

AI awareness and work stress among university teachers: The moderating roles of digital literacy and perceived organizational support

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ABSTRACT

As artificial intelligence (AI) gradually enters the teaching and research contexts of higher education institutions, university teachers' different perceptions of AI may elicit different psychological responses. Drawing on the Job Demands–Resources model, this study examines the effects of AI Challenge Awareness and AI Threat Awareness on university teachers' Work Stress, and further analyzes the moderating roles of Digital Literacy and Perceived Organizational Support. Using university teachers as the research subjects, 421 valid samples were obtained through a questionnaire survey, and hierarchical regression analysis was employed to test the research hypotheses. The results indicate that AI Challenge Awareness is significantly and negatively correlated with university teachers' Work Stress, whereas AI Threat Awareness is significantly and positively correlated with Work Stress. Both Digital Literacy and Perceived Organizational Support significantly weaken the positive effect of AI Threat Awareness on Work Stress, but neither of their moderating effects on the relationship between AI Challenge Awareness and Work Stress reaches a significant level. The findings suggest that university teachers' perceptions of AI do not merely manifest as a source of stress; rather, their effects depend on individuals' different interpretations of the work-related changes brought about by AI. Compared with challenge-oriented perceptions, threat-oriented perceptions are more readily transformed into Work Stress, while Digital Literacy and Perceived Organizational Support can, to a certain extent, buffer the stress induced by threat-oriented perceptions. The conclusions of this study help to deepen the understanding of individual differences in university teachers' psychological responses in the context of AI, and provide references for higher education institutions to optimize the AI application environment and improve teacher support measures.

Keywords: Artificial intelligence, AI challenge awareness, AI threat awareness, work stress, digital literacy, perceived organizational support.

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INTRODUCTION

Artificial intelligence (AI) technology is profoundly reshaping the logic of knowledge work and has become an indispensable technological resource in domains such as academic research, teaching, and professional services (Lin and Zhou, 2023). In the field of higher education, AI not only offers teachers the possibility of improving

teaching and research efficiency and expanding channels for knowledge acquisition, but also brings challenges such as changes in professional roles, the need for skill updating, and threats to professional competence (Kohnke et al., 2024; Wan et al., 2025). However, the actual impact of AI upon entering university work contexts is not uniform;

its effects depend on how teachers understand and respond to this technological transformation.

Compared with the technical attributes of AI itself, how university teachers perceive and evaluate AI may be a more important factor influencing their work experiences. Existing research has shown that individuals do not form entirely consistent perceptions when confronted with AI, and their evaluations may be shaped by their own experiences, abilities, and work contexts (Gui et al., 2024; Wang et al., 2024). Some teachers regard it as an opportunity for capability enhancement and career development, whereas others focus more on the threats it poses to job stability and professional value, thereby experiencing a sense of uncertainty and stress. Existing studies have largely focused on the technological replacement risks and threat perceptions associated with AI (Shin et al., 2026; Teng et al., 2024), while insufficient attention has been paid to the challenge-oriented perceptions that individuals may also form.

This difference further raises an important question: Do different AI perceptions exert different effects on university teachers' Work Stress? When teachers are able to view AI as an opportunity to enhance their capabilities and improve their work, technological change may be interpreted as a work demand that can be addressed through learning and effort, thereby reducing their experience of stress. Conversely, when teachers view AI as a threat to job stability, professional competence, and career development, they may focus more on career uncertainty and the potential loss of their own resources, which further increases their Work Stress (Lazarus and Folkman, 1984). Existing studies have found that AI threat perception is significantly associated with individual Work Stress (Xu and Wang, 2023), and that differences in AI-related technology exposure and ability may also affect individuals' stress experiences (Koch and Lodefalk, 2025; Yin et al., 2025). Therefore, starting solely from the technical use or objective characteristics of AI may be insufficient to fully explain the different stress experiences that university teachers develop in response to the same technological change.

This issue is particularly noteworthy for the university teacher population. The daily teaching and research work of university teachers is inherently highly knowledge-intensive and professional. As AI accelerates its penetration into teaching, research, and administrative processes, teachers must continuously adjust their working methods to adapt to the new technological environment (Ellis et al., 2025). Against this backdrop, Digital Literacy has become a key personal resource determining whether teachers can effectively harness AI. Teachers with higher Digital Literacy are more likely to adapt to and apply AI tools, whereas those with lower Digital Literacy may face higher adaptation costs (Zuo et al., 2025). In addition, support at the organizational level also affects teachers' adaptation to AI. When teachers perceive that their organization values their contributions

and provides necessary training, institutional arrangements, and resource guarantees, the likelihood that AI Threat Awareness translates into Work Stress will be significantly reduced (Ding et al., 2026).

Although existing research has laid an important foundation, two issues remain to be further explored. First, existing studies have mostly focused on the objective use of AI and technology-related stress, paying insufficient attention to the different orientations of individuals' subjective AI perceptions, and in particular lacking examination of the differential effects of AI Challenge Awareness and AI Threat Awareness. Second, whether Digital Literacy and Perceived Organizational Support can alter the relationship between AI perceptions and Work Stress still lacks sufficient empirical evidence.

Accordingly, this study distinguishes AI awareness into two dimensions—AI Challenge Awareness and AI Threat Awareness—to examine their differential effects on university teachers' Work Stress, and to test the moderating roles of Digital Literacy and Perceived Organizational Support. By distinguishing these two types of perception and simultaneously testing the resource-buffering effects along the two pathways, this study seeks to determine whether the role of resources differs depending on individuals' cognitive appraisals. Specifically, this study addresses three questions: Do the two types of AI perception exert effects on Work Stress in different directions? Can Digital Literacy weaken the positive effect of AI Threat Awareness on Work Stress? Can Perceived Organizational Support buffer the effect of AI Threat Awareness on Work Stress? By answering these questions, this study aims to deepen the understanding of individual differences in university teachers' psychological responses in the AI context and to provide references for higher education institutions in optimizing teacher support measures.

