Analysis of the role of social support - cognitive psychology and emotional process approach

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Abstract

The eyes are extremely important for communication. The muscles around the eyes express emotional states, and the size of the pupil signals whether a person is aroused and alert or bored and fatigued. Pupil size is an overlooked social signal, yet is readily picked up by observers. Observers mirror their pupil sizes in response, which can influence social impressions. Pupil diameter is enhanced in a variety of emotional contexts, including viewing pictures, listening to sounds, and during the threat of shock. This study shows that people associate positive faces with large pupil sizes and negative faces with small pupil sizes. Although workplace social support has been described as a profoundly emotional activity, little is known about the emotional demands faced by employees or how these impacts on their well-being. This study examined relationships between 'emotional labor,' burnout (emotional exhaustion, depersonalization, and personal accomplishment), and job satisfaction in a sample of an employee who works in the banking sector or manufacturing sector. Also examined was whether workplace social support moderated any relationships found between emotional labor and strain. The relationship between job experience and emotional labor was also investigated.

Key Words: Cognitive Psychology, Emotion, Well-Being, Pupil, Banach Space

The eyes are extremely important for communication. The muscles around the eyes express emotional states and the size of the pupil signals whether a person is aroused and alert or bored and fatigued. Pupil size is an overlooked social signal, yet is readily picked up by observers. Observers mirror their pupil sizes in response, which can influence social impressions. In a landmark study Hess shown that individuals with large pupils are perceived more positively than individuals with small pupils.[1] In that behavioral study, participants were asked to draw pupils in line drawings of faces with empty irises, and they drew large pupils in the happy face, and small ones in the angry face. The current study tested 628 participants (aged 20–80 years old) from the banking sector or manufacturing sector in China and extended this work by showing that this association between large (small) pupils and a positive (negative) impression develops overage and is absent in employees. Several explanations for how individuals through interactions with close others learn that large pupils mean care, interest and attention and small pupils the opposite, are discussed. To conclude, this study shows that pupil size and emotion perception are intertwined but that their relationship develops overage. Although workplace support has been described as a profoundly emotional activity, little is known about the emotional demands faced by employees or how these impacts on their well-being. This study examined relationships between *"emotional labor",* burnout (emotional exhaustion, depersonalization, and personal accomplishment), and job satisfaction in a sample of Chinese employees. Also examined was whether workplace social support moderated any relationships found between emotional labor and strain. The relationship between job experience and emotional labor was also investigated. 628 employees working in the banking sector or the manufacturing sector in China completed questionnaires.

Significant associations were observed between emotional labor and all outcomes, with a positive relationship found between emotional labor and personal accomplishment. Some evidence was found that social support mitigates the negative impact of emotional demands on emotional exhaustion, feelings of personal accomplishment and job satisfaction. More experienced employees reported higher levels of emotional labor. Findings highlight the need for employees of training programs to raise awareness of the emotional demands of workplace support and consider ways to enhance emotion regulation skills in experienced as well as recently qualified staff. A body of research indicates that employees are more vulnerable to work-related stress, psychological distress, and burnout than many other occupational groups.[2-4] To develop more precisely targeted interventions to enhance well-being in the profession, insight is needed into the aspects of the employee role in the organization that threatens psychological health and job satisfaction. Studies conducted in China and other countries have highlighted a wide range of stresses that are commonly experienced by employees. These encompass job-specific hazards, such as employee preparation, large organization sizes, poor pupil motivation and pupil misbehavior,[5-8] as well as more general stressors such as time pressures, administrative demands, lack of human and technical resources and a perceived imbalance between efforts and rewards.[9-16, 115] Studies of various occupational groups have found the emotional demands intrinsic to many types of jobs to be a considerable source of strain.[17] Workplace support has been described as a profoundly emotional activity,[18] requiring the effective management of personal emotions and the ability to engender the desired emotional state in others. Employees are expected to safeguard the emotional well-being of their pupils as well as their physical safety.[19,20]. They are also required to model successful emotional control at all times, treating pupils with warmth and compassion and suppressing any feelings of impatience or anger.[21] It has recently been argued that employees are increasingly expected to manage their emotions in ways similar to service sector employees.[22, 112] The concept of emotional labor was first introduced by Hochschild (1983) based on her studies of cabin crew,[23] but subsequent research has found emotional labor to be commonplace in a number of human service occupational groups and a considerable predictor of strain.[17, 24] As yet, however, little is known about how the emotional labor, involved in the employee role, may impact on the well-being of employees. Most of what is known has been gleaned from reviews, commentaries and ethnographic studies,[19,25-27] or small samples of employees working in the post-compulsory sector.[28,29] A notable exception is a recent study conducted by Philipp and Schupbach (2010) with a sample of German teachers.[30] Evidence was found that emotional labor was positively related to levels of emotional exhaustion. To extend knowledge of staff stress and inform the development of effective interventions to enhance well-being in the profession, the present study examines relationships between emotional labor, burnout and job satisfaction.

Materials and Methods

Pupil diameter is modulated by emotional arousal in a number of different contexts, including picture viewing, in which larger changes in pupil diameter are found when viewing highly arousing pleasant or unpleasant, compared to neutral, scenes.[31-34] Pupil dilation has also been reported when participants listen to pleasant or unpleasant, compared to neutral sounds,[35] and when participants anticipate the upcoming presentation of an adverse event. For example, Bitsios, Szbadi, and Bradshaw (1996) found that pupil diameter was enhanced when participants were under threat of shock exposure, compared to when no shock exposure as possible.[36] In the current study, we investigated whether pupil diameter is similarly modulated by emotion during mental imagery. Because emotional imagery is a key component in the assessment,[37,38] and treatment of mental health disorders,[39,40] pupil diameter could prove to be a useful psychophysiological index in a number of clinical venues. In this study, brief texts were presented that described a variety of emotional and neutral events. The participant was instructed to silently read each script and imagine the events described vividly as an active participant. Previous studies investigating physiological and neural reactivity during narrative imagery found that modulation of emotion begins while the participant is reading the script, and is sustained during a subsequent imagery period. For instance, skin conductance is enhanced when reading emotional scripts, and the difference is sustained in the imagery interval following the script offset.[41] Relatedly, greater BOLD activation is found in the medial prefrontal cortex and nucleus accumbens when participants read pleasant scripts, which again continues during the imagery interval following script offset.[42] These temporal parameters are reasonable, since reading a text, comprehending a text, and preparing to imagine the event involve similar, if not identical, cognitive processes that can begin as soon as the constituent information becomes available. An alternative imagery procedure that requires participants first to memorize to-be-imagined script,[43] eliminates the need for visual input, which could prove beneficial in studying pupil diameter, but imposes a relatively larger working memory burden on the participant, potentially affecting pupil diameter changes.[44,45] For this reason, scripts were presented visually in the current study. Importantly, scripts were selected to be of similar character length and did not differ in brightness. Moreover, each script was first to read and rated before the imagery session specifically to facilitate rapid and immediate image construction during psycho-physiological measurement.[42,46] Whereas previous studies have measured peripheral (e.g., skin conductance,

heart rate) and central (e.g., BOLD) indices of affective engagement, in this study, we explore pupillary changes occurring during emotional imagery. Pupil diameter changes are mediated by both parasympathetic and sympathetic action of the nervous system, which influences the sphincter and dilator muscles of the pupil, respectively. On the one hand, pupil diameter is greater when participants perform a difficult subtraction task compared to an easier addition task, and pharmacological manipulations suggest that this cognitive difference is likely modulated by inhibition of the sphincter muscle, mediated by parasympathetic activity, which reduces pupil constriction.[47] On the other hand, during emotional picture viewing, enhanced pupil diameter is found when participants view either highly arousing pleasant or unpleasant scenes, and this difference appears to be mediated by pupil dilation, probably due to differences in sympathetic action on the dilator muscle.[48]

