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# The Impact of Time Poverty on Teachers' AI Readiness: The Mediating Role of Teacher Resilience and the Moderating Role of Career Calling

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# Abstract

Teachers' time poverty is closely related to their readiness for artificial intelligence (AI). Time poverty not only affects teachers' mental health but may also hinder their acceptance and application of new technologies. This study employed a cross-sectional survey method and, based on theoretical frameworks such as the Job Demands-Resources (JD-R) model, explored the impact of time poverty on teachers' AI readiness and examined the mediating role of teacher resilience and the moderating role of career calling. The study sample consisted of 578 primary and secondary school teachers in China. The results showed that: (1) time poverty does not have a significant direct impact on teachers' AI readiness; (2) teacher resilience fully mediates the relationship between time poverty and teachers' AI readiness, that is, time poverty indirectly enhances teachers' AI readiness by increasing their teacher resilience; (3) career calling only significantly moderates the direct path from time poverty to teacher resilience, with a stronger career calling weakening the positive impact of time poverty on teacher resilience. This study fills the gap in research on the relationship between time poverty and teachers' AI readiness, providing a theoretical basis for educational managers and policymakers, which is conducive to optimizing teachers' digital teaching environment and improving their AI readiness level.


# 1 Introduction

With the widespread application of artificial intelligence (AI) technology in the field of education, teachers' AI readiness has become a key factor affecting the quality of education. AI readiness not only involves teachers' understanding and application abilities of AI technology, but also their willingness and confidence to integrate AI into teaching practices (Ramazanoglu & Akın, 2025; Wang et al., 2023). However, when facing AI technology, teachers are often constrained by time poverty. Time poverty refers to the situation where teachers find it difficult to complete their work tasks within limited time, leading to a perceived scarcity of time (Liu et al., 2023; Thompson et al., 2023). This time pressure not only affects teachers' mental health, but may also hinder their acceptance and application of new technologies (Zhou et al., 2025). Therefore, it is of great significance to deeply explore the impact of time poverty on teachers' AI readiness.

Time poverty is particularly prominent in the field of education, as teachers need to complete heavy teaching tasks within limited time, such as curriculum design, teaching implementation, and student assessment (Gavin et al., 2021; Lawrence et al., 2018). Studies have shown that time poverty can lead to teachers' emotional exhaustion (Maas et al., 2021; Hoppe et al., 2023), which in turn affects their job performance and mental health (Liu et al., 2025). In addition, time poverty may also weaken teachers' willingness to participate in professional learning and technological innovation, especially the adoption of AI technology (An et al., 2023; Filiz et al., 2025). The complexity of AI technology requires teachers not only to master the technical operations, but also to understand the algorithms and ethical issues behind it, which further increases the time burden on teachers (Hu et al., 2021; Polly et al., 2021).

When exploring the relationship between time poverty and teachers' AI readiness, teacher resilience may play an important mediating role. Teacher resilience refers to the ability of teachers to effectively use personal and environmental resources to adapt and recover when facing occupational challenges (Peixoto et al., 2020). Studies have shown that teacher resilience can reduce job stress, and enhance job satisfaction and professional commitment (Burić et al., 2019; Hascher et al., 2021). In addition, teacher resilience may also enhance teachers' acceptance of new technologies and promote their adaptability in educational reforms (Gârdan et al., 2025). Therefore, teacher resilience may play a mediating role between time poverty and teachers' AI readiness, alleviating the negative impact of time poverty on AI readiness.

Career calling may also play a moderating role in this relationship. Career calling refers to the perception of teachers that teaching is an intrinsic calling and that their work has important social significance (Wrzesniewski et al., 1997; Dik & Duffy, 2009). Studies have shown that career calling can enhance teachers' job motivation and job satisfaction, and mitigate the negative impact of job stress (Hirschi et al., 2018; Huang et al., 2022). In addition, career calling may also enhance teachers' willingness to accept new technologies and promote their adaptability in educational reforms (Seco & Lopes, 2013; Zhang et al., 2020). Therefore, career calling may play a moderating role between time poverty and teachers' AI readiness, alleviating the negative impact of time poverty on AI readiness.

In summary, this study aims to explore the impact of time poverty on teachers' AI readiness, and further examine the mediating role of teacher resilience and the moderating role of career calling. The specific research questions include: (1) Does time poverty have a negative impact on teachers' AI readiness? (2) Does teacher resilience play a mediating role between time poverty and teachers' AI readiness? (3) Does career calling play a moderating role between time poverty and teachers' AI readiness? By answering these questions, this study expects to provide a new perspective for understanding the challenges faced by teachers in the digital education era, and provide theoretical basis and practical guidance for educational managers and policy makers to support teachers' professional development.

## 2 Literature Review

# 2.1 Teacher’s Time Poverty and AI Readiness

The concept of time poverty, first introduced by Vickery (1977), originated within the field of economics as a framework for understanding resource constraints beyond financial measures. In today’s fast-paced society, however, it has become a widely recognized psychological and social phenomenon (Creagh et al., 2023; Zhao et al., 2024). According to Thompson et al. (2023), time poverty refers to the imbalance between workload demands (quantity of tasks) and work intensity (complexity and stakes of decisions), where increases in either dimension can independently lead to perceived temporal deficiency. Time poverty has been found to negatively influence not only individual development but also the functioning of organizations and the progress of nations (Giurge et al., 2020; Liu et al., 2023). Within this broader context, the education sector represents a particularly vulnerable domain, where time poverty among

teachers undermines their work performance, compromising mental well-being, and constraining both their professional growth and ability to engage with technological innovation (Zhu et al., 2024). This vulnerability is largely attributable to the multifaceted and competing demands placed on teachers, including lesson planning, instructional delivery, student assessment, counseling, ongoing professional development, or even 'non-core' tasks (e.g. administrative responsibilities)—all of which must be managed within increasingly constrained time frames (Gavin et al., 2021; Lawrence et al., 2018; Thompson et al., 2023).

Numerical studies provided clear evidence of the prevalence and impact of time poverty in educational contexts. For example, an Australian Research Council–funded project by Thompson et al. (2025) reported that for every 30 minutes of available time, teachers were expected to complete an average of 71 minutes of work. This structural overload led to a subjective sense of time compression, making the workday feel rushed and cognitively exhausting. Consistent with these findings, a longitudinal study of 1,071 Swiss teachers by Maas et al. (2021) found that perceived time pressure was strongly associated with emotional exhaustion at the between-person level, highlighting the cumulative nature of time-related stress. Hoppe et al. (2023) echoed this pattern by showing that time pressure leads to weekly fatigue in teachers, a relationship mediated by the self-endangering strategy of extending work time. Similarly, in a two-wave longitudinal study involving 322 primary and secondary school teachers, Liu et al. (2025) identified time poverty as a significant positive predictor of adverse mental health outcomes. Furthermore, their findings revealed that time poverty served as a mediating mechanism through which teachers' stress mindset exerted its influence on their mental health status.

