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# The moderating effect of physical exercises on job stress, emotional intelligence, and teaching satisfaction among Chinese University teachers

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This study presents a conceptual model that investigates teaching satisfaction as an outcome variable in mainland China. The model incorporates the mediating mechanism of emotional intelligence and the moderating role of physical activity. The results of a survey of 2500 university teachers from 25 public institutions, which tested teaching satisfaction, demonstrate that job stress is negatively related to teaching satisfaction and indirectly related to emotional intelligence. Physical exercise acts as a moderating factor that alleviates the negative correlation between job stress and emotional intelligence. Overall, our findings indicate that enhancing the frequency of physical exercises can potentially alleviate stress, regulate emotional intelligence, and ultimately contribute to a positive enhancement in teaching satisfaction. These outcomes undeniably hold practical significance for teachers and educational administrators in the realm of higher education.

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## Introduction

The quality of teaching forms the foundation of the university and is vital for its sustainable development. A crucial metric for assessing the effectiveness of instruction is teaching satisfaction (Truta et al. 2018). It refers to the degree of contented emotional state attained by a person's evaluation of instructional work and its worth. It reveals how much instructors love their jobs and how they see the state of education today (Skaalvik and Skaalvik, 2011; Oshagbemi, 2003). Teaching satisfaction is a crucial sign of the effectiveness of talent cultivation and instruction. It is essential for fostering the reform, expansion, and growth of institutions of higher learning (Gao et al. 2021). According to Yin et al. (2013) and Yin (2015), teachers' emotional intelligence (EI) is a key element in fostering teaching satisfaction. Additionally, a prior study (Biddle and Asare, 2011) found that physical activity enhances self-esteem, self-concept, and self-confidence. Additionally, it promotes communication and empathy while lowering job stress (De Benito and Luján, 2013; Ros et al. 2013).

In the fields of teaching, research, and administration, university faculty members frequently face conflicting expectations (Vardi, 2009). These pressures are sources of work stress for the majority of teachers, which can result in unpleasant feelings and poor professional results like burnout and low job satisfaction (Skaalvik and Skaalvik, 2007). According to earlier surveys, the situation for university academics in China is significantly worse. Universities and colleges have raised the expectations for teaching and research competitiveness, which has resulted in a high degree of stress, depressive symptoms, emotional exhaustion, and turnover among faculty members at universities (You, 2014; Yin et al. 2020; Han et al. 2021; Yu et al. 2022). A 2013 survey study found that 36% of university faculty members in China suffer from stress (Liu and Zhou, 2016), which has been linked to lower job satisfaction and unfavourable faculty emotions (Gao et al. 2015; Liu and Zhou, 2016; Wang et al. 2020; Liu et al. 2023).

Researchers have recently developed a strong interest in the study of instructors' emotions. EI is the capacity to perceive, classify, and express emotions accurately. The ability to produce emotions when they are beneficial for thinking, comprehending emotions, and learning about emotions, as well as the capability to control emotions to foster both intellectual and emotional development, are further traits of EI (Mayer and Salovey, 1997). According to previous studies, higher EI scores lead to greater health and well-being (Cabello and Fernández-Berrocal, 2015; Sánchez-Álvarez et al. 2016; Costa et al. 2014) and better job performance (Côté, 2014; Fox and Spector, 2000; Muchhal and Solkhe, 2017). Similar to how perceived stress is frequently described as the type and intensity of negative emotions, pleasant emotions are seen as a critical counterbalance to perceived stress (Rahm and Heise, 2019). Job satisfaction has been proven to be negatively correlated with perceived stress (Klassen and Chiu, 2010). Meanwhile, research has shown that high levels of EI are linked to healthy behaviours like avoiding alcohol and smoking, maintaining a nutritious diet, or engaging in more exercise and are associated with low levels of mental and physical health (Tsaousis and Nikolaou, 2005; Extremera and Fernández-Berrocal, 2002; Lewis et al. 2017).

There has been a significant increase in research related to physical exercise and EI, some from the field of physical education (Ferrer-Caja and Weiss, 2000; García-Martínez et al. 2018; González et al. 2019; Gutiérrez Sas et al. 2017; Lu and Buchanan, 2014; Mouton et al. 2013; Puertas Molero et al. 2017) and others from sport psychology (Bretón Prats et al. 2017; Zurita-Ortega et al. 2017). Emotional changes during physical exercise have been examined in individuals who have undergone physical activity (Duran et al. 2015; Acebes-Sánchez et al. 2019). For

instance, physical activity offers the chance to overcome obstacles, work with others as a team, and compete against oneself (Ubago-Jiménez et al. 2019). Experiences with physical activity can act as a mechanism for the development of emotions. Therefore, physical exercise enhances positive emotions (Biddle, 2000), and positive pleasant emotions (Wolfson and Turnbull, 2002; Kerr and Kuk, 2001) and enhances well-being (Szabo, 2003). Most studies have shown a positive correlation between EI and physical exercise levels (Zysberg and Hemmel, 2018; Li et al. 2009; Dev et al. 2012). Thus, those who met exercise recommendations had better EI compared to those who did not meet the exercise recommendations (Li et al. 2009; Dev et al. 2012). In a similar vein, there were notable differences in EI between physically active and inactive people; the active people had better EI (Fernández Ozcorta et al. 2015). Other studies (Tsaousis and Nikolaou, 2005; Saklofske et al. 2007; Magnini et al. 2011; Li et al. 2011) have demonstrated a substantial relationship between EI and the amount of exercise.