Emotional labor, burnout and job satisfaction

Emotional labor is typically conceptualized as the degree of dissonance between emotions that are genuinely felt and those that the job requires to be expressed or suppressed.[17] There is evidence that emotional labor can impair employee well-being, as psychological effort is frequently required to 'regulate' emotions to comply with organizational or professional expectations.[49] Particularly strong relationships have been found between emotional labor and emotional exhaustion.[50-52] Emotional exhaustion is a credible reaction to sustained demands for emotional regulation, but relationships with the other two dimensions of burnout (depersonalization and reduced feelings of personal accomplishment) are also plausible in the teaching profession. Sustained emotional labor may lead to employees depersonalizing their pupils, resulting in less sympathetic and more cynical attitudes towards them. A review of the literature implies that associations between emotional labor and feelings of personal accomplishment might be less clear cut. It could be argued that attempting to manage an emotionally demanding job over time might erode feelings of personal accomplishment and enhance negativity towards the self and the job,[49] but studies of other *"caring"* professions suggest that such feelings might be heightened.[24] As employees are a high-risk group for burnout,[53, 54] insight into the role played by emotional labor in the burnout process can only enhance understanding of employee well-being. Studies that have examined relationships between emotional labor and job satisfaction have yielded mixed findings. Some have found that emotional labor impairs job satisfaction as it may stifle the expression of true emotions and also deplete emotional resources,[17,55,56] whilst others conclude that the successful management of emotional demands can enhance feelings of satisfaction with the job role.[22,57-59] It has been suggested that the impact of emotional labor on job satisfaction depends upon the context in which it is performed.[60,61] There is some evidence that employees see emotional labor as intrinsic to their work, and believe that well-developed emotional regulation skills are required for maximum professional effectiveness.[62] Positive relationships between emotional labor and job satisfaction in this occupational context might, therefore, be expected.

Social support, emotional labor, and burnout

This study investigates the potential buffering role of workplace social support on any relationships found between emotional labor, burnout, and job satisfaction. Research conducted in occupational settings has found perceptions of a supportive working climate to be linked with enhanced health status, job satisfaction as well as other positive outcomes.[63]

Two processes have been proposed to elucidate the beneficial effect of social support.[64] The direct effects model suggests that social support has a positive impact on well-being regardless of the amount of stress experienced.

The moderator or buffer model postulates that social support is a resource that is most effective for people who are experiencing high levels of stress. There is evidence to support both theoretical models in predicting burnout and other affective outcomes, but some studies have failed to find evidence for the buffering effect.[65,66] Several studies have found negative relationships between workplace social support and burnout in samples of teachers, thus supporting the main effects model.[67] Other studies of employees provide evidence that support can buffer the negative impact of work-related stressors.[16,68] There are reasons to believe that social support at work is a theoretically plausible moderator of emotional labor and strain in occupational settings. Firstly, employees who experience more supportive interpersonal relationships at work may find fulfilling the emotional demands of their job role to be less onerous. Secondly, employees who feel more supported may report lower levels of emotional labor as the 'appropriate' emotional response arises more spontaneously. Thirdly, the ability to disclose emotional events and 'true' feelings in a supportive environment might help employees develop more successful coping strategies that protect them against health risks.[49] As yet, few studies have examined the role played by social support in the emotional labor process. A study of customer service representatives conducted by Abraham (1998) reported an interaction between social support and emotional labor on levels of job satisfaction.[55] Similarly, a more recent study by Duke, Goodman, Treadway, and Breland (2009) found that social support attenuated the negative impact of emotional labor on job satisfaction and performance in a sample of retail workers.[69]

As little is known about whether social support protects employees from the negative impact of emotional labor, this study examines whether workplace support might help employees manage the emotional demands of their work.

Emotional labor and job experience

As an insight into the role played by teaching experience in the emotional labor process will help inform more precisely targeted interventions, this will be examined in the present study. Research conducted with service sector employees suggests that the longer an employee is required to perform emotion work, the more negative the consequences for well-being due to the gradual erosion of emotional resources.[49,70] It has also been argued, however, that employees might become gradually 'desensitized' to the emotional demands of their work as they develop more effective coping strategies and utilize workplace social support more effectively.[71] Consequently, positive or negative relationships between emotional labor and job experience might be expected.

Conceptual Modeling: Definition, Purpose, and Benefits

This study investigated relationships between emotional labor and burnout (emotional exhaustion, depersonalization, and personal accomplishment) and job satisfaction in a sample of Chinese employees. Associations between emotional labor and job experience are also examined. Finally, whether workplace social support moderates the relationship between emotional labor and strain is investigated.

Banach Space Model in this Research

(See Appendix for the main results).

For defining the Banach Space, we give necessary and sufficient conditions for the existence of solutions.
We consider the second-order nonlinear difference equations of the form:

$$\Delta\left(r_{n-1}\Delta x_{n-1}\right)+p_n f\left(x_{n-k}\right)=h_n \qquad (1)$$

We show that there exists a solution (x_n), which possesses the asymptotic behavior:

$$\left\| x_n - a\sum_{j=0}^{n-1}\left(1/r_j\right)+b\right\| = 0(1), a,b \in \mathbb{R} \qquad (2)$$

In this paper, we extend the results of Agarwal (1992),[72] Dawidowski et al. (2001),[73] Drozdowicz, and Popenda (1987),[74] M. Migda (2001),[75] and M. Migda and J. Migda (1988).[76] We suppose that f has values in Banach space and satisfies some conditions concerning the measure of noncompactness and measure of weak noncompactness.
Let $\mathbb{C}$ be the set of complex numbers and let $\mathbb{R}$ be the set of real numbers and $l_1(\mathbb{C})$ the space of complex-valued sequences (C_n) such that:

$$\left\|(C_n)\right\|_1 := \sum_{i=1}^{\infty}\left|C_n\right| \prec \infty \qquad (3)$$

Let $\left(X, \|.\|\right)$ be a complex (real) Banach space and $l_\infty(X)$ denote the space of bounded sequences $x = (x_n)$ in X with the norm:

$$\|x\|_\infty = \left\|(x_n)\right\|_\infty = \sup_n\|x_n\| \qquad (4)$$

This norm $l_\infty(X)$ is a Banach space.

In this paper, we are concerned with the difference equation in Banach space:

$$\Delta\left(r_{n-1}\Delta x_{n-1}\right)+p_n f\left(x_{n-k}\right)=h_n, \qquad n \in \mathbb{N} \qquad (5)$$

where Δ is the forward difference operator, that is,

$$\Delta x_n = x_{n+1}-x_n,$$

$$\Delta^2 x_n = \Delta\left(\Delta x_n\right), \qquad (6)$$

and $f: X \to X$

By a solution of (5), we understand a sequence $x = (x_n)$ in $l_\infty(X)$ which satisfies (5).

The results obtained here generalize some results of M. Migda and J. Migda.[9,10] In M. Migda and J. Migda,[10] the second-order difference equation of the form:

$$\Delta^2 x_n = a_n\varphi\left(x_{n+k}\right), \quad n=1,2,..., \quad k=0,1,2,..., \quad (7)$$

was considered. The authors give a condition when this equation has a solution, asymptotically equal to $c, c \in \mathbb{R}$.