Beyond its psychological and emotional toll, time poverty has also been shown to hinder teachers' engagement in professional learning and innovation, particularly in relation to the adoption of new technologies (Zhou et al., 2025). Both Hu et al. (2021) and Polly et al. (2021) highlighted that the integration of digital tools into teaching practice requires extensive time for learning, adapting, and implementation—activities that, when combined with existing professional responsibilities, significantly exacerbate teachers' workload and hinder effective technology adoption. Compared to general digital tools, the integration of AI technologies poses an even greater challenge, as it demands technical proficiency alongside a deeper conceptual understanding of algorithmic processes, pedagogical data application, and ethical considerations—each of which amplifies the time and cognitive load required for adoption. For instance, An et al. (2023) found that teachers were often reluctant to adopt AI-powered systems due to the extensive time needed to learn and adapt to such tools. Consistently, Filiz et al. (2025) reported that time constraints—particularly those arising from overloaded teaching schedules—were a major barrier to AI adoption, even among teachers who expressed positive attitudes toward educational innovation.

Given that AI readiness serves as a prerequisite for successful AI adoption (Kurup & Gupta, 2022; Yang et al., 2024), and considering the documented barriers that time poverty poses to technology integration, understanding the concept of AI readiness becomes particularly relevant. AI readiness, defined as an individual's preparedness and capability to effectively adopt and utilize artificial intelligence technologies

in their professional context, has emerged as a critical construct in educational research (Ramazanoglu & Akın, 2025). In the teaching profession, AI readiness encompasses multiple dimensions including technical competence (understanding AI functionalities and applications), pedagogical integration skills (ability to meaningfully incorporate AI tools into instruction), ethical responsibility (awareness of ethical considerations and commitment to responsible AI use), and psychological preparedness (openness to change and confidence in using AI technologies) (Fundi et al., 2024; Kohnke et al., 2023; Ramazanoglu & Akın, 2025; Wang et al., 2023). However, while previous research has established time poverty as a barrier to AI adoption, direct empirical examination of its relationship with AI readiness in educational contexts remains limited.

Therefore, this study aims to address this gap by examining the relationship between time poverty and AI readiness among teachers. Based on the theoretical rationale outlined above, we propose the following hypothesis:

**Hypothesis 1**

*Teacher time poverty is negatively related to their AI readiness.*

# 2.2 Teacher Resilience as a Mediator

Resilience, as defined by Peixoto et al. (2020), is a dynamic process through which individuals mobilize both personal and environmental resources to effectively manage adversarial circumstances. This multifaceted construct requires the concurrent engagement of various individual and contextual assets (Hascher et al., 2021). Beltman (2020) identified four primary conceptualizations of resilience: person-focused (resilience as an individual trait), process-focused (resilience as person-context interaction), context-focused (resilience as adaptation to challenging environments), and system-focused (resilience as dynamic interaction among multiple internal and external systems). Teacher resilience represents the manifestation of general resilience within educational contexts. It specifically refers to teachers' capacity to adapt, recover, and sustain development when confronted with occupational challenges, pressures, and adversities, while maintaining professional commitment, teaching efficacy, and job satisfaction in educational practice (Kangas-Dick & O'Shaughnessy, 2020; Liu & Chu, 2022). Given the complexity of this construct, Mansfield et al. (2012) developed a four-dimensional framework of teacher resilience encompassing profession-related factors, emotional dimensions, motivational aspects, and social elements.

Empirical research has consistently demonstrated positive effects of teacher resilience across multiple dimensions of personal well-being and educational practice. Based on a comprehensive review, Hascher et al. (2021) proposed the AWaRE model, which demonstrates that teacher resilience supports the maintenance and development of teacher wellbeing. Similarly, research by Burić et al. (2019) revealed that highly resilient teachers demonstrated substantially reduced psychological distress and fewer adverse emotional responses, emphasizing resilience's dynamic characteristics through their finding that these beneficial outcomes emerged only through comprehensive assessment of multiple factors

simultaneously. Building on these evidences, Baatz and Wirzberger (2025) conducted a literature review specifically investigating resilience as a professional competence and found that resilience consistently shows positive impacts on teachers' burnout reduction, stress management, general well-being, and effectiveness. Beyond the individual benefits, teacher resilience has a ripple effect on student outcomes (Lu et al., 2024). Resilient teachers create an environment that fosters resilience in their students, facilitating supportive classroom dynamics that enhance student learning and emotional well-being (Nadeem et al., 2024; Zhang & Luo, 2023). Furthermore, research indicates that resilient teachers exhibit enhanced work adaptability and greater openness to innovation, maintaining positive attitudes and learning motivation when confronted with technological changes and educational reforms (Aburn et al., 2016; Kangas-Dick & O'Shaughnessy, 2020; Lu et al., 2024). For example, empirical research by Gârdan et al. (2025) provided direct evidence for this relationship in AI adoption contexts, demonstrating that resilient teachers were significantly more likely to perceive AI as beneficial and useful in educational settings ($\beta = 0.386$, $p < 0.01$).

However, teacher resilience is vulnerable to various risk factors that operate across individual and contextual levels and can undermine teachers' adaptive capacity. (Stavraki & Karagianni, 2020). At the individual level, research has identified multiple psychological vulnerabilities that compromise teacher resilience. Through qualitative analysis, Fan et al. (2021) revealed contextual and emotional factors such as uncertainty, unfamiliarity, and isolation. Complementing this perspective, Beltman (2020) outlined cognitive and behavioral risk factors including "negative self-beliefs," "reluctance to seek help," and "conflicts between personal beliefs and practices"(p. 13). In terms of contextual factors, extensive research has documented environmental risks including inadequate teaching resources, limited institutional support, lack of relational trust, challenging classroom environments, and excessive policy demands that threaten teacher resilience (e.g. Costantine et al., 2025; Duan et al., 2023; Fan et al., 2021; Flores-Builes et al., 2022). However, there is growing consensus among researchers that excessive workload and the resulting extended working hours and time scarcity represent particularly pervasive threats to teacher resilience (Beltman, 2020; Chen & Lee, 2022; Li et al., 2019; Pöysä et al., 2025). This time scarcity and the chronic sense of insufficient time to meet professional demands directly align with the concept of time poverty discussed earlier, suggesting that time poverty may serve as a critical pathway through which contextual pressures undermine teacher resilience.