THEORETICAL BACKGROUND AND HYPOTHESES

Job demands-resources model

The Job Demands–Resources Model (JD-R) is an important theoretical framework for explaining the relationships among job demands, job resources, and individuals' psychological states. Bakker and Demerouti classified factors in the work environment into two categories: job demands and job resources. Job demands refer to work-related factors that require individuals to continuously invest physical and mental effort and that may lead to corresponding depletion, whereas job resources refer to factors that help individuals achieve work goals, reduce the depletion caused by job demands, and promote personal growth and development (Bakker and Demerouti, 2017). On this basis, the JD-R model emphasizes that individuals' psychological states are not determined by job demands alone, but depend on the

dynamic relationship between job demands and available resources. When job demands are high and resources are insufficient, individuals are more likely to develop negative psychological responses such as stress (Bakker and Demerouti, 2017; Demerouti et al., 2001).

Within this framework, AI awareness can be understood as university teachers' subjective cognition and psychological appraisal of AI technology and its possible impact on their work and career development, rather than an evaluation of objective conditions such as the extent of AI technology application or the level of digitalization in higher education institutions. This study defines AI awareness as a two-dimensional cognitive appraisal construct, comprising AI Challenge Awareness and AI Threat Awareness. Existing research has conceptualized AI awareness as a cognitive job demand within the JD-R framework and has found that individuals' challenge appraisals and hindrance appraisals of AI can influence work outcomes through different psychological pathways (Liu et al., 2026). This finding provides a theoretical basis for distinguishing AI Challenge Awareness from AI Threat Awareness.

Specifically, AI Challenge Awareness refers to teachers viewing AI as an opportunity for learning, development, and improved job performance; AI Threat Awareness refers to teachers viewing AI as a potential threat to job stability, professional value, and career development. Although both originate from AI-related job demands, the former emphasizes the growth and development possibilities brought about by technological change, whereas the latter points more to potential resource loss and uncertainty, and may therefore elicit different stress responses. Although the two derive from different measurement traditions, both reflect individuals' cognitive appraisals of AI-related work changes.

Meanwhile, the JD-R model emphasizes the important role of resources in coping with job demands. As a domain-specific personal resource, Digital Literacy can help individuals understand and respond to technology-related demands and alleviate the resulting psychological stress (Kaiser et al., 2026). Perceived Organizational Support, in turn, constitutes an important external job resource that helps teachers cope with job demands through training, guidance, and resource provision (Chen, 2025). Therefore, the JD-R model provides a theoretical foundation for understanding the relationship between AI perceptions and Work Stress, as well as for examining the roles of Digital Literacy and Perceived Organizational Support in this relationship.

Hypothesis development

AI awareness and work stress

Teachers' cognitive appraisals of AI determine their subsequent psychological and behavioral responses.

When teachers possess stronger AI Challenge Awareness, they are more likely to focus on the learning and development opportunities presented by AI and to proactively learn and use related technologies. In this case, although adapting to AI still requires teachers to invest a certain amount of time and effort, technological change may also bring new job resources and growth opportunities. Teachers are therefore more likely to develop a sense of control over work-related changes and to experience less stress arising from technological change (Kong et al., 2026). Existing research has shown that when individuals view work-related changes as challenging demands, they tend to develop positive psychological states and adopt proactive coping behaviors (Glazer and Ion, 2023; Toniolo-Barrios and ten Brummelhuis, 2023), which differs significantly from the stress response pattern observed when the same changes are viewed as hindering demands.

By contrast, AI Threat Awareness mainly reflects teachers' concerns that AI may lead to career instability, skill depreciation, and limited career development. When teachers worry that their professional competence may be undermined by AI, or believe that they are unable to adapt to new technological requirements, they need to invest additional time and effort in coping with these uncertainties, which may increase their Work Stress. Research in organizational behavior has confirmed that when individuals appraise work-related changes as threats, stress response mechanisms are activated and psychological resources are depleted (Pindek et al., 2024; Podsakoff et al., 2023). Empirical research on university teachers has also confirmed that when teachers perceive AI technology as being mandatorily introduced into their work contexts, this perception itself significantly amplifies their technostress (Qureshi et al., 2026).

Taken together, the above analysis suggests that teachers' challenge-oriented and threat-oriented perceptions of AI may influence their Work Stress experiences through psychological mechanisms operating in different directions. Accordingly, this study proposes the following hypotheses:

H1: AI Challenge Awareness negatively affects university teachers' Work Stress.

H2: AI Threat Awareness positively affects university teachers' Work Stress.

The moderating role of digital literacy

Digital Literacy is an important capability for individuals to access, understand, evaluate, and use digital technologies, and it is also an important personal resource for adapting to digitalized work environments (van Laar et al., 2017). As AI gradually enters teaching and research activities in higher education, teachers need to continuously learn and use new digital tools. Teachers with

higher Digital Literacy generally possess stronger capabilities in information acquisition, technology learning, and digital tool application. When confronted with work-related changes brought about by AI, they may find it easier to understand and use related technologies, thereby reducing difficulties in the adaptation process. Existing research has shown that higher Digital Literacy can effectively buffer technostress and reduce individuals' anxiety responses caused by technological change (Altıntaş, 2026).

For teachers with AI Threat Awareness, higher Digital Literacy means that they possess more capabilities to cope with technological change. When teachers worry that AI may affect their work and career development, stronger digital capabilities can help them learn related technologies, adjust their working methods, and improve their ability to respond to technological change, thereby reducing the likelihood that threat awareness further translates into Work Stress.

Conversely, teachers with lower Digital Literacy need to invest more time and effort in learning and adapting to AI. When faced with already-existing threat awareness, this deficiency in capability makes it more difficult for them to effectively respond to the challenges brought about by technological change, and instead makes them more likely to interpret technological change as an additional workload (Avcı, 2025). When Digital Literacy is insufficient to support teachers in coping with new technological requirements, their existing threat awareness is more likely to be reinforced into actual Work Stress. Therefore, Digital Literacy may weaken the positive relationship between AI Threat Awareness and Work Stress.

Accordingly, the following hypothesis is proposed:

H3: Digital Literacy negatively moderates the relationship between AI Threat Awareness and Work Stress, such that Digital Literacy weakens the positive effect of AI Threat Awareness on Work Stress.

The moderating role of perceived organizational support

Perceived Organizational Support (POS) refers to the extent to which employees believe that their organization values their contributions and cares about their well-being (Rhoades and Eisenberger, 2002). Against the backdrop of AI continuously entering university work contexts, Perceived Organizational Support is manifested not only in general work assistance, but also potentially in technical training, work guidance, and the institutional and resource guarantees provided to help employees cope with technological change.