Pupils Size and Diameter

The eyes are extremely important for communication. The muscles around the eye's express emotional states, and the size of the pupil signals whether a person is aroused and alert or bored and fatigued. Pupil size is an overlooked social signal, yet is readily picked up by observers. Observers mirror their pupil sizes in response, which can influence social impressions. Pupil diameter is enhanced in a variety of emotional contexts, including viewing pictures, listening to sounds, and during the threat of shock.
In this study, we investigated pupil diameter changes during emotional imagery. Participants imagined scenes describing pleasant, unpleasant, or neutral events while the pupil diameter was continuously recorded. Second, by second changes in pupil diameter were analyzed to determine whether, and when, modulation of the pupil as a function of hedonic content is found. This part of the study aims to get insight into the question of whether the positive evaluation of someone with large pupils is innate or prone to changes overage. To that extent, we adapted a very simple paradigm from Hess (1975),[1] where he showed adult participants two-line drawings of a face of a happy and angry person. The eyes of these line drawings did not contain pupils and participants were asked to draw this in. What was observed was that participants drew large pupils in the happy face and small pupils in the angry face. The aim of the current study is threefold. The first aim of this study is to replicate this earlier finding. A second aim is to investigate potential alterations overage. A third aim is to explore gender differences. While Hess (1975)[1] did observe sex
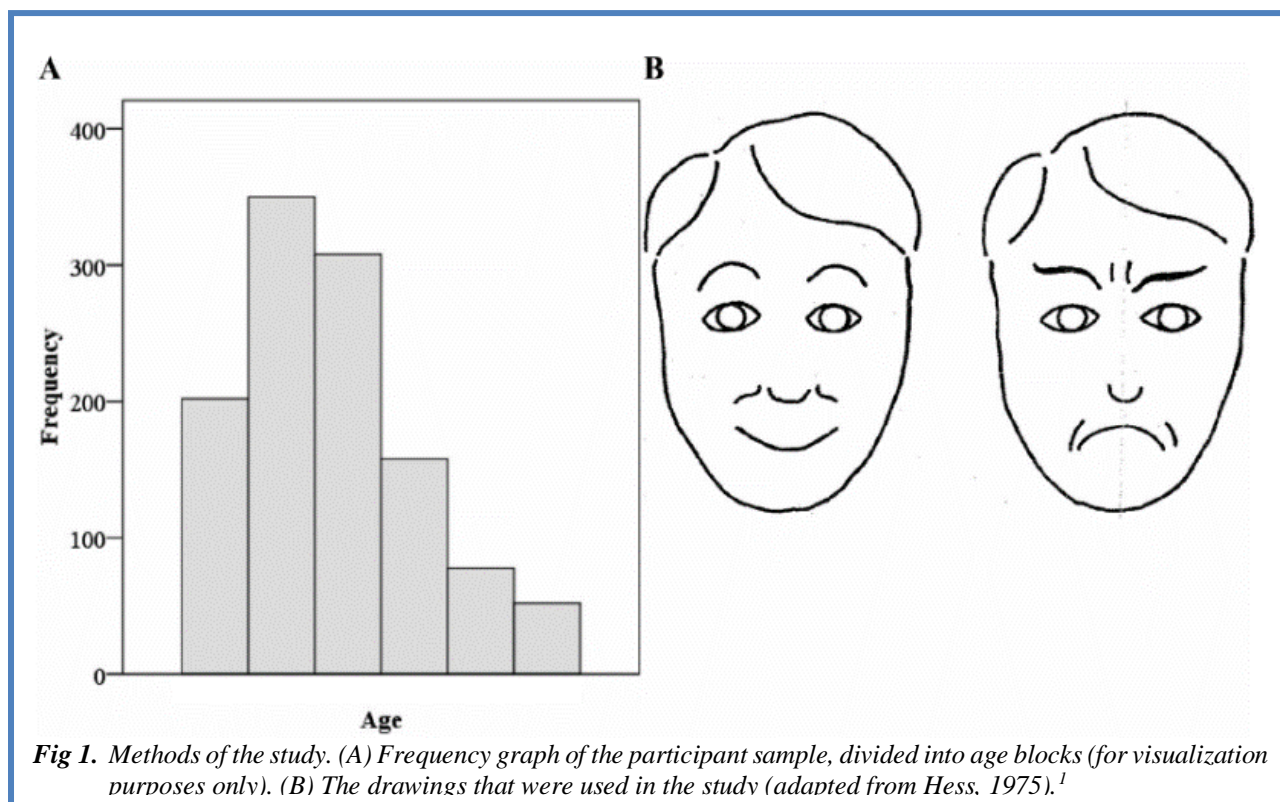
Fig 1. *Methods of the study. (A) Frequency graph of the participant sample, divided into age blocks (for visualization purposes only). (B) The drawings that were used in the study (adapted from Hess, 1975).[1]*

differences in the perception of pupil size, Kret and de Dreu (2017) did not.[77] Thus, whether this putative difference in drawn pupil size in the happy compared to angry faces is modulated by gender is an open question. In the current study, a large number of subjects with a wide age range was asked to draw pupil sizes in the line drawings first used in the study by Hess (1975).[1]

Stimuli

Two line-drawings of a happy and angry face were taken from Hess (1965)[78] and printed out. See Figure 1.

Procedure

Participants were told that the pupils were missing in the printed drawing and asked to draw them and to color them in. The order at which the drawings were handed out was randomized. After data collection, all line drawings were scanned and imported into Adobe Photoshop. Next, the number of pixels that fell within the outline of the drawn pupils were counted and served as the dependent variable.

Ethical considerations

This study was approved by the Nanjing University of Science and Technology, School of Economics and Management. This study was conducted in accordance with the Declaration of Mohammad Heydari Ph.D. dissertation. All of the participants signed informed consent prior to participating in the study. For more information please contact [Mohammad_Heydari@njust.edu.cn].

Statistical analysis

Data were analyzed in a two-level Generalized Mixed Model, implemented in SPSS. The two drawings were nested within participants. As the drawn pupil sizes were significantly skewed to the right, a gamma regression was selected (similar to log-transforming the data). *"Emotion"* (angry and happy) was included as a fixed factor and the intercept as a random factor.

Results

As predicted, the main effect of emotion was observed. Participants drew larger pupils in happier face than in the angry face $F (1, 1,141) = 13.302$, $p < .001$.
However, when adding Age and Sex of Participant and their interactions with Emotion to the model, the main effect of Emotion disappeared ($p = .301$). To get to the best fitting, yet most parsimonious model, non-significant factors were dropped one by one, starting with the three-way interaction, then the two two-way interactions with Sex of Participant and the final factor that was dropped was Sex of Participant.
With the final model, a significant interaction effect was observed between Emotion and Age of Participant1$F (1,1,131) = 12.464$, $p < .001$, showing that the difference in the size of the pupils drawn in the happy face as compared to those drawn in the angry face, increased with age. When investigating the effect of Age of Participant separately per Emotion Category, this effect turned out to be driven by the angry faces $F (1, 565) = 14.926$, $p < .001$ (happy: $p = .451$). Thus, overage, participants started to draw the pupil sizes in the angry
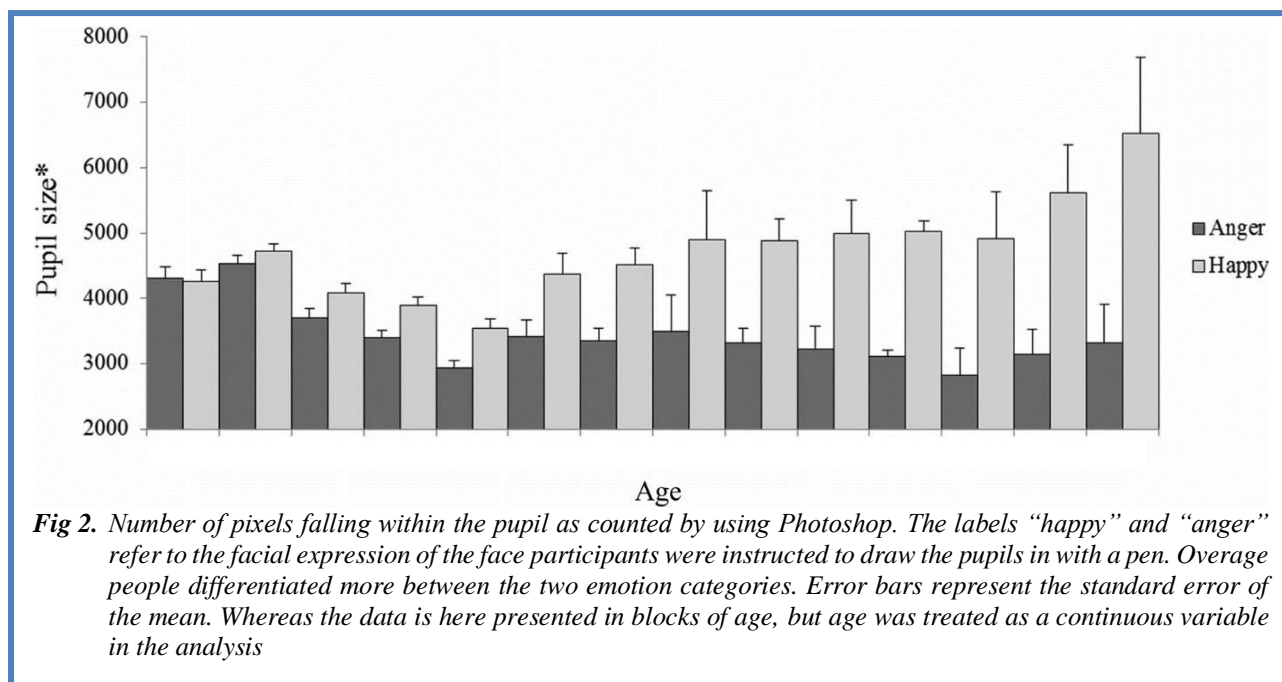
Fig 2. *Number of pixels falling within the pupil as counted by using Photoshop. The labels "happy" and "anger" refer to the facial expression of the face participants were instructed to draw the pupils in with a pen. Overage people differentiated more between the two emotion categories. Error bars represent the standard error of the mean. Whereas the data is here presented in blocks of age, but age was treated as a continuous variable in the analysis*