Based on the theoretical foundations and empirical evidence presented above, this study proposes the following hypotheses regarding the relationships among time poverty, teacher resilience, and AI readiness:

**Hypothesis 2**

*Teacher time poverty negatively influences teacher resilience.*

**Hypothesis 3**

*Teacher resilience positively influences AI readiness.*

While the direct relationships between various stressors and teacher resilience, as well as between resilience and positive outcomes, have been well-established, there is growing interest in understanding teacher resilience as a mediating mechanism that explains how external challenges influence teacher outcomes. For example, Chen and Lee's (2022) study found that task overload significantly undermined teachers' social resilience, which in turn strongly predicted job performance, yielding a negative indirect effect. In another study with Korean early childhood educators, resilience was shown to significantly mediate the relationship between job-related stress and teacher-child interaction, confirming a partial indirect effect (Seo & Yuh, 2022). Additionally, Zewude et al. (2023) demonstrated that teacher resilience partially mediated the relationship between COVID-19 stress and teacher wellbeing, with stress directly undermining resilience while resilience continued to protect wellbeing. These studies collectively underscore that teacher resilience functions as a critical psychological resource that mediates the relationship between different challenges and teacher outcomes, demonstrating its dual role as both vulnerable to various risk factors and protective against their negative effects.

Building on this understanding of teacher resilience as a mediator, and considering the established relationships between teacher time poverty and resilience (Hypothesis 2) and between teacher resilience and AI readiness (Hypothesis 3), this study proposes:

**Hypothesis 4**

*Teacher resilience mediates the relationship between teacher time poverty and AI readiness.*

Given that teacher time poverty represents a significant occupational challenge that can undermine teachers' psychological resources, and that resilience serves as a protective factor for adaptive outcomes such as technology acceptance, teacher resilience is expected to function as a critical pathway through which teacher time poverty influences their AI readiness.

## 2.3 Career Calling as a Moderator

Calling, formally introduced into organizational psychology literature by Wrzesniewski et al. (1997), is characterized as a work experience that becomes thoroughly integrated with one's life, generating deep fulfillment through engagement and representing an inherently meaningful pursuit rather than merely a means to external rewards. Building on this foundation, Dik and Duffy (2009) conceptualize calling as a work orientation where individuals view their career as central to their life purpose and as a means to contribute to the greater good. As research proliferated, scholars developed divergent perspectives on calling's conceptualization, leading to what Thompson and Bunderson (2019) described as competing theoretical camps. Through comprehensive meta-analytic examination, Dobrow et al. (2023) identified two primary calling types that capture this conceptual diversity: internally-oriented calling, characterized by passion, personal fulfillment, and self-actualization through work, and externally-oriented calling, emphasizing duty, societal contribution, and transcendent purpose. Given this theoretical foundation, the concept of calling holds particular relevance in the educational sector due to the profession's inherently service-oriented nature. Teachers who perceive their work as a calling demonstrate greater career

dedication and experience enhanced job fulfillment, as calling represents the one of the most profound ways to derive meaning from one's profession (Wu et al., 2024).

From the two seminal research in the calling literature (i.e. Wrzesniewski et al., 1997 and Dik & Duffy, 2009) to the more recent studies (e.g. Huang et al., 2022; Kim et al., 2018; Wang et al., 2025; Wen et al., 2022), numerous scholars have proven that career calling functions as a powerful psychological resource with dual moderating capabilities. On one hand, career calling acts as an amplifying mechanism that enhances the positive effects of personal resources and favorable work conditions. The intrinsic motivation and meaning derived from calling can magnify the benefits of supportive environments, personal strengths, and developmental opportunities, leading to superior performance and well-being outcomes (Dik & Duffy, 2009; Kim et al., 2018; Wrzesniewski et al., 1997). On the other hand, career calling serves as a protective buffer that mitigates the negative impact of workplace stressors and challenges. When individuals experience their work as a calling, they demonstrate greater stress tolerance and adaptive responses to occupational demands, job insecurity, and role conflicts, as their deep sense of purpose provides psychological armor against adversity (Hirschi et al., 2018; Huang et al., 2022; Thompson & Bunderson, 2019).

Research has documented the dual moderating function within various settings. Early seminal work by Duffy et al. (2012) demonstrated the moderating role of calling between perceiving and living one's calling in relation to job satisfaction outcomes. Building on this foundational study, recent research has provided more nuanced evidence of calling's moderating mechanisms. A study by Chang et al. (2021) with 350 engineers demonstrated that calling enhanced the positive relationship between job crafting and career commitment, with the relationship being significantly stronger for high-calling individuals compared to low-calling individuals. Similarly, Huang et al. (2022) examined the moderating role of career calling in the relationship between job demands and job satisfaction among 1,117 health workers in China. They found that career calling amplified the positive relationship between job resources and job satisfaction, with high-calling workers showing significantly stronger benefits from available job resources compared to low-calling ones. Studies also confirmed calling’s buffer role in mitigating negative relationships, with Kim et al. (2021) revealed that career calling weakened the negative indirect effect of perceived overqualification on organizational citizenship behaviors via job boredom among white-collar employees, with the negative effect being significant only for low-calling individuals. Additionally, Nielsen et al. (2020), through a time-lagged study of 327 employees across various industries and job levels, illustrated that calling attenuated the detrimental impact of work-family conflict on job satisfaction.

Similar patterns have been observed in educational contexts. Seco and Lopes (2013) showed that teachers with career calling exhibited more positive attitudes toward educational public service delivery and revealed that career calling significantly moderated the relationship between authentic leadership and work engagement. Zhang et al. (2020) examined 399 primary school teachers and found that career calling significantly moderated the relationship between occupational stress and occupational burnout,

with calling serving as a personal resource that attenuated the positive relationship between stress and burnout.

This dual functionality of career calling is well-grounded in established psychological theories. Conservation of Resources (COR) theory (Hobfoll, 1989) explains the buffering function, suggesting that calling serves as a valuable psychological resource that helps individuals cope with resource threats and losses. When facing workplace stressors, those with strong calling can draw upon their sense of purpose and meaning as protective resources, preventing resource depletion and maintaining psychological well-being. Additionally, Self-Determination Theory (SDT) (Deci & Ryan, 2012) illuminates the amplifying function, proposing that calling satisfies the fundamental psychological needs for autonomy, competence, and relatedness. When these intrinsic needs are fulfilled through calling, individuals experience enhanced motivation and energy that amplify the positive effects of other resources and opportunities.