The majority of recent research on teachers' stress has used faculty samples from Western universities. However, given the cross-national cultural differences associated with stress interpretation and coping, it is questionable to what extent these findings are applicable to the Chinese higher education context (Shin and Jung, 2014). Few researchers have examined whether job stress and EI are associated with the level of physical exercises that faculty do to enhance teaching satisfaction. The purpose of our study was to explore the direct relationship between job stress and teaching satisfaction and to attempt to understand how EI and physical exercise work together to influence teaching satisfaction and thus help university faculty feel satisfied with their teaching jobs.

## Literature review

**Job stress and teaching satisfaction.** Faculty satisfaction in teaching is significantly influenced by job stress. Numerous contextual factors, such as an increased workload, a lack of free time, problems with student behaviour, a lack of adequate resources, a lack of administrative support, and the variety of tasks needed are frequently predictors of teacher job stress (Kokkinos, 2007; Berryhill et al. 2009; Fütterer et al. 2022). These elements may lower job satisfaction (Armstrong et al. 2015), lower teaching self-efficacy (Klassen et al. 2013), job burnout (Wang et al. 2020), and lower EI (Petrides et al. 2016) as well as lower educational quality.

In Chinese higher education, there have been few studies that specifically analyze the relationship between faculty job stress and job satisfaction, but it is well known that job stress is a major contributor to dedication, presentation, and faculty turnover, all of which are strongly correlated with job happiness (Toropova et al. 2021; Bogler and Nir, 2015; Dorenkamp and Ruhle, 2019; Riyadi, 2015). Academic and teaching job stress has increased in colleges and universities as a result of the changing working conditions and environment in higher education, including increased levels of management control, increased job demands, and job insecurity (Kinman and Jones, 2008; Ablanedo-Rosas et al. 2011; Shin and Jung, 2014). In addition, studies have shown that teacher self-efficacy is a strong predictor of teachers' effective implementation of instructional strategies (Künsting et al. 2016), and Gentile et al. (2023) argued that teachers with low self-efficacy also have a greater negative impact on the implementation of instructional strategies and teaching performance. Even faculty members who are happy with their jobs can experience extremely high levels of job stress. Tian and Lu (2017) found that the rapid expansion of China's shift to mass education and the

demanding requirements to improve international rankings and competitiveness, as well as higher demands on research productivity and funding, resulted in greater teaching workload pressures on faculty and staff. Because of this, faculty members are being forced to handle heavier responsibilities in terms of teaching and research, which increases workplace stress (Jacobs and Winslow, 2004; Tytherleigh et al. 2005; Houston et al. 2006; Dickson-Swift et al. 2009).

High job stress is also a problem for Chinese university professors (Li and Kou, 2018; Han et al. 2021), and it is linked to lower job satisfaction (He and Liu, 2012; Gao et al. 2015; He, 2015). For university teachers, the strain and weight of a large workload are more likely to diminish the value of their work experience, encourage negative feelings, and reduce job satisfaction (Zang et al. 2022). University lecturers with more stressful occupations have been found to have higher rates of burnout (Li, 2018). Job stress was shown to be negatively correlated with job satisfaction but mitigated the negative association between job stress and organisational commitment, according to a recent study of 1906 university instructors in China (Wang et al. 2020). Previous studies on the job satisfaction of university professors have discovered a significant correlation between job stress and job satisfaction in various groups. As a result, the first hypothesis of this study is that teaching pleasure is adversely correlated with the job stress of university professors.

**Emotional intelligence and teaching work.** EI refers to the ability to express and evaluate one's own and others' emotions, control one's own and other's emotions, and use emotions to resolve practical issues. It is the comprehensive ability to accurately perceive, express, and evaluate emotions (Mayer and Salovey, 1997). According to previous studies, Salovey and Mayer (1990) stated that EI can be viewed as "a subset of social intelligence that includes the ability to monitor one's own and other's feelings and emotions, distinguish between them, and use this information to guide ones' thinking and actions" (p. 189). EI includes abilities including awareness of oneself, compassion, handling emotions, self-motivation, and managing connections with others, according to Goleman (1995).

The two different EI models that are now accessible are the ability model and the trait model. EI is the ability to understand, use, and regulate one's own and other people's emotions. Two maximum performance tests can be used to measure EI: the Multifactor Intelligence Scale (MEIS; Mayer and Salovey, 1997) and the Salovey-Caruso Emotional Intelligence Scale (MSCEIS; Mayer et al. 2004). EI is classified at a lower level of personality taxonomies and is viewed in the trait model as a constellation of emotion-related self-perceptions and behavioural dispositions that affect peoples' capacity to perceive and exploit emotion-related information (Shi and Wang, 2007). Two self-report measures that are frequently used in studies to measure EI are the Wong and Law Emotional Intelligence Scale (WLEIS; Wong and Law, 2002) and the Emotional Intelligence Scale (EIS; Schutte et al. 1998).

In the context of higher education, some academics have accepted the characteristic model. When using the EIS developed by Schutte et al. (1998), Chan (2004, 2006) suggested that teachers' EI has four dimensions: emotional assessment, positive regulation, empathy sensitivity, and positive utilisation. Some researchers have suggested that teachers' EI includes four different dimensions: self-evaluation of emotions, evaluation or recognition of others' emotions, regulation of self-emotions, and use of emotions to facilitate performance (Wong et al. 2010; Karim and Weisz, 2011). Additionally, Petrides (2009) developed the TEIQue-SF (short form), which consists of 30 items measuring

four broad factors (well-being, self-control, emotionality, and sociability) and global trait EI that is directly entered into the TEIQue-SF total score. The TEIQue-SF focuses on emotion-related self-perceptions as measured by self-report questionnaires. The higher-order structure of the TEIQue-SF is assumed to be oblique, making it a multifaceted construct (Petrides and Mavroveli, 2018). This study synthesises this plethora of knowledge by focusing on the EI model and using a self-report questionnaire to assess teachers' EI.