face smaller (Figure 2). There was no main effect of Emotion (p = .281) and no main effect of Age (p = .203). Age distribution of participants in this study is (18-28; 28-38; 38-48; 48-58; 58-68; 68-78).

According to Hess (1975)[1] "*When we say that someone's eyes are soft, hard, beady, cold or warm, we are in most instances referring only to a certain aspect of that person's eyes: the size of the pupils*". Large pupils are generally perceived positively and small pupils negatively.[79-82] Taking a developmental perspective, the findings of the current study suggest that these associations are most likely learned rather than hard-wired. In this study, participants from different ages were asked to draw pupils in two-line drawings of a happy and angry face. Overall, participants drew larger pupils in the happy compared to the angry face, and this study in addition to that replicates Hess (1975)[1] earlier description of this phenomenon. Interestingly though, the current study shows that this difference in pupil size drawn in the happy versus angry face continues to increase throughout people's lifetime and is absent in young children, independent of the gender of the participant.

Data reduction

Pupil diameter was converted offline from arbitrary units to millimeters. Linear interpolation was used to estimate pupil size for samples in which the pupil was occluded due to blinking with the ASL Results software. Five participants were not included in the final analysis due to unsuccessful pupil discrimination on more than 15% of trials during the imagery task. For the remaining 30 participants, trials with insufficient pupil discrimination for over 15% of the trial were excluded from the analysis (mean percentage of trials excluded52%). For each trial, pupil diameter in the 1 s before script presentation was subtracted from each of the following pupil samples. For each subject and trial, the mean change in pupil diameter was then calculated in 1-s intervals for 11s, which included the 6-s, period in which the script was on the screen and the following 5-s imagery period before the onset of the earliest light probe. Analyses of variance (ANOVAs) were conducted with hedonic content (pleasant, neutral, and unpleasant) and time (1-s intervals) as repeated measures factors, and follow-up ANOVAs were conducted separately on each 1-s interval to decompose significant interactions.

Script analysis

In this analysis, script, rather than a participant, served as the unit of analysis in a regression that used the average pleasure and arousal ratings for each script (across participants) to predict pupil diameter change. Figure 3 illustrates the change in pupil diameter for each second following script onset as a function of hedonic content. A repeated-measures ANOVA indicated main effects of time, $F (10, 20)=15.7$, $p<.001$, $\eta\rho^2 = .351$, and hedonic content, $F (2, 28)=4.6$, $p<.05$, $\eta\rho^2 = .136$, as well as an interaction of time and content, $F (2, 28)=3.3$, $p<.005$, $\eta\rho^2 = .103$. Simple main effects tests were conducted for each time bin, and indicated that pupil diameter varied with hedonic content beginning in the third time bin after script onset, which was then sustained across the imagery period (time bins 3–11: Fs (2, 28)=6.6, 6.2, 4.4, 5.4, 2.4, 3.7, 4.8, 6.1, 6.5, ps <.05 except time bin 7, p5.1). Significant quadratic trends indicated that pupil diameter when imagining pleasant or unpleasant scenes was larger than when imagining neutral scenes at each time bin (time bins 3–11: Fs (2, 28) =12.5, 11.9, 7.9, 5.4, 4.1, 6.3, 7.8, 9.4, 10.0; ps<.05, except time bin 7, p5.05). Consistent with this, when pupil diameter was averaged
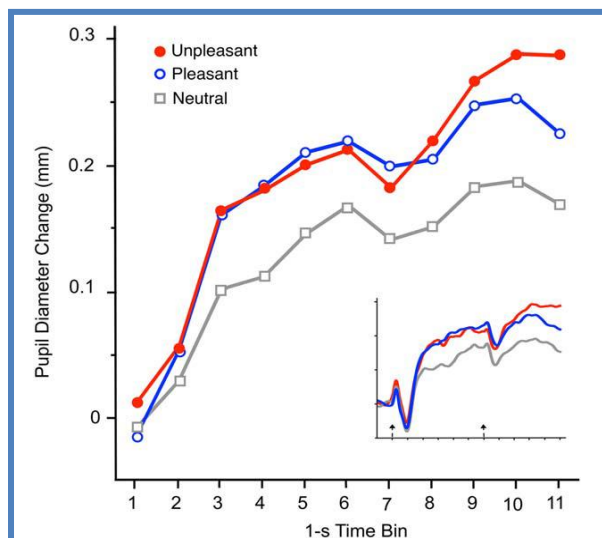
***Fig 3.** Pupil diameter change (mm) from a 1-s baseline interval during imagery of unpleasant, pleasant, and neutral scenes, averaged over 1-s intervals, shows enhanced pupil diameter for emotionally arousing (pleasant or unpleasant), compared to neutral, scenes. The inset shows pupil data at the acquired 60 Hz sampling rate, and the dotted arrows indicate script onset and offset.*
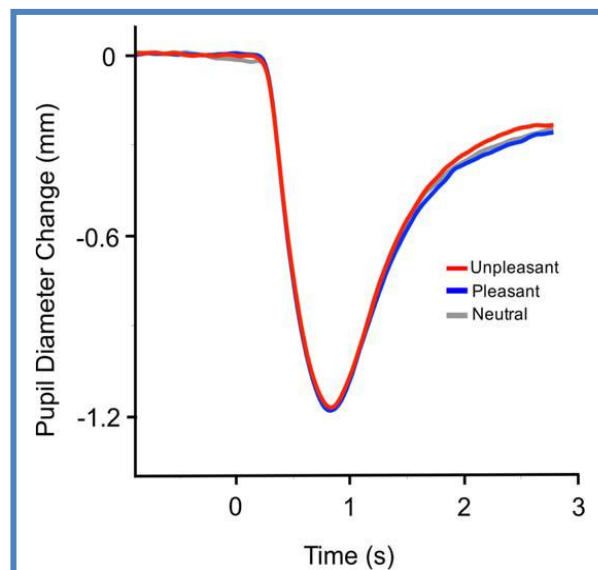

***Fig 4.** Pupil diameter change (mm) following the presentation of a light probe consisting of a brief change in screen illumination in the context of imagining either unpleasant, pleasant, or neutral scenes. Pupil diameter is shown deviated from a 1-s preprobe baseline.*

across the effective imagery interval (time bins 3–11), there was a significant main effect of content, $F_{(2, 28)}=5.4$, $p<.01$, and follow-up comparisons indicated enhanced pupil diameter when imagining unpleasant (M=0.23, SD=0.19; $F_{(2, 28)}=5.7$, $p<.05$) or pleasant (M=0.22, SD=0.19; $F_{(2, 28)}=10.2$, $p<.005$), compared to neutral (M=0.15, SD=0.21) events. Figure 4 shows pupil diameter changes to the brief light probes presented during imagery. A large transient constriction is evident that was not modulated by hedonic content. Pleasure and arousal ratings for each script were used to predict pupil diameter in the interval in which emotional modulation was significant (average of time bins 3–11). Rated emotional arousal accounted for significant variations in the amplitude of pupil dilation, $F_{(1, 44)} =5.8$, $p<.05$, r5.35, but there was no relationship between rated pleasure and pupil dilation.

