, C., & Zou, H. (2024). The relationship between work–family conflict and job burnout among primary and secondary school teachers: the role of depression and cognitive reappraisal. Frontiers in Psychology, 15. https://doi.org/10.3389/fpsyg.2024.1438933
21.Ma, J., Peng, Y., & Wu, B. (2021). Challenging or hindering? The roles of goal orientation and cognitive appraisal in stressor-performance relationships. Journal of Organizational Behavior, 42(3), 388–406. https://doi.org/10.1002/job.2503
22.Merkebu, J., Kitsantas, A., Durning, S. J., & Ma, Ti. (2023). What is metacognitive reflection? The moderating role of metacognition on emotional regulation and reflection. Frontiers in Education, 8. https://doi.org/10.3389/feduc.2023.1166195
23.Moritz, S., Klein, J. P., Lysaker, P. H., & Mehl, S. (2019). Metacognitive and cognitive-behavioral interventions for psychosis: new developments. Dialogues in Clinical Neuroscience, 21(3), 309–317. https://doi.org/10.31887/DCNS.2019.21.3/smoritz
24.Oishi, S., Takizawa, T., Kamata, N., Miyaji, S., Tanaka, K., & Miyaoka, H. (2018). Web-Based Training Program Using Cognitive Behavioral Therapy to Enhance Cognitive Flexibility and Alleviate Psychological Distress Among Schoolteachers: Pilot Randomized Controlled Trial. JMIR Research Protocols, 7(1), e32. https://doi.org/10.2196/resprot.8541
25.Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). Declaración PRISMA 2020: una guía actualizada para la publicación de revisiones sistemáticas. Revista Española de Cardiología (English Edition), 74(9), 790–799. https://doi.org/10.1016/j.rec.2021.07.010
26.Reinke, W. M., Herman, K. C., Stormont, M., & Ghasemi, F. (2025). Teacher Stress, Coping, Burnout, and Plans to Leave the Field: A Post-Pandemic Survey. School Mental Health. https://doi.org/10.1007/s12310-024-09738-7
27.Sarıçam, H., Çelik, İ., & Sakız, H. (2017). Mediator Role of Metacognitive Awareness in the Relationship between Educational Stress and School Burnout among Adolescents. Journal of Education and Future, 11, 159–175.
28.United Nations. (2024, February 29). UN issues global alert over teacher shortage. https://news.un.org/en/story/2024/02/1147067

29.Wang, D., Jia, Q., & Mao, L. (2024). Systematic Review of Language Teachers' Self-efficacy Research over the Past Twenty Years: A Bibliometric Analysis. Sage Open, 14(4). https://doi.org/10.1177/21582440241289194
30.Yasmin, K., Yaqoob, A., & Sarwer, H. (2022). Effect of Cognitive Behavioral Therapy (CBT) Based Intervention on Resilience and Burnout among Staff Nurses Working in Critical Care Departments. Pakistan Journal of Medical and Health Sciences, 16(3), 295–298. https://doi.org/10.53350/pjmhs22163295
31.Zhang, M., Surienty, L., & Hu, D. (2024). Bibliometric visualization analysis of teachers' work stress. IJERI: International Journal of Educational Research and Innovation, 21. https://doi.org/10.46661/ijeri.10257