Ignat and Clipa (2012) argued that teachers' EI plays a key role in the expression of their positive attitudes and satisfaction with their work and life, which contributes to their effectiveness as a teacher. Similarly, EI is an important component of positive psychology that has a significant impact on human performance, well-being, and subjective well-being (Bar-On, 2010). However, current research on the relationship between EI and teacher burnout or work-related stress, which explores the relevance of trait EI to teachers' teaching jobs, has yielded inconsistent findings. For instance, Zeidner et al. (2012) proposed that EI has an effect on reducing occupational stress, decreasing negative emotion levels, and experiencing positive emotional states. In addition, a meta-analytic review that correlated EI with health, well-being, and performance indicators revealed differences in self-reported and performance EI tests (Miao et al. 2016; Sánchez-Álvarez et al. 2015). However, these cumulative findings suggest that different conceptualisations of EI and specific emotional skills, as measured by different EI tests, are associated with lower burnout or higher teaching satisfaction symptoms. In fact, it is not understood how different EI types impact burnout symptoms in different ways. Based on ability and trait models, a number of instruments have been created that include several aspects (Mayer et al. 2008). Therefore, it is challenging to synthesize the present understanding of research in this domain due to the variability of measures.

**Physical exercise, job stress, and emotional intelligence.** Physical exercise is defined as "any bodily movement produced by skeletal muscle that results in energy expenditure in excess of resting energy expenditure" (Thompson, 2003). Physical exercise is associated with physical (Kokkinos, 2008; Chomistek et al. 2013; Archer and Blair, 2011; Hamilton et al. 2007; Cavill et al. 2006), psychological, and social wellness (Penedo and Dahn, 2005; Biddle and Asare, 2011; Paluska and Schwenk, 2000; Mammen and Faulkner, 2013; Ströhle, 2009; Hills et al. 2015). In the particular context of mental health, earlier research has discovered that people who exercise physically exhibit improved psychological well-being and experience less stress and despair. These results applied to young people (Norris et al. 1992; Brand et al. 2017), college students (Castillo and Molina-García, 2010; Molina-García et al. 2011), and the elderly (Netz et al. 2005; Gogulla et al. 2012). Human physiology benefits from physical activity in a number of ways. Its value in preventing obesity, cardiovascular disease, and high blood pressure has been shown in some trials (Okay et al. 2009). Exercisers may have decreased rates of depression, according to Strawbridge et al. (2002) study. Additionally, those who exercised were more likely to partake in other healthy and beneficial pursuits. This study also looked at the causal link between physical activity and depression and came to the conclusion that there was none. Increased exercise and decreased job stress were found to have a real association but not a causal relationship. Early studies (Lawlor and Hopker, 2001; Sjösten and Kivelä, 2006; Stathopoulou et al. 2006) revealed that physical activity as an intervention has clinical consequences for the treatment of depression. Moreover, it has been asserted (Wickramasinghe, 2010) that physical activity is a form of

personal coping that not only lessens stress (Clark et al. 2016; Nguyen-Michel et al. 2006) but also guards against its negative effects (Fang et al. 2019; Moreira-Silva et al. 2014; Toker and Biron, 2012). Adults should engage in at least 75 min of vigorous aerobic exercise (VPE), at least 150 min of moderate aerobic exercise (MPE), or an equivalent combination of both, every week, according to the World Health Organisation (WHO) (World Health Organization T, 2010).

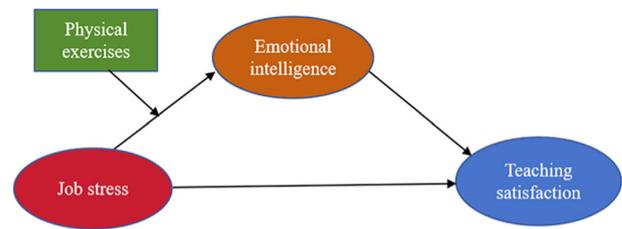
Over the past few decades, a number of theories have been put up to explain how regular physical activity participation influences employees' psychological functioning in terms of work-related outcomes (Naczenski et al. 2017). According to empirical research on physiological mechanisms, regular physical activity can help reduce workplace psychological stress (Klaperski et al. 2014). Regarding the cross-stressor adaptation hypothesis mechanism, regular physical activity causes biological adaptations (such as altering individual sedation patterns, lowering blood pressure, and reducing hormone production) that lessen physiological reactions to stressors in general, including job stressors, as well as to stressors specific to physical exercise (Klaperski et al. 2013; Sothman, 2006; Zhao et al. 2021). Given that empirical research has demonstrated that quick recovery from stress can avoid many health-related issues, adaptability across stressors through physical activity is regarded as a key health-protective strategy (Chrousos, 2009). Additionally, a number of research on the mechanisms for recovering from job stress (such as Feuerhahn et al. 2014; Sonnentag et al. 2017) have noted the importance of physical exercise outside of work for reducing job stress, refilling depleted resources, and increasing levels of work engagement.

According to the studies consulted, people appreciate how the practice of physical activity and sport provides much satisfaction in exchange for much effort. Physical exercise involves relaxation, provides an opportunity to face challenges, and is a way to work together and motivate as a team, or to compete with oneself (Castro-Sánchez et al. 2018; Castro-Sánchez et al. 2018). IE and physical exercise are strongly related to the extent that many relaxation, concentration, and visualisation techniques are being shared in more and more clubs, and federations, and even coaches are hiring more professionals to implement these techniques with the aim of improving athletes' performance (Puertas-Molero et al. 2018). Similarly, it emphasises the importance of physical exercise practices in producing improvements in physical, psychological, and social aspects, as well as the quality of life reflected (González Valero et al. 2017). However, the use of physical exercise to regulate faculty emotions in higher education is insufficiently studied.