For teachers with AI Threat Awareness, the support provided by the organization can, to a certain extent, reduce their resource deficiencies when facing AI-related changes. When higher education institutions can provide necessary technical training, work guidance, and institutional guarantees, teachers can obtain more external resources needed to cope with technological change, thereby reducing their concerns about technological uncertainty. Existing empirical research has confirmed that Perceived Organizational Support can effectively alleviate the Work Stress and anxiety that individuals develop due to AI awareness (Wang and Zhou, 2025), and can buffer the negative impact of AI shocks on job insecurity (Li et al., 2025). Conversely, if teachers lack Perceived Organizational Support, they may need to rely more on their own resources to address related issues when facing AI-related changes, and AI Threat Awareness is more likely to further translate into Work Stress.

From the perspective of the JD-R model, Perceived Organizational Support, as an important external job resource, can help teachers cope with the new job demands brought about by AI. Therefore, Perceived Organizational Support may weaken the positive effect of AI Threat Awareness on Work Stress.

Accordingly, the following hypothesis is proposed:

H4: Perceived Organizational Support negatively moderates the relationship between AI Threat Awareness and Work Stress, such that Perceived Organizational Support weakens the positive effect of AI Threat Awareness on Work Stress.

Research model

Based on the above theoretical analysis, this study proposes the research model shown in Figure 1, in which AI Challenge Awareness and AI Threat Awareness are the independent variables, Work Stress is the dependent variable, and Digital Literacy and Perceived Organizational Support are the moderating variables. The study primarily addresses three questions: whether the effects of the two types of AI perception on teachers' Work Stress differ in direction; whether Digital Literacy can buffer the positive relationship between AI Threat Awareness and Work Stress; and whether Perceived Organizational Support can buffer the positive relationship between AI Threat Awareness and Work Stress. Through these three questions, this study attempts to understand, from the perspective of teachers' subjective cognition, the possible pathways through which AI affects Work Stress after entering university work contexts.

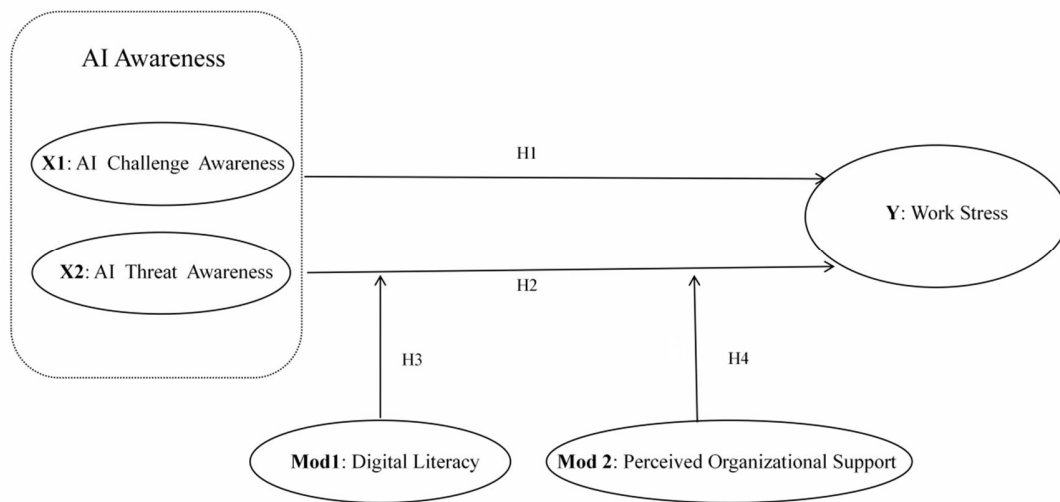


Figure 1. Research model.

MATERIALS AND METHODS

Measures

All variables in this study were measured using established, mature scales, and the item wording was localized and adapted to the work context of Chinese university teachers using AI. First, two bilingual Chinese–English researchers translated and back-translated the original English items, and experts in higher education and educational technology were invited to review the clarity and cultural appropriateness of the item wording. On this basis, some items were revised in light of the actual situations in which Chinese university teachers use AI in teaching and research. For example, the original item in the AI Threat Awareness scale, “I believe that AI technology will have a substantial impact on my work in the future,” was revised to “I believe that the development of AI technology will have a substantial shock on my work in the future,” so as to strengthen its orientation toward threat perception. Before formal data collection, a small-scale pilot survey was conducted. The results showed that the reliability and construct validity of each scale were satisfactory; only the communality of Item 1 in the AI Threat Awareness scale was relatively low, and its wording was therefore revised. All items were measured using a 5-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”).

AI Challenge Awareness was measured using the challenge appraisal scale developed by Webster et al. (2011), which consists of five items. Higher scores indicate a greater tendency to view AI technology as a challenging opportunity.

AI Threat Awareness was measured using the STARA awareness scale developed by Brougham and Haar

(2018), which consists of five items. Higher scores indicate a greater perception of the threatening impact that AI and related smart technologies may have on one’s work and career development.

Work Stress was measured using the core items of the psychological job demands dimension from the Job Content Questionnaire (JCQ) developed by Karasek et al. (1998), adapted to the research context of AI integration into university work. A total of four items were formed, with higher scores indicating a stronger perception of AI-related Work Stress.

Digital Literacy was measured using the Digital Literacy scale developed by van Laar et al. (2018), which consists of five items. Higher scores indicate a higher level of Digital Literacy among university teachers.

Perceived Organizational Support was measured using the Perceived Organizational Support scale developed by Rhoades and Eisenberger (2002), which consists of four items. Higher scores indicate stronger Perceived Organizational Support.

In addition, this study included gender, age, highest educational attainment, years of work experience, professional title, and disciplinary category as control variables.

Participants and procedure

This study employed a combination of purposive sampling and snowball sampling, with in-service teachers from public undergraduate universities in Guangxi as the survey respondents. The questionnaire was distributed to 29 public undergraduate universities in Guangxi, including four vocational undergraduate institutions that have been included in the scope of public undergraduate universities

by the Guangxi Department of Education. The questionnaire was distributed online via the “Wenjuanxing” platform, primarily through the Guangxi Association of Higher Education, which forwarded it to the teaching management departments of member universities, supplemented by targeted invitations through the researcher's academic social networks (WeChat and QQ groups for university teachers). Data collection was conducted from June to mid-July 2026.

An informed consent statement was placed on the first page of the questionnaire, informing respondents of the purpose of the survey, the guarantee of anonymity, and the fact that the data would be used solely for academic research. Respondents voluntarily clicked “Agree” before proceeding to complete the questionnaire.