Based on the theoretical framework and empirical evidence reviewed above, this study proposes three hypotheses regarding the moderating role of career calling:

**Hypothesis 5**

*Career calling buffers the negative effect of time poverty on AI readiness.*

**Hypothesis 6**

*Career calling buffers the negative effect of time poverty on teacher resilience.*

**Hypothesis 7**

*Career calling enhances the positive effect of teacher resilience on AI readiness.*

Figure 1 shows the theoretical framework.

# 3 Method

This study employed a questionnaire survey to examine the mechanism through which time poverty affects teachers' artificial intelligence (AI) readiness. It further explored the mediating role of teacher resilience and the moderating role of career calling in this relationship. To ensure the scientific rigor and validity of the measurements, four well-validated scales were utilized, including the Time Poverty Scale, the Teacher resilience Scale, the Career Calling Scale, and the Teacher AI Readiness Scale. In addition, a demographic questionnaire was included to capture the basic characteristics of teachers and their AI usage patterns (Alwaqdani, 2025; Zhao et al., 2022) .

In terms of data analysis, the study primarily employed mediation and moderation effect analyses to test the proposed hypotheses. A mediation analysis using the bootstrap method with 5,000 resamples was conducted to determine whether teacher resilience significantly mediates the relationship between time

poverty and teachers' AI readiness. A moderation analysis was also performed to assess whether career calling moderates this relationship, with interaction plots generated to visually illustrate the direction and strength of the moderation effect. These analytical methods are widely used in educational psychology and teacher professional development research and are effective in uncovering the complex mechanisms of variable interactions within educational contexts (Wen et al., 2005). The empirical findings of this study are expected to provide further insight into the influence pathway of time poverty on teachers' AI readiness and offer both theoretical and practical implications for policy development aimed at enhancing teachers' AI competencies.

# 3.1 Participants and procedure

To investigate the influence of time poverty on teachers' AI readiness, this study collected and analyzed empirical data from primary and secondary school teachers in China. A questionnaire survey was conducted in several schools across Fujian and Jiangxi provinces. These two regions were selected because they possess well-established educational systems and diverse teacher populations, which meet the representativeness requirements of empirical research. A cluster sampling method was employed. First, schools in the two provinces were categorized into five types—urban schools, rural schools, public schools, private schools, and international schools—to ensure comprehensive coverage across school types. Then, random sampling was conducted within each category to further enhance the representativeness of the sample. Once selected, the research team contacted school administrators online to confirm their participation, thereby finalizing the sample framework.

Data collection was divided into three phases: preparation, questionnaire distribution, and a silent follow-up period. During the preparation phase (December 14–27, 2024), the research team communicated with school representatives via WeChat, online meetings, face-to-face interviews, and email to confirm participation and coordinate logistics. It is worth noting that although such coordination typically takes over a month, the process was completed in about ten days due to preliminary contacts established through prior research projects, reflecting efficient groundwork. The formal distribution of the questionnaire began on January 1, 2025, allowing ample time for teachers to complete the survey before the Chinese New Year. With the support of school leaders, teachers were randomly selected and invited to participate via an online link and QR code. To ensure anonymity and voluntary participation, the questionnaire included a clear statement explaining data confidentiality and the right to withdraw at any time.

The data collection lasted three weeks: 431 responses (67.2%) were collected in the first week, followed by 210 responses (32.8%) in the second week. The third week served as a silent period for late submissions (no additional responses received). All responses were collected via WJX, a professional Chinese online survey platform, ensuring data security and stability. In total, 641 responses were received. After data cleaning to remove responses with abnormal durations, incomplete answers, duplicates, or highly patterned responses, 578 valid responses were retained (220 male teachers and

358 female teachers), resulting in a 90.2% effective response rate. Complete demographic information is presented in Table 1.

Table 1
Demographic information of the sample

| Demographic Variables | Count | Percentage |
|---|---|---|
| Gender | | |
| Male | 358 | 61.9% |
| Female | 220 | 38.1% |
| Education level | | |
| Below Bachelor's | 15 | 2.6% |
| Bachelor's | 445 | 77.0% |
| Master's | 107 | 18.5% |
| Doctorate | 11 | 1.9% |
| Teaching experience (years) | | |
| 0–5 years | 294 | 50.9% |
| 6–10 years | 106 | 18.3% |
| 11–15 years | 92 | 15.9% |
| 16 years or more | 86 | 14.9% |
| Current teaching stage | | |
| Elementary school | 86 | 14.9% |
| Middle school | 256 | 44.3% |
| High school | 236 | 40.8% |
| Age | | |
| 30 years old or younger | 306 | 52.9% |
| 31 to 40 years old | 194 | 33.6% |
| 41 to 50 years old | 64 | 11.1% |
| 51 years old or older | 14 | 2.4% |
| Does your school provide AI equipment and support? | | |
| Yes | 493 | 85.3% |
| No | 85 | 14.7% |
| Does your school offer AI training opportunities? | | |

| Demographic Variables | Count | Percentage |
|---|---|---|
| Yes | 235 | 40.7% |
| No | 343 | 59.3% |

# 3.2 Measures

To ensure the accuracy and reliability of the data collected in this study, validated and widely used standardized measurement tools were adopted to more precisely assess the actual performance of the core variables. Specifically, four established scales were employed to measure primary and secondary school teachers' time poverty, teacher resilience, career calling, and AI readiness. These instruments were selected to enhance the scientific rigor, reliability, validity, and cross-study comparability of the data.

All selected scales were derived from empirically tested instruments in existing literature, with internal consistency reliability (Cronbach's α) and construct validity meeting the accepted standards within the field of social science research. Furthermore, to improve the applicability and comprehensibility of these instruments within the Chinese educational context, certain items were culturally adapted during translation or localization. These adjustments ensured semantic clarity and alignment with the cognitive backgrounds and linguistic habits of Chinese primary and secondary school teachers. The adaptation process was reviewed by experts in education and psychometrics to guarantee consistency in semantics, language, and measurement objectives.

## 3.2.1 Time Poverty Scale (TPS)

The Time Poverty Scale was employed to assess teachers' perceived time poverty (Liu et al., 2023). This unidimensional scale consists of seven items (e.g., "There is no autonomy in the allocation of my time"), each rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scale generates a mean score to reflect the level of time poverty, with higher mean values indicating a stronger perception of time scarcity and lower values indicating the opposite. Previous studies have confirmed the scale's applicability to Chinese teachers (Liu & Wang, 2024; Zhu et al., 2024), and in the present study, it demonstrated good internal consistency (Cronbach's $\alpha = 0.884$).