Emotional labor

This was measured by a five-item scale developed to assess emotional dissonance by Zapf et al. (1999).[17] This scale examines how often respondents were required to perform emotional labor on a five-point scale ranging from 1 = 'very rarely/never' to 5 = 'very often.' An example item is: 'How often do you have to display emotions that do not agree with your true feelings?' This measure has been used widely in a range of occupational groups including employees.[30,83] Mean scores were calculated across items with higher scores representing higher levels of emotional labor (a = 0.90).

Burnout

We utilized the 22-item Maslach burnout inventory.[84] This measure assesses three related but independent aspects of burnout. The questions were adapted to apply to pupils rather than recipients of care. Example items from each subscale are 'I feel emotionally drained from my work' (emotional exhaustion), 'I've become more callous towards people since I took this job' (depersonalization) and 'I have accomplished many worthwhile things in this job' (personal accomplishment). Items are measured on a seven-point scale ranging from 1= 'Never' to 7 = 'Every day.' This measure has been used widely in samples of employees, and the three-factor structure has been supported [10, 85]. Mean scores were calculated across items with higher scores denoting higher levels of emotional exhaustion, depersonalization and personal accomplishment (Emotional exhaustion [nine items: a = 0.98], depersonalization [five items: a = 0.78 and personal accomplishment [eight items: a = 0.91]).

Job satisfaction

We utilized the Warr, Cook, and Wall's (1979) 15-item measure.[86] This global measure assesses levels of satisfaction with extrinsic aspects of work (e.g., rate of pay and promotion opportunities), as well as intrinsic factors (e.g., variety, control, and recognition). This is one of the most commonly used measures of job satisfaction, and its unidimensionality has been confirmed.[86,87] Responses are invited on a seven-point scale ranging from 1 = 'I'm extremely dissatisfied' to 7
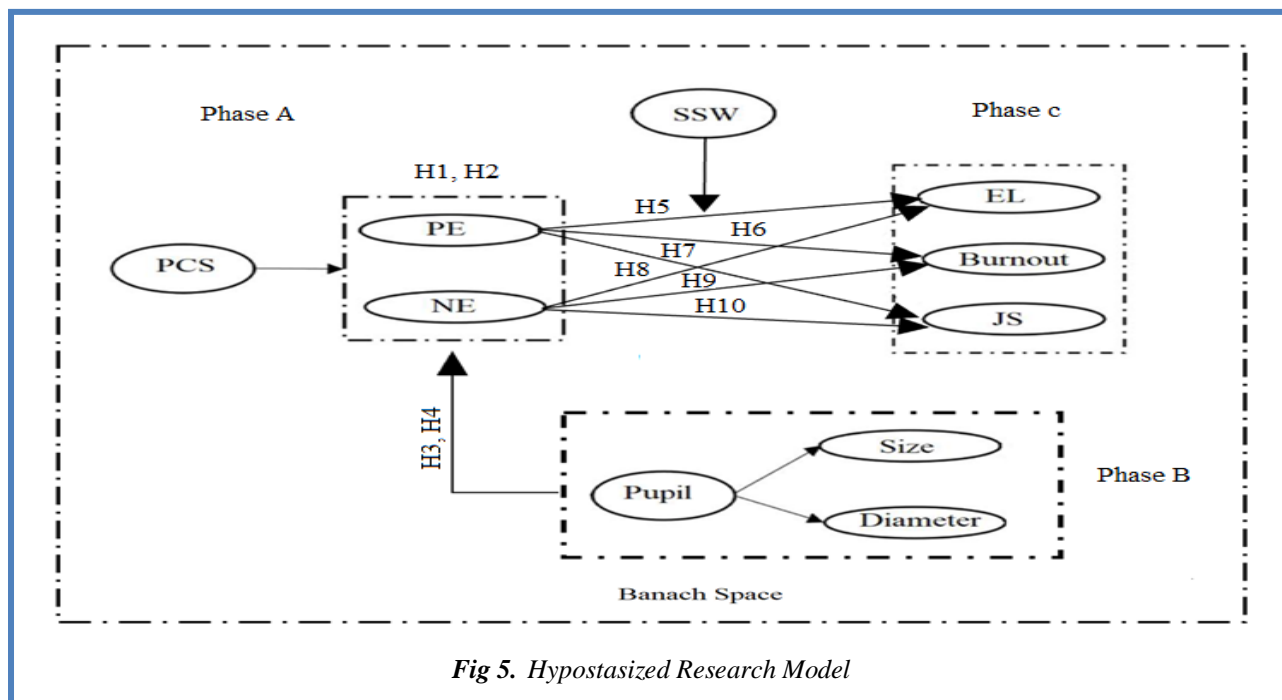
Fig 5. *Hypostasized Research Model*

= 'I'm extremely satisfied.' Mean scores were calculated across items with higher scores representing more job satisfaction (a = 90).

Social support

We assessed Social support by an eight-item measure developed by Ybema and Smulders (2002).[88] The measure assesses levels of support from different sources at work on a five-point scale ranging from 1 = 'Not at all' to 5 = 'A great deal.' Items include 'To what extent can you count on your immediate manager to listen to you when you need to talk about problems at work?' and 'To what extent can you count on your colleagues to help you with a difficult task at work?' This measure has been used in a large-scale study of the working population in the Netherlands that included employees.[88] Principal component factor analysis confirmed the unidimensionality of this scale with a single factor accounting for 79% of the variance. Mean scores were calculated across items, with higher scores represent higher levels of workplace social support (a = 92).

Hypothesized Theoretical Model

Figure 5 illustrates (a) the direction of the relationships of Psychology Cognition Science, Emotions *"Positive and Negative";* and (b) Pupil *"Size and Diameter"* on Emotions *"Positive and Negative";* and (c) Social Support in Workplace as a mediating variable on the relation between emotions *"PE, NE"* and Emotional Labor, and Burnout and Job Satisfaction. PCS = Psychology Cognition Science, PE = Positive Emotion, NE = Negative Emotion, EL = Emotional Labor, JS = Job Satisfaction and SSW = Social Support in Workplace. This work has three-phase and the hypothesis will be reported to each phase. This is so important to consider

all of the space in this research are based on *"Banach Theory."*
About behavior, what we do is *"Asymptotic behavior of solutions of nonlinear delay difference equations in Banach spaces"* according to Anna Kisiolek and Ireneusz Kubiaczyk (2005).[111,113] In the second-order difference equation of the form was considered Eq. (7).

Authors give a condition when this equation has a solution, asymptotically equal to $c, c \in \mathbb{R}$.

Hypothesis

Phase A

H1. There is a positive relationship between PCS and PE.
H2. There is a positive relationship between PCS and NE.