This study strictly adhered to academic ethical standards and was approved by the Ethics Review Committee of Youjiang Medical University for Nationalities.

Data analysis

This study used SPSS 27.0 and AMOS 24.0 for statistical analysis. First, descriptive statistics, reliability analysis, validity analysis, and confirmatory factor analysis were conducted for each variable, and common method bias was assessed using Harman's single-factor test and the unmeasured latent method construct (ULMC) approach. Second, hierarchical regression analysis was employed to test the main effects and moderating effects.

In the first step, control variables were entered, including gender, age, highest educational attainment, years of work experience, professional title, and disciplinary category; in the second step, AI Challenge Awareness and AI Threat Awareness were entered as independent variables; in the third step, Digital Literacy and Perceived Organizational Support were entered as moderating variables; in the fourth step, standardized interaction terms were entered, including AI Threat Awareness $\times$ Digital Literacy, AI Threat Awareness $\times$ Perceived Organizational Support, AI Challenge Awareness $\times$ Digital Literacy, and AI Challenge Awareness $\times$ Perceived Organizational Support. The first two interaction terms were used to test H3 and H4, while the latter two were exploratory interaction terms used to examine whether the moderating effects of Digital Literacy and Perceived Organizational Support exhibit path specificity. All continuous variables were standardized before constructing the interaction terms to reduce multicollinearity. Simple slope analysis was used to further interpret significant interaction effects, with high and low levels defined as the mean $\pm$ 1 standard deviation.

RESULTS

Sample characteristics

A total of 503 questionnaires were collected in this study.

To ensure that the respondents had practical experience with AI-enabled work contexts, an AI usage screening question was embedded in the survey. Respondents were required to use AI at least three times per week, and AI should serve as an important auxiliary tool for their job tasks; those who failed to meet this criterion were prevented from continuing the survey. After excluding questionnaires that did not pass the screening check, contained incomplete responses, or exhibited obvious response patterns, 421 valid questionnaires were retained, yielding an effective response rate of 83.7%.

Among the valid sample, 188 respondents were male teachers (44.7%) and 233 were female teachers (55.3%). In terms of age, 122 participants were aged 30 years or younger (29.0%), 233 were aged 31–40 years (55.3%), 58 were aged 41–50 years (13.8%), and 8 were aged 51 years or older (1.9%). Regarding educational attainment, 9 participants held qualifications below bachelor's degree (2.1%), 133 had a bachelor's degree (31.6%), 208 had a master's degree (49.4%), and 71 held a doctoral degree (16.9%). For professional titles, 78 participants had no professional title (18.5%), 94 held junior titles (22.3%), 185 held intermediate titles (44.0%), and 64 held senior titles (15.2%). In terms of disciplines, 212 participants were from natural sciences (50.4%) and 209 from social sciences (49.6%).

Reliability and validity

The results of reliability analysis showed that the Cronbach's α coefficients of all scales ranged from 0.773 to 0.877, exceeding the acceptable threshold of 0.7. Specifically, AI Challenge Awareness had an α value of 0.875, AI Threat Awareness was 0.877, Work Stress was 0.852, Perceived Organizational Support was 0.845, and Digital Literacy was 0.773. These findings indicate good internal consistency for each dimension of the questionnaire.

In terms of validity, the KMO value was 0.869, which is greater than 0.6, and Bartlett's test of sphericity was significant ($p < 0.001$), suggesting that the data were suitable for factor analysis. Exploratory factor analysis extracted five factors with eigenvalues all greater than 1. The cumulative variance explained after rotation reached 64.86%. The factor loading of each item exceeded 0.6, and the correspondence between items and factors was consistent with theoretical expectations. These results demonstrate satisfactory construct validity of the measurement scales.

To further examine the construct validity of the measurement scales, confirmatory factor analysis (CFA) was performed to test the five-factor model (AI Challenge Awareness, AI Threat Awareness, Work Stress, Perceived Organizational Support, and Digital Literacy). The results indicated that the five-factor model achieved an adequate fit: $\chi^2 = 256.258$, $df = 220$, $TLI = 0.99$, $CFI = 0.991$, $RMSEA = 0.02$, $SRMR = 0.023$, which supports satisfactory

construct validity of the scales.

Regarding convergent validity, the average variance extracted (AVE) values for each dimension ranged from 0.407 to 0.591, all above 0.40. The composite reliability (CR) values ranged from 0.773 to 0.877, exceeding the threshold of 0.70. These results demonstrate good convergent validity across all dimensions.

For discriminant validity, the Fornell-Larcker criterion was adopted for assessment. The square roots of the AVE values of each dimension ranged from 0.638 to 0.769, all

larger than the Pearson correlation coefficients between the focal dimension and other dimensions, suggesting sound discriminant validity among the constructs.

In terms of common method bias, Harman's single-factor test revealed that the first extracted factor accounted for 24.639% of the total variance, below the critical cut off of 40%. To further assess common method bias, this study employed the unmeasured latent method construct (ULMC) approach for model comparison, and the results are presented in Table 1.

Table 1. Confirmatory factor analysis and ULMC model comparison.

Model	χ^2	df	TLI	CFI	RMSEA	SRMR	Δ CFI	Δ RMSEA	Δ SRMR
Five-factor model(AI Challenge Awareness, AI Threat Awareness, Work Stress, Perceived Organizational Support, Digital Literacy)	256.258	220	0.99	0.991	0.02	0.023	-	-	-
Six-factor model(AI Challenge Awareness, AI Threat Awareness, Work Stress, Perceived Organizational Support, Digital Literacy + latent method factor)	254.182	219	0.99	0.991	0.02	0.024	0	0	0.001

As shown in Table 1, compared with the five-factor model, the six-factor model yielded Δ CFI = 0, Δ RMSEA = 0, and Δ SRMR = 0.001. The changes in all fit indices failed to meet the criteria for a meaningful improvement. This result indicates that adding the ULMC latent method factor did not substantially improve model fit, suggesting that common method bias was not a serious concern in

this study.

Descriptive statistics

The means and standard deviations of all variables are presented in Table 2.

Table 2. Descriptive statistics.