## 3.2.2 Teacher Resilience Scale (PRS)

The Teacher Teacher Resilience Scale was used to evaluate teachers' teacher resilience (Li et al., 2014) (7). This scale comprises 13 items across three dimensions: Passion and Dedication to Teaching (5 items, e.g., "I can maintain my love for students"), Teacher Self-Efficacy (4 items, e.g., "I can handle problems in my work well"), and Job Satisfaction and Optimism (4 items, e.g., "I can remain satisfied with my teaching work at school"). All items are rated on a 5-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Higher mean scores indicate stronger teacher resilience, while lower scores suggest weaker resilience. The scale has demonstrated good applicability among Chinese

teachers (Cronbach's α ∈ (0.87, 0.93)) (Li et al., 2014), and it also exhibited excellent internal consistency in this study (Cronbach's α = 0.942), with subscale reliability coefficients of α = 0.898, 0.890, and 0.901, respectively.

### 3.2.3 Career Calling Scale (PCS)

The Career calling Scale for teachers was adapted from the original Calling Scale (Dobrow & Tosti-Kharas, 2011). This scale follows a unidimensional structure and consists of 12 items (e.g., "I have a sense of mission to be a teacher"). Each item is rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Higher mean scores indicate a stronger sense of career calling, while lower scores reflect a weaker sense. The scale has been validated longitudinally and demonstrated strong convergent and discriminant validity (Dobrow & Tosti-Kharas, 2011). In the present study, the scale showed excellent internal consistency (Cronbach's α = 0.941).

### 3.2.4 Teacher' s AI Readiness Scale (TAIRS)

The Teacher AI Readiness Scale was used to assess teachers' readiness for artificial intelligence (AI) (Ramazanoglu & Akın, 2024). The scale comprises 19 items across three dimensions: Technological Self-Efficacy (6 items, e.g., "I can learn a programming language at a level that can create an artificial intelligence product"), Student Interaction (7 items, e.g., "I can lead classroom discussions on artificial intelligence topics with students"), and Ethical Awareness (6 items, e.g., "I pay attention to data privacy in artificial intelligence applications"). All items are rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher average scores indicate greater readiness for AI integration, while lower scores reflect poorer readiness. In the present study, the scale demonstrated excellent internal consistency (Cronbach's α = 0.957), with subscale reliability values of α = 0.929, 0.937, and 0.890, respectively.

## 3.3 Data analysis

Data analysis for this study was conducted primarily using SPSS 29.0 (IBM Corporation, New York, USA) and its external macro, Process 4.1. The analysis followed several key steps: (1) Harman's single-factor test was employed to assess the extent of common method bias; (2) descriptive statistics and correlation analysis were performed for the four core variables of the study; and (3) the theoretical model was constructed and tested using Model 59 in Process 4.1, with bootstrap estimation based on 5,000 resamples (significance level set at 95%).

# 4 Results

## 4.1 Common Method Bias

Harman's single-factor test was used to assess the extent of common method bias in this study (Tang & Wen, 2020). The results showed that seven factors had eigenvalues greater than one, and the first factor

accounted for 36.1% of the total variance, which is below the commonly accepted threshold of 40% (Podsakoff et al., 2003). This indicates that common method bias is not a serious concern in this study.

## 4.2 Descriptive statistics and correlation analysis

Table 2 presents the descriptive statistics (means and standard deviations) and Pearson correlation analysis results for the core variables in this study. Specifically, time poverty did not show significant correlations with teacher resilience, career calling, or teachers' AI readiness (ps > 0.05). In contrast, teacher resilience was positively and significantly correlated with career calling ($r = 0.78$, $p < 0.01$) and AI self-efficacy ($r = 0.49$, $p < 0.01$). Additionally, career calling was also significantly and positively correlated with teachers' AI readiness ($r = 0.49$, $p < 0.01$). These findings preliminarily indicate that time poverty may not exert a negative influence on teachers' teacher resilience, career calling, or AI readiness. The significant positive correlations among teacher resilience, career calling, and AI readiness suggest a potentially beneficial and constructive relationship, highlighting the possibility of mediation and moderation effects. These preliminary results partially support the study's hypotheses, which require further validation through model testing.

Table 2
Descriptive statistics and correlation analysis

| Main Variables | | M | SD | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| 1 | Time Poverty | 3.36 | 0.75 | - | 0.07 | 0.03 | -0.08 |
| 2 | Teacher resilience | 3.61 | 0.64 | | - | 0.78** | 0.49** |
| 3 | Career Calling | 3.59 | 0.67 | | | - | 0.49** |
| 4 | Teachers' AI Readiness | 3.00 | 0.81 | | | | - |

Note: N = 578; M = Mean, SD = Standard Deviation, *p < 0.05, **p < 0.01, ***p < 0.001, the same as below.

## 4.3 Mediation and moderation effect testing

Using Process 4.1, this study examined the relationship between teachers' time poverty and their AI readiness, as well as the mediating role of teacher resilience and the moderating role of career calling. Prior to statistical analysis, the four core variables were standardized to improve model robustness. In addition, several potential confounding variables were controlled for, including gender, education level, teaching experience (years), current teaching stage, age, and AI usage-related factors. These control variables are presented in Table 1.

The model testing results showed that time poverty had no significant direct effect on teachers' AI readiness ($\beta = -0.05$, BootCI $\in [-0.125, 0.019]$), consistent with the findings of the correlation analysis. This indicates that perceived time poverty does not significantly diminish teachers' readiness for AI, and thus, Hypothesis 1 was not supported. Unexpectedly, time poverty had a small but significant positive effect on Chinese primary and secondary school teachers' teacher resilience ($\beta = 0.06$, BootCI $\in [0.005,$

0.117]), which contradicts Hypothesis 2. Teacher resilience, in turn, had a significant positive effect on teachers' AI readiness (β = 0.35, BootCI ∈ [0.203, 0.449]), supporting Hypothesis 3. This further confirms the mediating role of teacher resilience in the relationship between time poverty and teachers' AI readiness. The estimated indirect effect was 0.02, with a bootstrapped 95% confidence interval of [0.002, 0.044], indicating a full mediation. In practice, this implies that time poverty indirectly enhances teachers' AI readiness by strengthening their teacher resilience, thus supporting Hypothesis 4. Full model results are presented in Table 3.