People who engage in physical exercise experience emotional changes during the practice (Zamorano-García et al. 2018; Romero-Martín et al. 2017). Some scholars have pointed out that physical exercises are strongly associated with EI, and the emotional characteristics of individuals become more obvious after physical exercises. People who consciously and consistently exercise for a long period of time are generally less likely to have emotional problems such as anxiety, fright, and social disorders (Downs and Strachan, 2013; Ubago-Jiménez et al. 2019). In modern countries, the lack of physical exercise may have a negative impact on physical health and psychological well-being (Erikssen, 2001; Gutin et al. 2007; Rexrode et al. 1998; Blaes et al. 2011). Physical exercise is linked to better stress management and increased levels of EI, which are crucial for human interaction in daily life (Gacek and Frączek, 2005; Bhoohibhoya et al. 2014; Roxana Dev et al. 2014).

### The current study

A review of the literature found that there is still little empirical data on the connections between job stress, teachers' EI, physical



**Fig. 1 The proposed moderated mediation model.** Conceptual model of job stress, emotional intelligence, teaching satisfaction, and physical exercises.

exercise, and teaching satisfaction. Therefore, this study attempts to examine the effects of teachers' job stress, EI, and physical exercises on teaching satisfaction using a sample of university teachers from China (Fig. 1). Specifically, this study aims to answer the following five research hypotheses:

- H1. Teachers' job stress is negatively related to teaching satisfaction.
- H2. Teachers' job stress is negatively related to teachers' EI.
- H3. Teachers' EI predicts and positively influences teaching satisfaction.
- H4. Teachers' EI would undermine the negative relationship between job stress and teaching satisfaction.
- H5. The mediating effect of EI will differ by the frequency of physical exercises.

### Methodology

**Participants and data collection.** The study utilized a quantitative survey design that encompassed higher education institutions (HEIs) in Sichuan Province, China. A voluntary, anonymous online poll was conducted with 2680 university teachers from 25 public universities in Sichuan, western China. The university teachers are from different disciplines: math education, international economics and trade, accounting, financial management, business management, and statistics. The poll was carried out using a convenience sample approach as part of a university teacher training programme that the Sichuan Provincial Department of Education launched in July 2023.

Before data collection, we obtained approval from the Academic Board of the Faculty of Education and Psychology of the authors' university. Afterwards, the research team sent a consent letter to each teacher. In the letter, we specified our confidentiality protection code, the pure nature of the volunteers' participation, as well as the secure storage of the data and access restrictions. Moreover, the university professors had to respond to all of the questions.

Data collection consisted of four questionnaires (i.e., job stress, emotional intelligence, physical exercise, and teaching satisfaction). The questionnaires were administered online, so teachers were free to decide when and where they would participate. In addition, all research participants were informed about the research objectives of the study and were given the same instructions. Finally, anonymity was guaranteed in all steps of data processing. Exclusion criteria for participation in the study included refusal to provide informed consent, unwillingness to continue with the study, multiple completion of questionnaires by the same participant, and incomplete questionnaires. A total of 92 questionnaires were excluded due to incompleteness, 25 questionnaires were removed as they represented multiple responses from the same participant, and 63 samples were discarded during the data cleaning process. As a result, a final dataset of 2500 questionnaires was retained, yielding a response rate of approximately 93.3%.

**Instruments.** Four different scales were used in this study to measure job stress, teachers' EI, physical exercise, and teaching satisfaction. The questionnaire was based on a set of four standardised scales and a set of demographic questions.

**Job stress.** The College Work Stress Scale (CWSS; Li, 2005) was employed in this study to gauge employee stress. The CWSS, which consists of 24 items and is scored on a Likert scale from 1 (no stress) to 5 (severe stress), is intended to measure the level of job stress among university staff. "Please assess these factors as a source of stress for you: a chance for promotion", read one sample question. The scale took into account five factors that affect work stress, including job stability, academic tenure, social connections, work pressure, and work enjoyment. The CWSS exhibited strong internal consistency reliability ( $=0.92$ ) for all items, according to Lis' 2005 study. The CWSS has sufficient internal consistency reliability ( $=0.81$  to  $0.91$ ) and construct validity evidence in Chinese studies, according to a number of earlier investigations (He and Liu, 2012; Ni et al. 2016; Wang and Jing, 2019). Employment security (1 item), interpersonal relationships (3 items), and work enjoyment (2 items) were the three employment stresses considered in this study.

**Emotional intelligence.** The Emotional Intelligence Scale (EIS) measures a person's capacity for emotional expression, self-regulation, and problem-solving. The Wang (2002) revised Chinese version of the scale was applied in this investigation. The measure has 33 items total, of which 5, 28, and 33 are quantified using a 5-point Likert scale and are reverse-scored. They were scored on a scale of 1–5 based on the "very inconsistent-very consistent" option, with scores ranging from 33–165, and higher scores indicating stronger EI. The final three dimensions of EI used in this study are self-emotion appraisal (4 items), use of emotions (4 items), and regulation of emotions (4 items) (Wong and Law, 2002).