Variable	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
AI challenge awareness	1.4	5.0	3.19	0.574	0.073	-0.039
AI threat awareness	1.2	4.8	2.90	0.588	0.050	-0.252
Work stress	1.0	5.0	2.90	0.616	-0.063	0.116
Perceived organizational support	1.0	4.75	2.79	0.860	0.308	-1.077
Digital literacy	1.2	4.6	2.49	0.665	0.701	0.213

As shown in Table 2, AI Challenge Awareness had a mean of 3.19 (SD = 0.574), the highest score among the five variables, with skewness of 0.073 and kurtosis of -0.039, indicating that its data approximated a normal distribution. AI Threat Awareness yielded a mean of 2.90 (SD = 0.588), skewness of 0.050, and kurtosis of -0.252, reflecting an

approximately symmetric distribution. Work Stress had a mean of 2.90 (SD = 0.616), identical to that of AI Threat Awareness, with skewness of -0.063 and kurtosis of 0.116, showing a slight negative skew. Perceived Organizational Support obtained a mean of 2.79 (SD = 0.860) and the largest standard deviation across the five

variables, with skewness of 0.308 and kurtosis of -1.077, suggesting high data dispersion and a relatively flat distribution. Digital Literacy had a mean of 2.49 (SD = 0.665), the lowest value among the five constructs, with skewness of 0.701 and kurtosis of 0.213, presenting moderate positive skewness. Overall, the absolute values of skewness for all variables were less than 1, and the absolute values of kurtosis were below 2. The data were

generally close to normal distribution, which justified the subsequent regression analysis.

Correlations

The correlation coefficients among variables are presented in Table 3.

Table 3. Correlation matrix.

	AI challenge awareness	AI threat awareness	Work stress	Perceived organizational support	Digital literacy
AI challenge awareness	0.764				
AI threat awareness	-0.325**	0.767			
Work stress	-0.378**	0.398**	0.769		
Perceived organizational support	0.054	-0.202**	-0.083	0.760	
Digital literacy	-0.029	-0.126**	-0.150**	0.086	0.638

Note: Bold values on the diagonal represent the square roots of the AVE values for each dimension. * $p < 0.05$, ** $p < 0.01$; N = 421.

As shown in Table 3, AI Challenge Awareness was significantly and negatively correlated with AI Threat Awareness ($r = -0.325$, $p < 0.01$) and Work Stress ($r = -0.378$, $p < 0.01$). The correlations of AI Challenge Awareness with Perceived Organizational Support ($r = 0.054$, $p > 0.05$) and Digital Literacy ($r = -0.029$, $p > 0.05$) were not statistically significant.

AI Threat Awareness exhibited a significant positive correlation with Work Stress ($r = 0.398$, $p < 0.01$), and significant negative correlations with Perceived Organizational Support ($r = -0.202$, $p < 0.01$) and Digital Literacy ($r = -0.126$, $p < 0.01$).

The correlation between Work Stress and Perceived Organizational Support was non-significant ($r = -0.083$, $p > 0.05$), whereas Work Stress was significantly negatively correlated with Digital Literacy ($r = -0.150$, $p < 0.01$). The correlation between Perceived Organizational Support and Digital Literacy was not significant ($r = 0.086$, $p > 0.05$).

These findings reveal that AI Challenge Awareness and AI Threat Awareness have opposite correlational directions with Work Stress: higher challenge awareness is associated with lower work stress, whereas higher threat awareness is associated with greater Work Stress. These results offer preliminary support for Hypotheses H1 and H2 in the subsequent regression analyses.

Direct effects

Hierarchical regression analysis was adopted in this study to examine the direct effects of AI Challenge Awareness and AI Threat Awareness on Work Stress. The results are presented in Table 4.

As shown in Table 4, after controlling for gender, age, highest educational attainment, working years, professional title, and discipline, Model 1 indicated that the control variables explained little variance in Work Stress ($R^2 = 0.007$, adjusted $R^2 = -0.008$). The overall model was non-significant ($F(6,414) = 0.460$, $p = 0.838$), and none of the control variables exerted a significant predictive effect on Work Stress ($p > 0.05$).

After adding AI Challenge Awareness and AI Threat Awareness in Model 2, the explanatory power of the model increased significantly ($\Delta R^2 = 0.226$, $\Delta F(2,412) = 60.757$, $p < 0.001$). The total R^2 was 0.233 (adjusted $R^2 = 0.218$), and the model was statistically significant ($F(8,412) = 15.634$, $p < 0.001$). AI Challenge Awareness exerted a significant negative effect on Work Stress ($\beta = -0.273$, $p < 0.01$), whereas AI Threat Awareness exerted a significant positive effect on Work Stress ($\beta = 0.313$, $p < 0.01$). Accordingly, Hypotheses H1 and H2 were supported.

After adding Digital Literacy and Perceived Organizational Support in Model 3, the explanatory power of the model was further improved ($\Delta R^2 = 0.016$, $\Delta F(2,410) = 4.489$, $p = 0.012$). The total R^2 was 0.249 (adjusted $R^2 = 0.231$), and the model was statistically significant ($F(10,410) = 13.617$, $p < 0.001$). Digital Literacy exerted a significant negative predictive effect on Work Stress ($\beta = -0.132$, $p < 0.01$), whereas the predictive effect of Perceived Organizational Support was non-significant ($\beta = 0.007$, $p > 0.05$). AI Challenge Awareness ($\beta = -0.282$, $p < 0.01$) and AI Threat Awareness ($\beta = 0.295$, $p < 0.01$) remained statistically significant.

To test multicollinearity, this study conducted collinearity diagnostics for the regression model incorporating all predictors and interaction terms. The results are presented in Table 5.

Table 4. Hierarchical regression results for direct effects.

Variables	Model 1	Model 2	Model 3
Gender	0.007	0.039	0.037
Age	-0.049	-0.025	-0.046
Highest educational attainment	0.021	0.003	0.018
Years of work experience	0.009	0.021	0.042
Professional title	0.057	0.036	0.039
Disciplinary category	0.057	0.047	0.054
AI Challenge Awareness		-0.273**	-0.282**
AI Threat Awareness		0.313**	0.295**
Digital Literacy			-0.132**
Perceived Organizational Support			0.007
R ²	0.007	0.233	0.249
Adjusted R ²	-0.008	0.218	0.231
ΔR^2	0.007	0.226**	0.016*
ΔF	F(6,414) = 0.460, p = 0.838		
F	F(6,414) = 0.460, p = 0.838		
	F(2,412) = 60.757, p < 0.001		
	F(8,412) = 15.634, p < 0.001		
	F(2,410) = 4.489, p = 0.012		
	F(10,410) = 13.617, p < 0.001		

Note. Values are standardized regression coefficients (β). N = 421. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 5. Collinearity diagnostics.