Table 3
Model bootstrap results

| | **Teacher Resilience** | | | | **Teacher's AI Readiness** | | | |
|---|---|---|---|---|---|---|---|---|
| | β | BootSE | BootLLCI | BootULCI | β | BootSE | BootLLCI | BootULCI |
| **Control variables** | | | | | | | | |
| Gender | 0.12 | 0.04 | 0.051 | 0.187 | 0.07 | 0.06 | -0.035 | 0.190 |
| EL | -0.03 | 0.04 | -0.106 | 0.045 | 0.07 | 0.05 | -0.030 | 0.171 |
| TEXP | -0.02 | 0.03 | -1.001 | 0.040 | -0.16 | 0.04 | -0.251 | -0.079 |
| TS | 0.01 | 0.03 | -0.043 | 0.055 | -0.02 | 0.04 | -0.093 | 0.062 |
| Age | 0.07 | 0.05 | -0.023 | 0.159 | -0.03 | 0.06 | -0.142 | 0.092 |
| AI ES | 0.07 | 0.05 | -0.025 | 0.157 | -0.08 | 0.08 | -0.231 | 0.077 |
| AI TO | 0.07 | 0.04 | 0.003 | 0.139 | 0.37 | 0.06 | 0.255 | 0.486 |
| **Main variables** | | | | | | | | |
| TP | 0.06 | 0.03 | 0.005 | 0.117 | -0.05 | 0.04 | -0.125 | 0.019 |
| PC | 0.69 | 0.03 | 0.638 | 0.743 | 0.30 | 0.07 | 0.152 | 0.430 |
| TP x CC | -0.11 | 0.03 | -0.161 | -0.051 | -0.04 | 0.05 | -0.139 | 0.061 |
| TR x CC | | | | | 0.06 | 0.06 | -0.051 | 0.180 |
| TR | | | | | 0.35 | 0.07 | 0.203 | 0.499 |
| **Mediation** | | | | | | | | |
| TP → TR → TAIR | | | | | 0.02 | 0.01 | 0.002 | 0.044 |

Note: EL = Education Level; TEXP = Teaching Experience; TS = Teaching Stage; AI ES = AI equipment and support; AI TO = AI Training Opportunities; TP x CC = the interaction term between time poverty and career calling; TR x CC = the interaction term between teacher resilience and career calling; TP → PR → TAIR = the mediation effect of teacher resilience.

Moderation effects were also assessed simultaneously. Specifically, career calling was tested as a moderator in the three paths: TP → PR, PR → TAIR, and TP → TAIR. The results showed that career calling significantly moderated only the direct path from time poverty to teacher resilience (β = -0.11, BootCI ∈ [-0.161, -0.051]). This indicates that the positive impact of time poverty on teacher resilience becomes weaker as teachers' career calling increases, providing partial support for Hypothesis 5. A graphical representation of the moderation effect is presented in Fig. 2 for a more intuitive understanding.

## 5 Discussion

This study examines the impact of time poverty on teachers' AI preparedness in the context of digital teaching and finds that time poverty does not significantly affect the AI preparedness of Chinese teachers. However, time poverty can enhance teachers' teacher resilience, which in turn improves their AI preparedness. Career calling only plays a significant moderating role in the direct path from time poverty to teachers' teacher resilience.

## 5.1 Time poverty did not significantly affect Chinese teachers' AI readiness.

This study finds that time poverty does not significantly affect Chinese teachers' readiness for AI, which deviates from the traditional view. The traditional view holds that resource scarcity (including time) usually inhibits individuals' learning and adoption of new technologies (Venkatesh et al., 2003). However, in the context of the continuous advancement of AI - empowered education, this "non - significant" result has realistic and structural explanations.

**First**, with the popularization of AI in teaching scenarios and the advocacy of policies, teachers' attitudes towards AI technology are shifting from "passive acceptance" to "active participation." In particular, the promotion of the "Double Reduction" policy and the "Digital Transformation of Education" strategy has led more and more Chinese teachers to realize that AI technology is not an "additional burden," but a key tool for improving teaching efficiency and optimizing teaching processes. This cognitive shift prompts teachers to maintain a strong willingness to learn and take action, even when their time resources are limited, thus keeping a high level of AI readiness.

**Second**, policy promotion is a key factor. UNESCO (2021) pointed out in "From Teacher Policy to Quality Teacher: A Training Manual" and "Reimagining Our Futures Together: A New Social Contract for Education" that future teachers should not only have good teaching abilities but also actively adapt to technological changes and enhance their digital literacy (Osman et al., 2021; UNESCO, 2021). In recent years, Chinese education authorities have also frequently issued guidelines on teachers' information - based capabilities, AI literacy training, and teaching innovation, further strengthening teachers' institutional responses to AI capacity building. Although these policy "soft norms" do not directly alleviate teachers' time pressure, they indirectly prompt teachers to prioritize AI - related learning and

practice through professional ethics, professional standards, and performance assessment mechanisms, weakening the obstructive effect of time poverty.

**Furthermore**, in terms of cultural and professional role awareness, Chinese teachers generally have a strong sense of responsibility and career calling (Su et al., 2024). Faced with the challenges of educational changes brought by artificial intelligence, many teachers regard the improvement of AI capabilities as an important part of their professional growth and teaching quality assurance, and are willing to invest additional energy in learning and practicing AI technology outside of their routine work. This "internal professional motivation" to some extent makes up for the lack of external time resources.

**In summary**, the non - significant impact of time poverty on AI readiness does not mean that time is unimportant, but rather that under the strong advocacy of policies, the positive psychological shift, and the drive of career calling, teachers' behavioral performance in AI readiness may have a certain degree of flexibility and proactivity. Future research can further explore the dynamic trade - off relationship between these internal and external motivations to gain a more comprehensive understanding of the complex mechanisms in teachers' technology adoption.

## 5.2 Time poverty can enhance teachers' teacher resilience and further improve their AI readiness.

Although time poverty does not have a significant direct impact on Chinese teachers' AI readiness, it can indirectly and positively affect their AI readiness by enhancing their teacher resilience. This unique mediating path provides a new perspective for understanding teachers' technological adaptation behavior.

According to the Stress-Adaptation-Growth Model (Tedeschi & Calhoun, 2004), when individuals face continuous stress, if they have high teacher resilience, they will not be overwhelmed by stress, but instead will be able to stimulate stronger motivation for growth and adaptive resources. When teaching tasks are heavy and time is tight, teachers may be more inclined to try and accept AI tools due to the practical need to improve efficiency in order to achieve the goal of "saving time and increasing efficiency," thus showing higher technological readiness.