**Physical exercise.** Physical exercise was the moderating variable in this study, and the item measured was "In the past 12 months, how many times per week did you typically engage in up to 30 min of physical activity that made you sweat?" It was developed as an enhancement to the International Physical Activity Questionnaire (IPAQ), which has been validated and used to evaluate physical exercise patterns (Craig et al. 2003). This is a continuous variable with a maximum value of 7, a minimum value of 1, and a mean value of 4.36.

**Teaching satisfaction.** A specific aspect of faculty satisfaction with the teaching profession as a whole was evaluated using the 5-item Teaching Satisfaction Scale (TSS), which was created by Ho and Au (2006). A 5-point scale (1 being entirely disagreed, and 5 being completely agreed) was used for all five questions.

**Demographics.** Gender, professional rank (professors and associate professors, lecturers and teaching assistants), and type of higher education institution (national research-oriented universities and provincial teaching-oriented universities) were the three primary demographic indicators that were collected for this study. The items in all four scales used in this research were originally developed in English and later translated into Chinese. To ensure linguistic equivalence, a translation and back-translation procedure was employed. This process helped in achieving consistency and accuracy in the Chinese translations of the scale items.

## Data analysis strategy

The discrepancies between participants' responses were examined during the data filtering procedure. If participants responded the same to each question, cases were eliminated. Using the expectation maximisation (EM) method, it was calculated that less than 5% of the data were missing. Three stages made up the analysis plan for this investigation. First, the scales' validity and reliability were examined using confirmatory factor analysis (CFA) and the internal consistency (Cronbachs' alpha) coefficient. Second, the link between the bivariate variables was examined using Pearson correlation analysis and linear regression analysis. The levels of significance were set at  $p < 0.05$ ,  $p < 0.01$ , and  $p < 0.001$ . Thirdly, using Mplus 8.0, a comprehensive structural equation model (SEM) was built based on a mediation analysis of bootstrap techniques to ascertain the connection between job stress, EI, and teaching satisfaction among university professors in a higher education context. A variety of acceptable metrics, such as  $RMSEA < 0.08$ ,  $SRMR < 0.05$ ,  $CFI > 0.9$ , and  $TLI > 0.9$ , were used to assess the model fit (Schreiber et al. 2006). The bootstrap method was utilized in mediation analysis to find unintended consequences (Hayes, 2009).

## Results

**Reliability and CFA analysis of the scales.** This analysis's first phase involved applying CFA to examine each standardised measure's factor structure. Each scale's reliability and CFA analyses were evaluated in various educational settings. The findings show that each scale's reliability coefficients, with Cronbachs' alpha values ranging from 0.785 to 0.892, were satisfactory.

Table 1 presents a summary of the CFA findings. The CFA assessment of SEA, OEA, UOE, and ROE revealed a well-fitting model ( $\chi^2 = 418.744$ ,  $df = 100$ ,  $p < 0.001$ ,  $RMSEA = 0.036$ ,  $CFI = 0.987$ ,  $TLI = 0.984$ ,  $SRMR = 0.021$ ). Similarly, the CFA analysis of JS demonstrated a good model fit ( $\chi^2 = 546.656$ ,  $df = 202$ ,  $p < 0.001$ ,  $RMSEA = 0.026$ ,  $CFI = 0.990$ ,  $TLI = 0.988$ ,  $SRMR = 0.017$ ). As for PE, the CFA analysis indicated an appropriate model fit ( $p < 0.001$ ,  $CFI = 1$ ,  $TLI = 1$ ). The results of the CFA analysis suggest that TS ( $\chi^2 = 57.442$ ,  $df = 5$ ,  $p < 0.001$ ,  $RMSEA = 0.065$ ,  $CFI = 0.992$ ,  $TLI = 0.984$ ,  $SRMR = 0.013$ ) was a good fit for the data.

**Descriptive statistics and correlation analysis.** The participants of this study were 2500 university teachers, in terms of gender, 1120 were male teachers (44.8%) and 1380 were female teachers (55.2%); in terms of position, 500 were professors (20%); 850 were associate professors (34%); 1000 were lecturers (40%); and 150 were teaching assistants (6%); in terms of experience, 230 were university teachers with 1–2 years (9.2%); 520 were university teachers with 3–5 years (20.8%); 850 were university teachers with 6–10 years (34%); and 900 were university teachers with 10 years and above (36%). In terms of experience, there were 230 university teachers with 1–2 years (9.2%); 520 university teachers with 3–5 years (20.8%); 850 university teachers with 6–10 years (34%); and 900 university teachers with 10 years and above (36%).

Table 2 shows the descriptive statistics for each of the latent variables in the sample of university teachers. The results show that job stress was significantly and negatively related to emotional intelligence ( $r = -0.494$ ,  $p < 0.01$ ), teaching satisfaction ( $r = -0.618$ ,  $p < 0.01$ ), and physical exercise ( $r = -0.061$ ,  $p < 0.01$ ). However, emotional intelligence was found to be significantly and positively related to teaching satisfaction ( $r = 0.592$ ,  $p < 0.01$ ) and physical exercise ( $r = 0.097$ ,  $p < 0.01$ ). Finally, teaching satisfaction was significantly and positively associated with physical exercise ( $r = 0.123$ ,  $p < 0.01$ ).