	Unstandardized coefficients		Standardized coefficients	t	p	Collinearity statistics	
	B	Std. Error	Beta			VIF	Tolerance
Constant	3.107	0.334	-	9.311	$p < .001$	-	-
Gender	0.042	0.053	0.034	0.778	0.437	1.081	0.925
Age	-0.018	0.064	-0.020	-0.278	0.781	3.066	0.326
Highest educational attainment	0.012	0.038	0.015	0.324	0.746	1.189	0.841
Years of work experience	0.023	0.053	0.032	0.434	0.664	3.062	0.327
Professional title	0.009	0.037	0.014	0.233	0.816	1.962	0.510
Disciplinary category	0.069	0.053	0.056	1.300	0.194	1.071	0.934
AC	-0.314	0.049	-0.292	-6.472	$p < .001$	1.181	0.847
AT	0.302	0.048	0.288	6.288	0.000**	1.214	0.824
OS	-0.003	0.031	-0.004	-0.082	0.935	1.068	0.937
DL	-0.134	0.040	-0.145	-3.379	0.001**	1.064	0.940
AT_DL	-0.072	0.027	-0.118	-2.705	0.007**	1.108	0.902
AT_OS	-0.069	0.028	-0.112	-2.492	0.013*	1.166	0.857
AC_DL	0.034	0.030	0.050	1.138	0.256	1.110	0.901
AC_OS	0.047	0.026	0.083	1.810	0.071	1.207	0.829
R ²				0.299			
Adjusted R ²				0.274			
F				F (14,406) = 12.350, p = 0.000			
Durbin-Watson				1.905			

Note: Dependent variable = WS, * p < 0.05, ** p < 0.01.

The VIF values of all independent variables ranged from 1.064 to 3.066, all below 5. The tolerance values ranged from 0.326 to 0.940, all greater than 0.1. These results

indicate that no serious multicollinearity exists among the predictor variables.

Moderating effects

This study further examined the moderating effects of

Digital Literacy and Perceived Organizational Support on the relationships between AI awareness and Work Stress. The results are presented in Table 6.

Table 6. Moderating effects.

Variables	Model 4	t	p
Gender	0.034	0.778	0.437
Age	-0.020	-0.278	0.781
Highest educational attainment	0.015	0.324	0.746
Years of work experience	0.032	0.434	0.664
Professional title	0.014	0.233	0.816
Disciplinary category	0.056	1.300	0.194
AI Challenge Awareness	-0.292**	-6.472	$p < .001$
AI Threat Awareness	0.288**	6.288	$p < .001$
Digital Literacy	-0.145**	-3.379	0.001
Perceived Organizational Support	-0.004	-0.082	0.935
AI Threat Awareness $\times$ Digital Literacy	-0.118**	-2.705	0.007
AI Threat Awareness $\times$ Perceived Organizational Support	-0.112*	-2.492	0.013
AI Challenge Awareness $\times$ Digital Literacy	0.050	1.138	0.256
AI Challenge Awareness $\times$ Perceived Organizational Support	0.083	1.810	0.071
R^2	0.299		
Adjusted R^2	0.274		
ΔR^2	0.049**		
ΔF	$F(4,406) = 7.142, p < 0.001$		
F	$F(14,406) = 12.350, p < 0.001$		

Note. Values are standardized regression coefficients (β). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

As shown in Table 6, after the four interaction terms were added, the explanatory power of the model increased significantly ($\Delta R^2 = 0.049$, $\Delta F(4,406) = 7.142$, $p < 0.001$). The total R^2 was 0.299 (adjusted $R^2 = 0.274$), and the overall model was statistically significant ($F(14,406) = 12.350$, $p < 0.001$). The interaction terms of AI Threat Awareness $\times$ Digital Literacy ($\beta = -0.118$, $p < 0.01$) and AI Threat Awareness $\times$ Perceived Organizational Support ($\beta = -0.112$, $p < 0.05$) were significant. In contrast, the interaction terms of AI Challenge Awareness $\times$ Digital Literacy ($\beta = 0.050$, $p > 0.05$) and AI Challenge Awareness

$\times$ Perceived Organizational Support ($\beta = 0.083$, $p > 0.05$) were non-significant. These findings indicate that Digital Literacy and Perceived Organizational Support mainly buffer the positive effect of AI Threat Awareness on Work Stress, whereas they exert no significant additional influence on the relationship between AI Challenge Awareness and Work Stress.

To further interpret the significant interaction effect of AI Threat Awareness $\times$ Digital Literacy, simple slope analysis was conducted. The results are presented in Table 7 and Figure 2.

Table 7. Simple slope analysis (AI Threat Awareness $\times$ Digital Literacy).

Level of moderator	Regression coefficient	Std. error	t	p	95% CI	
High level (+1 SD)	0.235	0.066	3.585	0.000	0.106	0.364
Low level (-1 SD)	0.568	0.065	8.723	0.000	0.440	0.696

Note. N = 421. DV = Work Stress.

As shown in Table 7 and Figure 2, when Digital Literacy was at a low level (-1 SD), AI Threat Awareness exhibited a stronger positive predictive effect on Work Stress. When

Digital Literacy was at a high level (+1 SD), the positive predictive effect of AI Threat Awareness on Work Stress was attenuated.

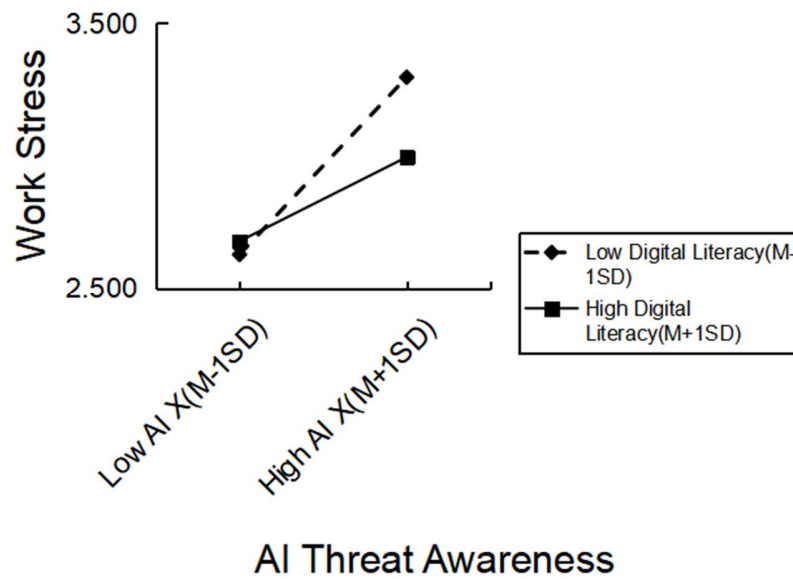


Figure 2. Moderating effect of Digital Literacy on the relationship between AI Threat Awareness and Work Stress. *Note.* Low and high levels = 1 SD below and above the mean; average level = the mean.