Phase B

H3. There is a positive relationship between Pupil size and *"PE, NE."*
H4. There is a positive relationship between Pupil diameter and *"PE, NE."*

Phase C

H5. PE has a positive relationship with EL trough considering SSW as a mediating role.
H6. PE has a positive relationship with Burnout trough considering SSW as a mediating role.
H7. PE has a positive relationship with JS trough considering SSW as a mediating role.
H8. NE has a positive relationship with EL trough considering SSW as a mediating role.
H9. NE has a positive relationship with Burnout trough considering SSW as a mediating role.
H10. NE has a positive relationship with JS trough, considering SSW as a mediating role.

Table 1. *Means, Standard Deviation and Inter-Correlations of variables*

	Mean (SD)	1	2	3	4	5	6	7
Emotional Labor (El)	2.90 (0.90)	0.00						
Emotional Exhaustion (EE)	3.78 (1.26)	0.4***	0.00					
Depersonalization	2.26 (1.14)	0.44***	0.58***	0.00				
Personal Accomplishment (PA)	3.93 (1.63)	0.10*	-0.11**	-0.07	0.00			
Job Satisfaction (JS)	4.77 (0.93)	-0.37***	0.55***	-0.36***	0.18***	0.00		
Workplace Social Support (WSS)	3.83 (0.90)	-0.26***	-0.54***	-0.15***	0.10*	0.60***	0.00	
Job Experience (JE)/Years	12.97 (11.36)	0.09*	0.02	0.03	0.36***	0.10*	-0.06	0.00

* p<0.05, ** p<0.01, *** p<0.001, and n=608-620

Discussion

The target sample comprised 1500 employees working in the banking sector or the manufacturing sector across China. The employee was accessed at their places of work and during training sessions. 628 completed questionnaires were returned. 74% of respondents were female, with a mean age of 36 years (SD = 10.5). The number of years of working experience ranged from 1 to 39 with a mean of 12.97 years (SD = 11.4). Zero-order correlations were used to examine relationships between variables. Hierarchical regression analysis was utilized to examine whether workplace social support moderated the relationship between emotional labor and the three components of burnout (emotional exhaustion, depersonalization, and personal accomplishment). Before conducting the regressions, residual plots were used to test normality, linearity, and equality of variances, with no violations being found. The procedure recommended by Baron and Kenny (1986) for detecting moderating effects was followed. Interaction terms were computed as the product of the centered scores.[89] As differences between males and females have been found in the extent of emotional labor performed,[49] gender was entered in Step 1 of each regression to control for its potential effects. This step also controlled for job experience as this was significantly correlated with emotional labor and two of the three burnout dimensions (see results section below). Emotional labor and social support were entered simultaneously in Step 2, with the two-way interaction term emotional labor × social support introduced in Step 3. A significant moderation effect would be found in Step 3 accounted for additional variance in any of the outcome variables. Table 1 provides details of the mean scores and standard deviations for all study variables. Also shown are inter-correlations between emotional labor, the four-strain outcomes (emotional exhaustion, depersonalization, personal accomplishment, and job satisfaction), social support and job experience. Significant positive associations were observed between emotional labor and both emotional exhaustion and depersonalization, and a negative association with job satisfaction. A weak positive relationship was found between emotional labor and feelings of personal accomplishment. Employees who reported higher levels of workplace social support tended to report less emotional labor, emotional exhaustion and depersonalization, and more personal accomplishment and job satisfaction. Length of experience in the employee role was positively related to emotional labor, in that employees with longer service tended to perform more emotional labor, but this association was only weak. The working experience was positively related to feelings of personal accomplishment and job satisfaction, but no significant relationships with emotional exhaustion and depersonalization were observed. Hierarchical regression analyses were conducted to examine whether workplace social support colleagues moderated the relationship between emotional labor and the strain outcomes utilized in the study. Details of the regressions are provided in Table 2 (only significant regressions are shown). Findings suggest that workplace social support might, to some extent, protect employees from the negative impact of emotional labor. Significant two-way interactions were found between emotional labor and support in predicting emotional exhaustion, feelings of personal accomplishment, and job satisfaction. For emotional exhaustion, gender and job experience entered in Step 1 of the regression failed to account for variance. The main effects of emotional labor ($\beta = 0.43$, p < 0.001) and social support ($\beta = 0.15$, p < 0.001) entered in Step 2 of the regression explained 23% of variance in emotional exhaustion. The two-way interaction entered in Step 3 accounted for an additional 2% ($\beta = 0.92$, p < 0.01). In predicting personal accomplishment, gender explained 3% of the variance ($\beta = 0.18$, p < 0.001) and the main effects of emotional demands ($\beta = 0.43$, p < 0.001) and support ($\beta = 0.11$, p < 0.01) accounted for a further 21%. The two-way interaction explained an additional 1% ($\beta = 0.37$, p < 0.05). For job satisfaction, gender explained 3% of the variance ($\beta = 0.16$, p < 0.001) and the main effects of emotional demands ($\beta = 0.24$, p < 0.001) and support ($\beta = 0.55$, p < 0.001) accounted for a further 42%. When the two-way interaction was introduced in Step 3, a further 2% of the variance in job satisfaction was accounted for ($\beta = 0.63$, p < 0.01).

Table 2. Hierarchical regressions showing emotional labor predicting outcome variables

Predictors	Emotional exhaustion	Personal accomplishment	Job satisfaction
Gender	0.03	0.18***	-0.16***
Experience in Job Role	0.01	0.00	0.07
Step 1 R^2	0.00	-0.03***	0.03***
Gender	0.05	0.16***	-0.12***
Experience in Job Role	-0.05	0.05	0.18***
Emotional Labor	0.43***	-0.42***	-0.24***
Social Support	-0.15***	0.11**	0.55***
Step 2 R^2 Change	0.23***	-0.21***	0.42***
Gender	0.05	0.17***	-0.12***
Experience in Job Role	-0.05	0.06	0.18***
Emotional Labor	0.62***	-0.74***	-0.19**
Social Support	-0.12**	0.16	0.63***
Emotional Labor × Social Support	-0.92**	0.37*	
Step 3 R^2 Change	0.02**	0.01*	0.02**
Total R^2	0.25	0.25	0.49

* p<0.05, ** p<0.01, *** p<0.001

In line with previous research, the current study shows that large pupils are overall perceived more positively and small pupils more negatively.[79-81] Possibly, because large pupils fit in the baby schema (children tend to have larger pupils than adults, as have good characters in cartoons), people associate large pupils with harmlessness. However, research has shown that children are as sensitive to the baby schema as adults, and like faces that fit into that scheme much better than ones that do not.[90] Thus, those large pupils are consistent with the baby scheme is at least not the full explanation for why large pupils are liked so much. An alternative explanation is that people in positive compared to negative states do have actual large c.q. Small pupil sizes. Both sympathetic and parasympathetic inputs govern pupil size. Pupil dilation is typically seen in tasks requiring either physical (lifting weights) or mental effort, including tasks with a high working memory load.[91] Moreover, emotional arousal, regardless of valence, is also reflected in the magnitude of pupillary dilation,[92-94] and is associated with sympathetic activity and norepinephrine levels, elicited by the locus coeruleus.[95] Yet, initial pupillary dilations and those driven from higher-order visual features are largely driven by the release of parasympathetic inhibition at the Edinger-Westphal nucleus.[96] Pupillary constriction occurs to stimulus attributes such as the onset of color change, spatial structure, or coherent movement,[96] but a general small pupil size can be indicative of fatigue as well.[97] Thus, based on people's pupil size alone, it is hard to say anything meaningful about their state of mind and whether that is positive or negative. However, with extra contextual information, I would like to argue, it may be possible. In the context of social interaction, for instance, pupillary cues might be particularly meaningful. This study has extended knowledge of the type of stressors experienced by employees and the potential impact on well-being. The findings provide empirical support for previous observations that emotional labor is a fundamental aspect of their role that has potentially negative consequences for well-being.[20,26]. Evidence has also been provided that the emotional demands of teaching might have an adverse impact on job performance. Employees who reported more emotional labor were not only more emotionally exhausted and less satisfied with their work; they were also more likely to depersonalize their pupils. The employee may develop less sympathetic and more cynical attitudes towards their pupils over time as a self-protective strategy. The finding that emotional labor was positively related to job experience would support this proposition. Longitudinal studies are required to further elucidate the role played by emotional labor in the development of burnout in employees overtime, together with the impact of different coping strategies. Some evidence has been provided that the impact of emotional labor may not be wholly negative for employees. Several studies have found a negative association between sustained emotional labor and personal accomplishment that could be explained by increased feelings of negativity about the self and the job that are engendered by emotional exhaustion and depersonalization,[56,98] However, the present research