**Table 1 CFA analysis of the scales among variables.**

Variables	Dimensions	Cronbach's Alpha	X <sup>2</sup>	df	P	RMSEA	CFI	TLI	SRMR
JS	IRV	0.828	546.656	202	0.000	0.026	0.990	0.988	0.017
	POP	0.827							
	IA	0.892							
	RS	0.785							
	TB	0.844							
	SQ	0.824							
EI	IC	0.843	418.744	100	0.000	0.036	0.987	0.984	0.021
	SEA	0.879							
	OEA	0.869							
	UOE	0.855							
	ROE	0.874							
TS		0.892	57.442	5	0.000	0.065	0.992	0.984	0.013
PE		0.858	0	0	0.000	0	1	1	0

JS Job stress, EI Emotional intelligence, TS Teaching satisfaction, PE Physical exercise, IRV Inadequate recognition of personal values, POP Perceived organizational practices, IA Instructional activities, RS Research support, TB Teaching-research balance, SQ Student quality, IC Instructional change, SEA Self-emotion appraisal, OEA Other's emotion appraisal, UOE Use of emotion, ROE Regulation of emotion.

**Table 2 Descriptive statistics and correlation analysis among.**

Variables	JS	EI	TS	PE
JS	1	-0.494**	-0.618**	-0.061**
Sig. (two-tailed)		0.000	0.000	0.002
EI	-0.494**	1	0.592**	0.097**
Sig. (two-tailed)	0.000		0.000	0.000
TS	-0.618**	0.592**	1	0.123**
Sig. (two-tailed)	0.000	0.000		0.000
PE	-0.061**	0.097**	0.123**	1
Sig. (two-tailed)	0.002	0.000	0.000	
M	3.35	3.22	3.21	4.36
SD	0.70	0.73	0.83	1.21

JS Job stress, EI Emotional intelligence, TS Teaching satisfaction, PE physical exercise  
\*\*p < 0.01.

**Structural Model.** The model fit indicators show that the structural model had a good fit to the data ( $\chi^2 = 1566.41$ ,  $df = 846$ ,  $p < 0.001$ ,  $RMSEA = 0.018$ ,  $CFI = 0.989$ ,  $TLI = 0.988$ ,  $SRMR = 0.017$ ). As can be seen from Table 3, there is a statistically significant relationship between teacher job stress and emotional intelligence ( $\beta = -0.551$ ,  $p < 0.001$ ). However, emotional intelligence significantly and positively predicts teaching satisfaction ( $\beta = 0.418$ ,  $p < 0.001$ ). At the same time, there is a significant negative association between teacher job stress and teaching satisfaction ( $\beta = -0.454$ ,  $p < 0.001$ ).

**Mediation effect of emotional intelligence.** The bootstrap method was used to test the significance of the mediating path. That is, whether the indirect effect of teacher job stress on teaching satisfaction through teacher emotional intelligence was significantly different from zero. The path analysis was conducted using Mplus 8.0 for this purpose. The results are reported in Table 3.

Table 3 shows that the indirect effect of teachers' job stress on teaching satisfaction through emotional intelligence is significant ( $\beta = -0.230$ ,  $p < 0.001$ ), and the 95% C.I. is  $[-0.259, -0.209]$ . According to the results reported in Table 3, we can see that H1, H2, H3, and H4 are all supported.

**Testing of moderated mediation models.** For testing the moderating effect of physical exercise, we used hierarchical regression analyses in this study. As presented in Table 4, this study used PROCESS model 7 to test the relationship between the interaction

of physical exercise and job stress on emotional intelligence. The results show that the interaction between job stress and physical exercise was significant ( $b = 0.265$ ,  $t = 18.609$ ,  $p < 0.001$ ), and physical exercise was able to positively moderate the effect of job stress on emotional intelligence. Furthermore, we conducted simple slope analyses (Aiken et al. 1991) to analyse the mediating role of emotional intelligence on the relationship between job stress and teaching satisfaction at low (one SD below the mean) and high (one SD above the mean) levels of physical exercise. The results (see Fig. 2) show that job stress was significantly negatively correlated with emotional intelligence under the moderating effect of high and low group physical exercise ( $b = -0.188$ ,  $t = -7.743$ ,  $p < 0.001$ ;  $b = -0.827$ ,  $t = -34.433$ ,  $p < 0.001$ ). It can be seen that the level of negative correlation between job stress and emotional intelligence is somewhat stronger under the moderating effect of the low-group physical exercise.

In addition, this study also adopted Bootstrap (5000 times) results (see Table 4) and show that the difference in the mediation effect sizes between the low and high values of physical exercise was 0.274, and the 95% confidence intervals  $[0.239, 0.311]$  did not contain 0. The difference in effect sizes was significant, and physical exercise can positively moderate the mediating effect of emotional intelligence on the relationship between job stress and teaching satisfaction. This result supports the H5.

**Discussion**

This study's objective was to give theoretical and empirical knowledge about the evolution of university professors' mental health within the setting of Chinese higher education. This study focuses on the direct effects of job stress on university teachers' satisfaction with their instruction, the mediating effect of TEI on job stress and teaching satisfaction, and the mechanisms by which physical exercise modifies the relationship between teachers' job stress and EI. This is a crucial step in developing teachers' mental health and in comprehending the mechanisms that underlie them. The association between teachers' job stress, emotional intelligence, physical exercise, and teaching satisfaction is supported by our findings.