The Conservation of Resources Theory (Hobfoll, 1989) also supports this mechanism. The theory points out that when individuals face resource pressure, they will actively mobilize internal psychological resources to prevent further loss of resources. In this study, teacher resilience is the important psychological resource that teachers mobilize and use, enabling them to actively seek new technological tools to improve teaching effectiveness under time pressure.

Existing research also supports this view. For example, Gu and Day (2007) found that in high-load teaching situations, teacher resilience is a key variable for teachers to maintain professional development and the willingness to learn technology. Luthans et al. (2006) proposed that the resilience dimension in psychological capital can help individuals maintain a positive attitude and actively seek

solutions when facing challenges. Zheng et al. (2024) pointed out in their research on Chinese teachers that teacher resilience significantly predicts teachers' acceptance of AI and digital technology.

Therefore, this study reveals the "challenging" function of time poverty under the influence of specific psychological mechanisms. It is not only a source of teaching burden, but also an external driver to stimulate teachers' technological adaptability. This finding suggests that in the process of promoting AI-empowered teaching, time poverty should not be regarded as a purely negative factor, but attention should be paid to the regulatory and empowering role of teachers' psychological capital, especially in a cultural context in China that highly values educational responsibility and career calling.

**5.3 Career Calling only plays a significant moderating role in the direct path from time poverty to teachers' teacher resilience.**

# 5.3.1 Psychological Mechanism Level: The Amplification Effect of Internal Stress

When teachers have a strong sense of career calling, they usually regard teaching and nurturing as a "mission" rather than just an ordinary job. This perception helps enhance their occupational commitment. However, when facing time poverty (such as the accumulation of lesson preparation, teaching, assessment, and administrative tasks), it can trigger a stronger sense of "guilt" and the psychological burden of "unfulfilled responsibilities" (Conley & You, 2009). This type of stress is "intrinsic" pressure. The root of this pressure lies in the fact that the higher the teachers' expectations of their own roles, the more obvious their perceived insufficiency of real-time resources, which may offset or even weaken the "teacher resilience" rebound effect that might be triggered by the original time pressure.

# 5.3.2 Role Conflict Theory Perspective: The Contradiction Between Moral Obligation and Resource Limitations

Based on Role Conflict Theory (Role Conflict Theory; Kahn et al., 1964), when an individual assumes too many responsibilities in a certain social role and resources (time, energy, etc.) are limited, role conflict is likely to occur. In this study, the strong sense of career calling reinforces teachers' moral obligation to "fulfill their duties," but time poverty, as an objective resource limitation, makes it easier for teachers to experience the internal contradiction of "I know I should do better, but I can't" when facing task overload. This cognitive conflict can exacerbate psychological exhaustion and further inhibit teachers' ability to mobilize teacher resilience and respond flexibly to difficulties.

# 5.3.3 Resource Conservation Theory Perspective: Overmobilization and Consumption of Psychological Resources

According to the Conservation of Resources Theory (Conservation of Resources Theory; Hobfoll, 1989), when individuals face stress, they will mobilize their existing resources (such as beliefs, emotional support, self-efficacy, etc.) to cope with challenges. However, overmobilization can lead to resource depletion and "secondary stress." Although a strong sense of career calling can motivate teachers to overcome time shortages, if the stress is not relieved for a long time, it will accelerate the depletion of psychological resources. For example, in order to "be responsible for students," teachers may cut back on their personal rest time and work overtime to prepare lessons, which in turn leads to a decline in energy and emotional fatigue, thereby inhibiting the accumulation of teacher resilience.

## 5.3.4 The "High Moral Expectation" Dilemma in Cultural Context

In the context of Chinese culture, the role of teachers is often endowed with noble meanings such as "engineers of human souls" or "molders of human souls." This cultural belief is internalized into teachers' "sense of career calling" (Lee et al., 2011). However, in actual teaching, objective obstacles such as uneven resource allocation and heavy teaching tasks often make it difficult for teachers to achieve the "ideal of teaching and nurturing." The gap between culture and reality strengthens the sense of psychological gap. When facing time poverty, teachers with a strong sense of career calling are more likely to experience "moral debt" or a "sense of failure" due to their stronger moral drive, which inhibits their ability to transform stress into a driving force for growth.

## 5.3.5 Boundary Conditions and Individual Differences: Why Is the Moderating Effect Not Generalized?

It should be pointed out that a strong sense of career calling does not always weaken the positive effect of time poverty on teacher resilience in all situations. This effect may be moderated by individual differences (such as emotional regulation ability, sense of organizational support) and situational variables (such as job autonomy, school cultural atmosphere). For example, when teachers have a strong sense of career calling and also have strong self-regulation ability and organizational support (such as flexible working hours, principal support, etc.), they may effectively buffer resource depletion and maintain teacher resilience.

# 5.4 Educational implications

This study reveals the impact mechanism of time poverty on teachers' AI readiness, highlighting the critical mediating role of teacher resilience while identifying the moderating effect of occupational calling. These findings offer the following recommendations for enhancing teachers' AI adaptability and psychological resource allocation:

## 5.4.1 Ensuring the rational allocation of teachers' time resources and optimizing the configuration of their workload.

First, a professional AI teaching technology support team should be established. Schools or educational institutions need to set up a dedicated AI teaching technology support team, which consists of technical personnel and educational experts. They are committed to helping teachers solve technical problems encountered when using AI tools, and providing consulting services on the use of AI tools for teachers, helping them to better understand the functions of AI tools and their application value in teaching, thereby reducing the time teachers spend exploring the use of AI tools. Secondly, an AI application incentive mechanism needs to be built. An AI application reward fund should be established to provide material rewards and honor recognition to teachers who perform outstandingly in the application of AI technology. In the process of teacher title evaluation and promotion, the ability to apply AI technology should be included as one of the key assessment indicators. In this way, teachers are encouraged to actively learn and apply AI technology to enhance their teaching ability and competitiveness, while alleviating the additional time pressure caused by learning AI technology. Finally, the way of calculating teachers' workload should be adjusted. When calculating teachers' workload, schools should fully take into account the time cost for teachers to learn and apply AI technology. For teachers who actively use AI technology and achieve significant teaching results, certain reward-based reductions should be given in the calculation of workload.