Similarly, to further interpret the significant interaction effect of AI Threat Awareness $\times$ Perceived Organizational

Support, simple slope analysis was performed. The results are presented in Table 8 and Figure 3.

Table 8. Simple slope analysis (AI Threat Awareness $\times$ Perceived Organizational Support).

Level of moderator	Regression coefficient	Std. error	t	p	95% CI	
High level (+1 SD)	0.261	0.067	3.908	0.000	0.130	0.392
Low level (-1 SD)	0.570	0.067	8.558	0.000	0.439	0.701

Note. N = 421. DV = Work Stress.

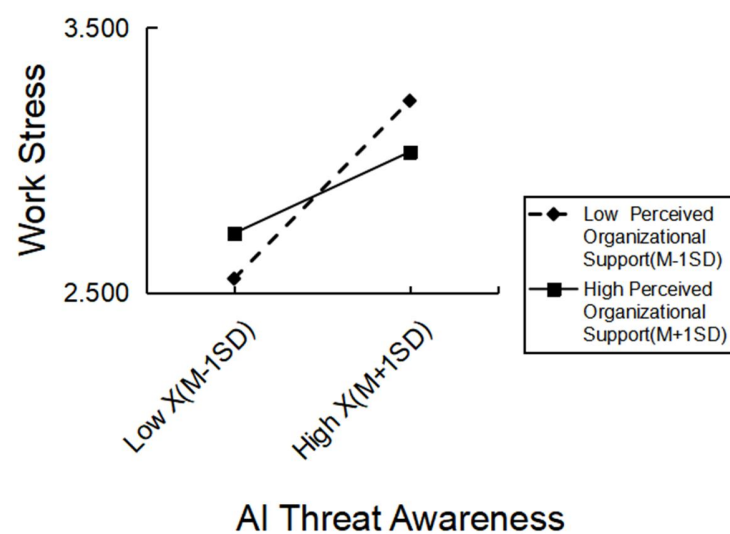


Figure 3. Moderating effect of Perceived Organizational Support on the relationship between AI Threat Awareness and Work Stress. *Note.* Low and high levels = 1 SD below and above the mean; average level = the mean.

As shown in Table 8 and Figure 3, when Perceived Organizational Support was at a low level (-1 SD), AI Threat Awareness exerted a stronger positive predictive effect on Work Stress. When Perceived Organizational Support was at a high level ($+1$ SD), the positive predictive effect of AI Threat Awareness on Work Stress was attenuated.

Taken together, the results reveal a tentative threat-path selectivity in the observed moderating effects of Digital Literacy and Perceived Organizational Support. Both constructs mainly buffer the translation from AI Threat Awareness to Work Stress, while exerting no significant additional influence on the relationship between AI Challenge Awareness and Work Stress.

DISCUSSION

Differential effects of AI challenge awareness and AI threat awareness on work stress

This study found that AI Challenge Awareness and AI Threat Awareness exerted effects in opposite directions on university teachers' Work Stress. Higher AI Challenge Awareness was associated with lower Work Stress, whereas higher AI Threat Awareness corresponded to greater Work Stress. This finding suggests that university teachers' psychological reactions to artificial intelligence are not solely determined by technological changes themselves; their perceptions of such changes also matter substantially.

For university teachers who view AI as a challenge, the shifts brought by artificial intelligence are largely interpreted as opportunities to learn new skills, optimize work practices, and improve work efficiency. Although adopting and adapting to new technologies requires certain investments of time and energy, such efforts may also create new opportunities for learning and professional development. Accordingly, work transformations induced by AI may not be directly experienced as additional burdens by university teachers. In contrast, when teachers focus more on potential job shifts, substitution of professional competencies, and uncertainties regarding future career development stemming from AI, technological changes are more likely to trigger concerns and further elevate Work Stress. This result is broadly consistent with prior findings regarding the relationships between AI threat perception, work stress, and job insecurity.

This finding also differs from several studies that discuss AI impacts exclusively from the perspective of technological threat (Shin et al., 2026; Teng et al., 2024). The introduction of artificial intelligence into the workplace does not necessarily yield only negative outcomes. For some university teachers, AI may also represent new ways of working and opportunities for growth. Therefore, when examining the association between artificial intelligence

and university teachers' work stress, merely focusing on the threatening nature of AI may be insufficient. It is also necessary to consider whether university teachers perceive such changes as opportunities that can be leveraged and managed.

The buffering roles of digital literacy and perceived organizational support and their boundaries

This study further found that both Digital Literacy and Perceived Organizational Support attenuated the positive effect of AI Threat Awareness on Work Stress. That is, even when university teachers hold strong threat perceptions of AI, higher digital literacy and greater organizational support can alleviate the stress stemming from such perceptions to a certain extent.

The moderating effect of digital literacy may relate to university teachers' capacity to cope with technological changes. Teachers with high digital literacy are generally more familiar with digital tools and find it easier to learn and adopt new technologies. When they recognize the potential impacts of AI on their work, robust digital competencies enable them to adapt rapidly to new job requirements, thereby reducing stress arising from uncertainty about how to respond. In contrast, if university teachers lack relevant digital competencies, the new demands brought by artificial intelligence may translate into greater costs of learning and adaptation, and AI Threat Awareness is more likely to be converted into Work Stress.

The function of organizational support operates through a different pathway. Faced with work transformations triggered by artificial intelligence, university teachers do not need to solve problems entirely on their own. Institutional arrangements and resource support provided by universities can assist teachers in tackling practical workplace difficulties (Chen, 2025). When teachers worry about their ability to adapt to AI-induced changes, such support reduces the pressure of confronting technological uncertainty alone. Accordingly, when organizational support is sufficient, the impact of AI Threat Awareness on Work Stress becomes relatively weaker.