Five hypotheses were tested using a higher-order model in SEM to provide support for our investigation. This study hypothesizes that teachers' job stress is negatively related to teaching satisfaction (H1). These associations help us understand the negative findings while providing opportunities to reformulate our theory of faculty stress in the Chinese context. University faculty members almost always encounter pressures connected to their jobs, and a significant amount of study has been done to

**Table 3 The mediating model results.**

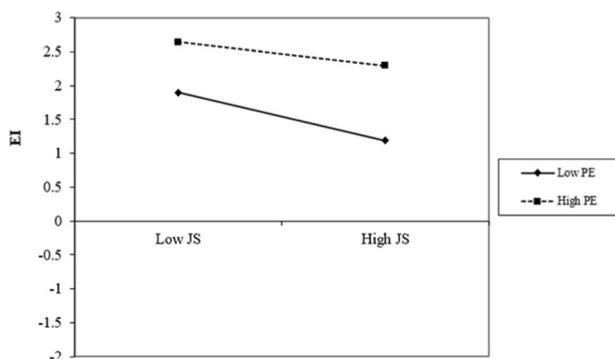
Path	Estimate	S.E.	Est./S.E.	P-Value	95% C.I.
EI → TS	0.418***	0.018	22.872	0.000	[0.385, 0.418]
JS → TS	-0.454***	0.018	-25.814	0.000	[-0.491, -0.454]
JS → EI	-0.551***	0.021	-26.211	0.000	[-0.591, -0.551]
JS → EI → TS	-0.230***	0.013	-18.387	0.000	[-0.259, -0.209]

JS Job stress, EI Emotional intelligence, TS Teaching satisfaction, PE physical exercise \*\*\* $p < 0.001$ .

**Table 4 Moderated mediation model.**

DV	IV	Coeff	SE	T-value	P-value	R <sup>2</sup>	F
EI	constant	3.239	0.012	271.557	0.000	0.3405	429.4953***
	JS	-0.507	0.017	-29.932	0.000		
	PE	0.038	0.010	3.871	0.000		
	JS×PE	0.265	0.014	18.609	0.000		
TS	constant	1.825	0.061	29.892	0.000	0.4903	1201.1058***
	JS	-0.506	0.019	-26.201	0.000		
	EI	0.428	0.019	23.048	0.000		
	Effect1	Effect2	Contrast	Boot SE	Boot LLCI		
-0.080	-0.354	0.274	0.018	0.239	0.311		

\*\*\* $p < 0.001$ .



**Fig. 2 Moderation plot with physical exercises as Moderator.** Interacting effects between job stress and physical exercise on emotional intelligence.

investigate this topic. Stress has been highlighted as an important component in the newly emerging literature on faculty development in China, serving as both a significant independent and dependent variable. Meng and Wang (2018), for instance, show that the stress levels of Chinese teachers varied according to their professional status, age, and amount of teaching time. They also stress the significance of understanding “the positive effects of occupational stress while working to eliminate stressors” (p. 603). Jing (2008) looked at workplace stress among undergraduate professors and discovered that it had a substantial impact on how well they were able to teach, which is why she encouraged “administrators and faculty to manage their stress and stimulus performance” (p. 294). According to Sun et al. (2011), China’s university teachers are particularly vulnerable to professional stress due to poor mental health. They came to the conclusion that one of the key steps in lowering occupational stress is to improve mental health and the organisational climate. These and other findings, such as Lai et al. (2014) and Tian and Lu (2017), have elevated the role of stressors in both theory and related research. Our study challenges this notion. More precisely, stress plays a significant role in this area of research, but by using stress assessment as the foundation for validity, we can better

comprehend the patterns and mechanisms connected to teaching satisfaction.

This study also predicts a negative relationship between teachers’ job stress and EI, thus supporting the study’s H2. The effect size of teachers’ job stress on EI was  $-0.551$ , indicating that job stress plays a promising role in predicting EI and outcomes (Zysberg et al. 2017; Asrar-ul-Haq et al. 2017; Naseem, 2018). The findings of the study confirm those reported in previous studies involving teachers in higher education settings, emphasizing that teachers’ job stress is a critical factor influencing TEI (Akomolafe and Ogunmakin, 2014; Yusoff et al. 2013; Usmani et al. 2022). At the higher education level, fewer studies have been conducted on the importance of teachers’ teaching satisfaction, and these studies have addressed teachers’ teaching styles, cultural backgrounds, and perceptions. The association between occupational stress and EI among faculty members in different fields in higher education institutions, however, does not appear to have been extensively examined in prior studies. The findings of this study stress the significance of this link for present and future faculty members and researchers in higher education institutions.

The study’s findings are consistent with the premise that there is a strong positive relationship between teachers’ feelings of job satisfaction and their EI. According to earlier studies (Khasawneh et al. 2022; Yin et al. 2013; Efendi et al. 2021), EI is a critical component of success as a teacher. The effects of EI on reducing occupational stress, reducing negative emotions, and promoting positive emotional states have been demonstrated in numerous studies (Keefer et al. 2009; Zeidner et al. 2012). Numerous research (Keefer et al. 2009; Zeidner et al., 2012) have shown that EI has a favourable impact on reducing occupational stress, reducing negative emotions, and boosting positive emotional states. Given this data, it is becoming more widely accepted that raising teachers’ well-being and enhancing their stress resilience can both benefit from EI training (Vesely-Maillefer and Saklofske, 2018). To measure teachers’ emotional intelligence, this study used three substructures: self-emotional appraisal, use of emotions, and management of emotions. The findings show a considerable correlation between EI and teaching satisfaction, with an EI-teaching satisfaction correlation coefficient of 0.592 being

statistically significant. This implies that teachers' levels of happiness at work are significantly influenced by their EI. Teachers who have high EI are more likely to believe in their ability to do their jobs well and to be open to taking on difficult teaching tasks that might result in effective performance.

The results of this study support hypothesis H4, which claims that instructors' emotional intelligence (EI) is a critical mediator between job stress and teaching satisfaction. This supports the EI theory stated by Mayer et al. (1999). To the best of our knowledge, no prior research has examined how EI in teachers may play a mediating role in the link between job stress and teaching satisfaction. However, earlier studies have demonstrated that EI is a key mediator in the relationship between various teacher attributes in primary and secondary schools (Yin et al. 2016; Ju et al. 2015; Vesely et al. 2013; Berkovich and Eyal, 2017; Basim et al. 2013; Mérida-López et al. 2017; Latif et al. 2017; Wang et al. 2023). Therefore, the findings of this study are well supported, and the mediating role of teachers' EI between job stress and teaching satisfaction is reasonable.