found that employees who performed more emotional labor tended to report higher rather than lower levels of personal accomplishment. Following the findings of a study of human service professionals conducted by Brotheridge and Grandey (2002), [24] this suggests that fulfilling the emotional demands of training in work might boost feelings of competence and satisfaction with achievement. It should be noted, however, that the relationship between emotional labor and personal accomplishment was not robust, and the strong negative associations observed with job satisfaction contradicts this argument. The findings of this study suggest that employees who perform more emotional labor tend to experience lower levels of job satisfaction. Studies of service sector employees have found that emotional labor can reduce feelings of satisfaction with the job role by depleting emotional resources and engendering feelings of emotional inauthenticity.[55,98]. Nonetheless, as it has been suggested that employees consider emotional labor to be an intrinsic part of their work,[62] positive associations between emotional labor and job satisfaction were anticipated. Further research is needed to examine the type of emotional demands that employees see as intrinsic to the job role (and therefore potentially a source of satisfaction), and those that are perceived to be less legitimate. Previous studies of employees have highlighted the positive impact of a supportive working climate on well-being.[67] Similarly, the present study found significant main effects of workplace social support on the three dimensions of burnout and job satisfaction. This implies that enhancing social support from various sources will help employees manage the emotional labor of the job more effectively, protect them from burnout, and engender job satisfaction. The inverse association between social support and depersonalization also suggests that developing a supportive work environment is likely to enhance job performance by helping employees manage feelings of estrangement from the job role. In support of the buffering hypothesis,[64] evidence was also found that workplace social support might protect employees against the negative impact of emotional labor on well-being. The relationship between emotional labor and emotional exhaustion, personal accomplishment, and job satisfaction tended to be attenuated by social support. Although workplace support is clearly a protective factor in helping employees withstand the negative effects of emotional labor, an examination of the relative impact of different types of social support (such as informational, practical, appreciative and emotional:[99] received from different sources (such as colleagues, managers, administrators and parents) would help elucidate this process. For some time, it has been argued that support is more likely to mitigate the effects of a stressor if the type of support received closely corresponds to the type of stressor.[64] The recently developed 'triple-match' principle,[100] extends this proposition by maintaining that a closer match occurs when the job stressor, resource, and

type of strain are based on 'qualitatively similar dimensions.' Future research in educational settings might utilize this framework to examine the potential buffering effects of emotional support on the relationship between emotional labor and emotional exhaustion. The findings would have the potential to inform more precisely targeted interventions to help employees manage the emotional labor process more effectively. Interventions are required to mitigate the negative impact of emotional labor in the teaching profession and help employees enhance their emotion management skills. Little is yet known, however, about the type of interventions that might be successful in achieving these aims in the context of teaching, but some suggestions can be made. The importance of helping employees develop firm emotional boundaries between work and home and utilize effective recovery strategies has been emphasized; indeed, there is evidence that employees who are more adept at detaching emotionally from work have greater protection from the adverse impact of emotional labor.[101] Evidence is also accumulating that emotional intelligence is an important personal resource that helps employees cope successfully with emotion work and helps build resilience to stress more generally.[52,102,103] A study of employees recently conducted by Brackett, Palomera, Mojsa-Kaja, Reyes, Salovey (2010)[104] suggested that those who are better able to regulate their own emotional states, and those of others, experience stronger feelings of personal accomplishment and more job satisfaction. These findings suggest that training to enhance emotional competence might be beneficial in helping employees manage emotional labor and other types of the stressor. To conclude, this study shows that people associate positive faces with large pupil sizes and negative faces with small pupil sizes. This effect increased overage, which was especially related to older individuals drawing particularly smaller pupil sizes in the angry face than younger individuals. The fact that age is of influence here at all makes it most likely that real-world experiences are necessary to establish these associations. Further suggestions could be made based on studies of service sector employees. Mann (2004)[105] recommends that policies and practices should be introduced to encourage the expression of emotion as a 'natural' part of the job. She further suggests that holistic programmes that encompass stress management interventions, debriefing, and the encouragement of 'healthy catharsis' are likely to be beneficial. The extent to which interventions that have been developed in other professional contexts would be successful in helping employees manage emotional labor is open to question. Interventions that encourage emotional expression may be particularly problematic in such environments. Hargreaves (2000)[20] has argued that successful emotion management in teaching tends to be perceived 'as largely a matter of personal disposition, moral commitment or private virtue,' rather than a skill that can be enhanced. Moreover, it has been suggested that the ethic of emotional control within the profession

might be so pervasive that employees are reluctant to discuss their 'true' feelings.[21] This may be particularly the case for employees who are more experienced and who may fear a loss of credibility if they share what they consider to be 'inappropriate' emotions with colleagues. Nonetheless, the findings of the present study suggest that interventions designed to enhance social support from managers and colleagues might be particularly beneficial in minimizing the negative impact of emotional labor on well-being. Enhancing staff support networks to increase group cohesion and the provision of emotional mentoring might be useful. Studies have found reciprocal peer coaching, where pairs of employees work together to reflect on practice and provide mutual support, can help employees develop their knowledge, skills, attitudes, and values.[106] Peer coaching techniques might, therefore, be particularly appropriate in facilitating healthy catharsis and helping employees develop more adaptive emotional management skills. Although this study has extended knowledge of the emotional labor inherent in teaching and its potential impact, it has several limitations. Firstly, as the study is cross-sectional, the postulated relationships cannot be interpreted causally. It is plausible that employees who experience burnout and job dissatisfaction might perceive more emotional demands arising from their work rather than vice versa. Longitudinal studies would validate the causality of the observed relationships. Secondly, the data obtained in this study were derived from self-report questionnaires. Although there is a fundamental difficulty in measuring emotion-related constructs more objectively, the risk of common method variance is acknowledged. Thirdly, this study obtained assessments of emotional labor through retrospective, aggregated reports. While such methods can highlight relationships between aspects of emotional labor and strain, little insight is gained into the type of situations that are considered to be particularly emotionally demanding.

Daily diaries and experiential sampling methodology have the potential to capture specific work events that are considered emotionally demanding, how employees cope with such events, and the impact on well-being through time.[107,108]

List of acronyms

BOLD – Blood Oxygenation Level-Dependent
EL - Emotional Labor
JS - Job Satisfaction
NE - Negative Emotion
PCS - Psychology Cognition Science
PE - Positive Emotion
SD - Standard Deviation
SSW - Social Support in Workplace

Appendix

We give necessary and sufficient conditions for the existence of solutions.

Let f be the function from X to X, (p_n), (r_n) sequences of real numbers, and (h_n) a sequence in Banach space.
Let D be a nonempty, closed, convex, and bounded subset of Banach spaces. The following fixed-point theorem will prove our result.
Equation 8.[109] Let D be a nonempty, closed, convex, and bounded subset of Banach spaces.
Let F: D $\rightarrow$ D be a continuous mapping, which is condensing concerning the measure of noncompactness α:

$$\alpha\left(F\left(V\right)\right) \leq L\alpha\left(V\right), \quad L \prec 1. \tag{8}$$

Then F has a fixed point, where α is the Kuratowski's measure of noncompactness.