On the other hand, this study found no evidence that Digital Literacy and Perceived Organizational Support significantly alter the relationship between AI Challenge Awareness and Work Stress. One plausible explanation is that university teachers who already perceive AI as a challenge and developmental opportunity are inherently more inclined to proactively learn and adapt to technological shifts. Under such circumstances, although digital literacy or organizational support remains valuable, they may not further modify the established association between AI Challenge Awareness and work stress.

These exploratory findings suggest that Digital Literacy and Perceived Organizational Support primarily help university teachers manage AI-related threats and uncertainties, rather than amplifying the effects induced by

AI Challenge Awareness. This observation implies that the resource buffering effect highlighted by the JD-R model (Bakker and Demerouti, 2017) may not exert identical buffering influences across different forms of AI-related cognitive appraisals within AI work contexts. We encourage future research to replicate and further examine this potential boundary condition of the JD-R model.

Theoretical and practical implications

Theoretically, this study distinguishes between AI Challenge Awareness and AI Threat Awareness, offering an alternative explanation for university teachers' psychological responses in AI-enabled work contexts beyond the unitary threat perspective. Existing AI-related research has largely focused on adverse outcomes such as technological substitution and job insecurity. By contrast, the present study considers both positive and negative perceptions of AI held by university teachers. Drawing on the JD-R model, these findings suggest that when artificial intelligence triggers workplace changes, teachers' cognitive appraisals of such changes constitute a critical factor shaping their stress responses.

Furthermore, the moderating roles of Digital Literacy and Perceived Organizational Support demonstrate that individual capabilities and organizational context matter for university teachers' adaptation to artificial intelligence. The distinction between AI Challenge Awareness and AI Threat Awareness also implies that the same technological change can be appraised by teachers as job demands of divergent nature. To some extent, this extends the JD-R model's conceptualization of "job demands": job demands are not homogeneous, and their nature depends on individuals' cognitive appraisals. Meanwhile, the buffering effects of digital literacy and organizational support exhibit clear path selectivity. Both factors significantly attenuate the positive association between AI Threat Awareness and Work Stress but fail to significantly moderate the relationship between AI Challenge Awareness and Work Stress. This finding qualifies the "resource buffering hypothesis" of the JD-R model: resources do not exert equivalent buffering effects across all types of job demands, and their effectiveness hinges on how individuals appraise those demands. Challenge-oriented perceptions may inherently resemble opportunities or resources rather than job demands in the conventional sense. This observation also suggests that the JD-R model requires a more nuanced delineation of the boundary between "demands" and "resources" when applied to AI contexts.

Practically, when promoting the adoption of artificial intelligence, universities should attend to both technological implementation and teachers' adaptation. On the one hand, training, experience-sharing sessions and other initiatives that help teachers understand the

application scenarios and limitations of artificial intelligence can reduce unnecessary concerns stemming from insufficient knowledge. On the other hand, targeted digital skills training tailored to teachers' practical needs enables them to better apply artificial intelligence to teaching, research, and daily work. Meanwhile, providing necessary technical support and work guidance, as well as promptly addressing problems encountered by teachers during AI implementation, also helps alleviate the stress induced by artificial intelligence adoption.

CONCLUSIONS

This study addresses a fundamental question: Does teachers' Work Stress inevitably rise once artificial intelligence is introduced into university work settings? The findings do not support this presumption. The emergence of stress does not hinge on the mere presence of artificial intelligence, but rather on how teachers interpret this technological shift. The same technological change, when construed as either a challenge or a threat, leads to entirely distinct stress outcomes. This result also provides a foundation for further investigating the boundary conditions under which threat perceptions operate in subsequent research.

A related question arises: Do threat perceptions necessarily induce stress? Again, the evidence from this study rejects such inevitability. The adverse effects of threat perceptions can be effectively attenuated by two types of resources: teachers' Digital Literacy and organizational support provided by universities. When these two resources are sufficiently available, teachers' concerns about artificial intelligence may not escalate into actual work stress. The implication of this finding partially shifts the research focus from "how teachers should think" to "what universities can do." Rather than attempting to homogenize teachers' attitudes toward artificial intelligence, institutions can offer tangible competency support and guarantee pathways for teachers with concerns at the institutional level.

From this perspective, an easily overlooked fact in the ongoing rollout of artificial intelligence applications in universities is that the teachers most in need of support are precisely those who lack not only knowledge of artificial intelligence but also practical capabilities to cope with changes and reliable organizational backing. If training and technology promotion merely pursue the efficiency goal of "getting more users onboard" while neglecting the safeguarding function of "calming anxious teachers", such initiatives may exacerbate rather than mitigate the divergence in teachers' stress levels.

LIMITATIONS AND FUTURE RESEARCH

This study has several limitations that could be addressed

in future research.

First, the cross-sectional design constrains causal inferences. Theoretically, this study assumes that AI perceptions shape Work Stress, yet a reverse explanation is also plausible: Could teachers experiencing higher stress be more inclined to perceive AI as a threat? This possibility cannot be fully ruled out. Moreover, all variables were measured via self-reports collected from the same participants at a single time point, which may introduce common method bias. Although Harman's single-factor test and the ULMC analysis did not indicate severe common method bias, its potential influence cannot be entirely eliminated. Future studies may adopt longitudinal designs, experience sampling methods, or multi-source data to capture the reciprocal effects between AI perceptions and Work Stress over time and conduct more rigorous tests for common method bias.

Second, the geographic concentration of the sample limits the generalizability of the findings. Universities in Guangxi may differ from those in eastern coastal regions or other central and western provinces in terms of information infrastructure resources and levels of organizational support. It remains unclear whether such differences moderate the strength of the associations among variables. Comparative studies across regions and university types represent an important avenue to test the robustness of the present findings.

Third, this study combined purposive sampling and snowball sampling. The sample may not fully represent the population of faculty at public undergraduate universities in Guangxi. Caution should be exercised when generalizing the conclusions to other regions or teacher groups.

Fourth, this study primarily examined the relationship between AI perceptions and Work Stress. Future research can further investigate teachers' actual coping behaviors under different AI perceptions to achieve a deeper understanding of psychological and behavioral responses within AI-enabled work settings.

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