Higher EI makes university faculty members more demanding in the higher education context. They have the capacity to put in the necessary effort to accomplish professional objectives including engaging in demanding instruction, producing works of high calibre, and submitting grant applications. Faculty members may be able to develop EI from these triumphs, allowing them to remain satisfied with their teaching even while under pressure.

In our mediation model, physical exercise was found to be significantly associated with EI as an external contextual variable. Our findings suggest that the mediating effect of EI is not dependent on physical exercise, as the mediating effect continues to work regardless of university faculty members' frequency of physical exercise (i.e. the non-significant result of moderated mediation). However, the significant moderating effect of physical exercise suggests that teachers who engage in more frequent physical activity may have higher EI, which may positively impact their perceptions of job stress and job satisfaction. This result supports the well-established idea that physical exercise is an important source of teachers' perceived evaluations of their own EI.

Furthermore, our results support earlier studies showing that instructors who exercise more frequently had higher emotional quotients (Gacek and Frączek, 2005; Bhochhibhoya et al. 2014; Roxana Dev et al. 2014; Ubago-Jiménez et al. 2019). Salovey and Mayers' (1990) hypothesis supports the idea that EI is made up of three distinct adaptive skills: emotion appraisal and expression, emotion regulation, and emotion utilisation in problem-solving. By controlling their negative emotions and focusing on their positive and pleasurable feelings, teachers can modify their emotions and lessen their work stress through physical exercise. This can lead to improved EI, better well-being, and less stress and depression.

Moreover, teachers who persist in physical exercise may have faced many challenging tasks and eventually found effective ways to cope with stressful situations. As a result, they can draw on their experiences of solving job stress problems to improve their emotional state and believe in their ability to accomplish any teaching task. When teachers have high levels of positive emotions, they are more likely to control their stress levels and cope effectively with challenging teaching tasks.

### Limitations

There are several limitations to this study that must be acknowledged. Firstly, the cross-sectional design of the study restricts our ability to make causal inferences about the results. A longitudinal design would provide greater certainty in

investigating and highlighting significant variation and development among the study variables over time. Secondly, the moderating effects of demographic factors such as age, gender, teaching experience, and highest education could have been better understood in relation to the focus of the study. Thirdly, the method of measurement of the study variables is also a limitation. Although it is more economically feasible to assess physical exercise (PE) with self-report instruments, similar scales need to be validated in different countries. Objective assessment of physical exercise using pedometers and accelerometers may be a more accurate tool that avoids the overestimation of physical exercise that often occurs with questionnaires (Haskell, 2012; Warren et al. 2010). Fourthly, our measures were derived exclusively from teachers' self-reports, which can sometimes lack reliability and be subject to reporting bias. In addition, there may be some potential limitations to self-reported data for reasons such as social expectations and desirability. Finally, EI is also measured using self-report instruments. If EI is assessed as a set of competencies or skills (Mayer et al. 1999), it can be measured with maximum validity.

### Conclusion

The present study provides an important contribution to the existing knowledge base by establishing a direct link between university faculty job stress and teaching satisfaction and EI, and between EI and teaching satisfaction. Moreover, the study highlights the moderating role of physical exercise between job stress and EI and the mediating role of EI between job stress and teaching satisfaction. These results successfully support all research hypotheses and provide considerable support for important theoretical propositions. However, it is essential to note that teachers' job stress and EI were equally important in influencing teaching satisfaction, and mediated the relationship between job stress and EI. The theoretical framework of this study contributes to the theoretical research in both the field of EI theory and social cognitive theory.

Furthermore, in contrast to universities with a focus on research in Western nations, faculty development programmes are extremely rare in China. However, given the formation of the China Education Project, our findings imply that we should apply psycho-cognitive and behavioural concepts to reduce the negative effects of occupational stress. Practical strategies for assessing health in specific situations and developing coping strategies to deal with potential stress may help individual teachers to reduce stress.

The stress of change in teaching and learning is a major concern as it has the potential to reduce teachers' sense of efficacy in teaching and increase their engagement and satisfaction with teaching. Enabling teachers to enjoy the process of dealing with changes in the teaching environment can have a positive impact on promoting their positive attitudes towards teaching. Therefore, to maximise the good effects of the changes in teaching, it is important to provide teachers with the practical aid and guidance they need to manage their perceived stress.

Finally, our findings highlight the need to improve teachers' perceptions of their own teaching efficacy in order to enhance their performance as teachers and raise their engagement and happiness with the profession. In order to address the actual demands at the individual and administrative levels, teacher development programmes may want to rethink and reevaluate the design and content of teacher training programmes.

### Data availability

The data supporting the results of this study are available at <https://osf.io/zeuhj>.

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### Author contributions

Mao Zhao drafted the paper. Yating Yu contributed to the data interpretation and language polishing. Kuen Fung SIN supervised the project and advised on the writing.

### Competing interests

The authors declare no competing interests.

### Ethical approval

Ethical approval was obtained from the Ethics Committee of the Faculty of Education and Psychology, Chengdu Normal University, China on January 6, 2023 (Approval No. CDNU [2023(01)]). All procedures used in the study involving human participants followed institutional and/or National Research Council ethical standards.

### Informed consent

The researchers sought and obtained consent from the participants to take part in the study, who were invited to sign the informed consent form prior to their participation.

### Additional information

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