Eq (9). Let $V \subset \mathbb{C}\left(N^+, X\right)$ be a family of functions. Then

$$\alpha\left(V\right) = \alpha\left(V\left(N^+\right)\right) = Sup\left\{a\left(V\left(i\right)\right) : i \in N^+\right\} \tag{9}$$

Where α (V) denotes the measure of noncompactness in. A theorem similar to Theorem 8 was proved by Arino et al. (1984),[110] see also I. Kubiaczyk,1995;[111] A. R. Mitchell and C. Smith, 1977,[114] when f is weakly-weakly sequentially continuous, that is, if $x_n \overset{w}{\rightarrow} x_0$, then

$f\left(x_n\right) \overset{w}{\rightarrow} f\left(x_0\right)$ for each sequence (x_n), and instead of α we used β-weak measure of noncompactness.

Theorem 10. Let f: X $\rightarrow$ X be the bounded and continuous function.
Let

$$t = \sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)|p_n| \prec \infty, \tag{10}$$

$$\sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)\|h_n\| \prec \infty.$$

Moreover,

$$a\left(f\left(V\right)\right) \leq ka\left(V\right) \tag{11}$$

Where kt<1.
Then for every, $a,b \in \mathbb{R}$ there exists a solution (x_n) of (Eq. 3) Which possesses the asymptotic behavior

$$\left\|x_n - a\sum_{j=0}^{n-1}\frac{1}{r_j} + b\right\| = 0\left(1\right) \tag{12}$$

Proof. Let $a,b \in X$. There exists a constant M >1 such that $\left\|f\left(t\right)\right\| \prec M$ for each t∈X.
Assume that

$$k_n = |p_n| + \|h_n\| \quad n \in N,$$
$$l_n = \frac{1}{r_n}\sum_{j=n+1}^{\infty}k_j \tag{13}$$

From (Eq. 10) we have

$$\sum_{n=1}^{\infty}\left(\sum_{j=1}^{n-1}\frac{1}{r_j}\right)|p_n|+\sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)\|h_n\|$$

$$=\sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)(|p_n|+\|h_n\|)=\sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)k_n \quad (14)$$

$$=k_1.\frac{1}{r_0}+k_2.\left(\frac{1}{r_0}+\frac{1}{r_1}\right)+k_3.\left(\frac{1}{r_0}+\frac{1}{r_1}+\frac{1}{r_2}\right)+\dots$$

$$=\frac{1}{r_0}(k_1+k_2+k_3+\dots)+\frac{1}{r_1}(k_2+k_3+\dots)+\frac{1}{r_2}(k_3+\dots)$$

$$=\sum_{n=1}^{\infty}\frac{1}{r_{n-1}}\sum_{j=n}^{\infty}k_j=\sum_{n=1}^{\infty}l_{n-1}.$$

So the series $\sum_{n=1}^{\infty}l_n$ is convergent.

Let $z_n=\sum_{j=n}^{\infty}l_j$ for $n\in N$.

Define the operator T: D →K, where

$$D=\left\{y=(y_1,y_2,y_3,\dots),\|y_n\|\le Mz_n\right\}, \quad n\in N \quad (15)$$

$$K=\left\{y=(y_1,y_2,y_3,\dots),\left\|y_n-\left(a\sum_{j=0}^{n-1}\frac{1}{r_j}+b\right)\right\|\le Mz_n\right\}, \quad n\in N.$$

For x∈D and n∈N we have

$$(Tx)_n=\begin{cases}a\sum_{j=0}^{n-1}\frac{1}{r_j}+b, & n\le m, \\ a\sum_{j=0}^{n-1}\frac{1}{r_j}+b-\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(p_if(x_{i-k})-h_i), & n\succ M.\end{cases} \quad (16)$$

For n>m we have

$$\left\|(Tx)_n-\left(a\sum_{j=0}^{n-1}\frac{1}{r_j}+b\right)\right\| \quad (17)$$

$$=\left\|a\sum_{j=0}^{n-1}\frac{1}{r_j}+b-\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(p_if(x_{i-k})-h_i)-a\sum_{j=0}^{n-1}\frac{1}{r_j}-b\right\|$$

$$=\left\|\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(p_if(x_{i-k})-h_i)\right\|$$

$$\le\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}\|(p_if(x_{i-k})-h_i)\|\le\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(\|p_if(x_{i-k})\|-\|h_i\|)$$

$$\le\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(\|h_i\|+M|p_i|)\le\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}Mk_i\le M\sum_{j=n}^{\infty}l_j=Mz_n.$$

So, the operator T: D →K and the continuity of f, T is continuous.

Now, we will prove that T satisfies condition (8) of Theorem (8).

Let V⊂D, where V = {v: v = (v₁, v₂, . . .)} and T(V) = {T(v): v∈V}.

Let V_k = {vk: v∈V, v = (v₁, v₂, . . . ,vₖ, . . .)}.

For n ≤ m we obtain

$$a(T(V))=a\left(a\sum_{j=0}^{n-1}\frac{1}{r_j}+b\right)=0. \quad (18)$$

For n>m we have

$$a(T(V))=\sup_n a\left(a\sum_{j=0}^{n-1}\frac{1}{r_j}+b-\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(p_if(V_n)-h_i)\right) \quad (19)$$

$$\le\sup_n a\left[a\left(a\sum_{j=0}^{n-1}\frac{1}{r_j}+b\right)+a\left(\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}(p_if(V_n)-h_i)\right)\right]$$

$$\le\sup_n a\left[\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}p_if(V_n)+\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}h_i\right]$$

$$\le\sup_n\left(\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}a(p_if(V_n))\right)\le\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}|p_i|a(f(V_n)).$$

Using the inequality

$$a(f(V))\le ka(V) \quad (20)$$

We obtain that

$$a(T(V))\le ka(V)\sum_{j=n}^{\infty}\frac{1}{r_j}\sum_{i=j+1}^{\infty}|p_i|\le ka(V). \quad (21)$$

By Theorem 8 T has a fixed point, and by the definition of T the solution x = (xₙ) satisfies the condition

$$\left\|x_n-a\sum_{j=0}^{n-1}\frac{1}{r_j}+b\right\|=0(1) \quad (22)$$

This completes the proof of the theorem.

Because we can extend Theorem (8) as in O. Arino, S. Gautier, and J.-P. Penot, 1984; [110] I. Kubiaczyk, 1995,[111] so similar to Theorem (9), we can prove the following theorem.

Theorem, (10). Let f: X →X be the bounded and weak-weakly continuous function.

Let

$$t=\sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)|p_n|\prec\infty,$$

$$\sum_{n=1}^{\infty}\left(\sum_{j=0}^{n-1}\frac{1}{r_j}\right)\|h_n\|\prec\infty. \quad (23)$$

And kt < 1. Moreover

$$\beta(f(V))\le k\beta(V) \quad (24)$$

Then for every, $a,b\in\mathbb{R}$ there exists a solution (xₙ) of (3) which possesses the asymptotic behavior

$$\left\|x_n-a\sum_{j=0}^{n-1}\frac{1}{r_j}+b\right\|=0(1) \quad (25)$$

Remark (Eq. 12). Observe that the class of continuous functions is different than the class of weakly-weakly sequentially continuous functions and weakly-weakly continuous functions. There exist many important examples of mappings that are weakly sequentially continuous but not weakly continuous. The strong relationship between weak and weak sequential continuity of mappings is studied in (J. M. Ball, 1975).[116]

Authors contributions

All authors equally contributed to the manuscript.

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For more information about this dissertation, you can contact mohammad_heydari@njust.edu.cn and njustzxh@njust.edu.cn. There are several questions contained in this paper, which identify the purpose of further research. Also, we mention that this paper is the result of ten years of research in different countries on *"Human and Organizational Behavior"*.

Conflict of Interest

The authors declare no competing interests.

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