## 5.4.2 Enhancing teachers' teacher resilience to calmly cope with technological innovation.

First, a teacher psychological counseling center should be established. Schools or educational institutions need to set up a dedicated teacher psychological counseling center staffed with professional counselors. These counselors can provide psychological support services to help teachers cope with the stress of learning AI technologies and conduct mental health seminars on dealing with the pressures of AI learning. The seminars could cover topics such as how to properly understand the challenges in learning AI technologies and how to adjust one’s mindset to face these challenges positively.Second, AI learning mutual aid groups should be created. By working together, teachers can build up their teacher resilience when learning AI technologies. Schools can organize teachers into AI learning mutual aid groups, each comprising teachers from different subjects and with varying levels of technical proficiency. Group members can assist each other in solving problems encountered while learning AI technologies and regularly engage in activities such as collaboratively completing an AI - based teaching project or attending AI technology training courses together.Finally, a positive learning atmosphere should be fostered. Schools can create a supportive learning environment that encourages mutual support and cooperation among teachers. AI technology learning experience sharing sessions can be held, where teachers who have already become proficient in AI technologies can share their learning processes and insights.

## 5.4.3 Enhancing teachers' sense of career calling and acknowledging the double-edged sword effect of technology.

First, specialized training on career calling should be implemented. Education departments or schools need to regularly organize teachers to participate in specialized training activities on career calling. The training content should cover the updating of educational concepts, the importance and value of the teaching profession, and the transformation of teachers' roles in the context of digital teaching. At the same time, experts in the field of education and outstanding teachers should be invited to share their experiences in using AI technology to achieve educational innovation in digital teaching, as well as the positive impact of these innovations on students' growth.Second, an incentive mechanism for career calling should be established. In the teacher evaluation system, assessment indicators for career calling should be added. Teachers who perform outstandingly in terms of career calling should be commended and rewarded. For example, by evaluating teachers through students, parents, and colleagues, it is possible to understand whether teachers actively use AI technology to provide better educational services for students in the teaching process and whether they demonstrate a strong sense of career calling.Finally, cooperation with the community and parents should be strengthened. Schools should actively cooperate with the community and parents to organize teachers and community volunteers to jointly create a social environment that supports teachers' career calling. For example, through parent-teacher meetings and community activities, the efforts and achievements of teachers in digital teaching and the application of AI technology can be publicized to parents and community residents, allowing teachers to feel the recognition and support of society.

# 6 Limitations and future directions

This study has achieved some results in exploring the impact of time poverty on teachers' artificial intelligence preparedness and its underlying mechanisms, but there are also several limitations. First, the sample is limited to primary and secondary school teachers in Fujian and Jiangxi provinces of China, which may restrict the generalizability of the research findings. This is because there are significant differences in educational systems, cultural backgrounds, and teaching environments across different countries and regions, and these differences may affect the relationships among time poverty, teacher resilience, career calling, and artificial intelligence preparedness. Second, this study adopts a cross-sectional research design, which cannot accurately capture the changes of these variables over time and their dynamic interactions. In addition, this study only examines the roles of teacher resilience and career calling as mediating and moderating variables, while there may be other mediating or moderating mechanisms, such as teachers' time management skills, job satisfaction, and social support networks. Finally, this study mainly relies on teachers' self-reported data, which may be subject to social desirability bias and self-reporting errors. Therefore, future research can expand the sample scope, adopt a longitudinal research design, further explore potential mediating and moderating variables, and combine external evaluation methods to enhance the universality, accuracy, and comprehensiveness of the research findings.

This study has certain limitations. Future research can be expanded and deepened in the following aspects: broadening the sample scope and cultural backgrounds to include teachers from different countries, regions, and educational stages, and exploring the impact of cultural background on the

relationship between time poverty and teachers' artificial intelligence preparedness; adopting a longitudinal research design to track the changes in relevant variables among teachers and reveal their dynamic causal relationships; exploring more mediating and moderating variables, such as time management skills, job satisfaction, and social support networks; combining multiple data sources and research methods to reduce biases and gain a deeper understanding of teachers' psychological experiences and coping strategies; and conducting intervention studies to verify the effectiveness of training programs in enhancing teachers' artificial intelligence preparedness. In summary, future research should expand in terms of sample scope, research design, variable exploration, and research methods to more comprehensively understand the impact mechanism of time poverty on teachers' artificial intelligence preparedness and provide support for theory and practice.

# Declarations

### Competing interests

The authors declare no competing interests.

### Ethical approval

This study received ethical approval from the Human Research Ethics Committee of Science and Technology College, Gannan Normal University, in accordance with institutional policy on minimal risk research involving adult participants. The approval was made on 4 December 2024, under the reference ID 202412443. All research involving human participants was conducted in accordance with the relevant institutional guidelines and the ethical principles outlined in the Declaration of Helsinki.

### Informed Consent

All participants provided informed consent before participating in the study. The anonymity and confidentiality of the participants were guaranteed, and participation was completely voluntary.

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# References


1. Aburn, G., Gott, M., & Hoare, K. (2016). What is resilience? An Integrative Review of the empirical literature. *Journal of Advanced Nursing*, 72(5), 980–1000. https://doi.org/https://doi.org/10.1111/jan.12888
2. Alwaqdani, M. (2025). Investigating teachers' perceptions of artificial intelligence tools in education: Potential and difficulties. *Education and Information Technologies*, 30(3), 2737–2755. https://doi.org/10.1007/s10639-024-12903-9
3. An, X., Chai, C. S., Li, Y., Zhou, Y., Shen, X., Zheng, C., & Chen, M. (2023). Modeling English teachers' behavioral intention to use artificial intelligence in middle schools. *Education and Information Technologies*, 28(5), 5187–5208. https://doi.org/10.1007/s10639-022-11286-z
4. Baatz, J., & Wirzberger, M. (2025). Resilience as a professional competence: a new way towards healthy teachers? *Social Psychology of Education*, 28(1), 56. https://doi.org/10.1007/s11218-024-10010-8
5. Beltman, S. (2020). Understanding and Examining Teacher Resilience from Multiple Perspectives. In C. F. Mansfield (Ed.), Cultivating Teacher Resilience: International Approaches, *Applications and Impact* (pp. 11–26). Springer Singapore. https://doi.org/10.1007/978-981-15-5963-1_2
6. Burić, I., Ana, S., & and Penezić, Z. (2019). Understanding teacher well-being: a cross-lagged analysis of burnout, negative student-related emotions, psychopathological symptoms, and resilience. *Educational Psychology*, 39(9), 1136–1155. https://doi.org/10.1080/01443410.2019.1577952
7. Chang, P.-C., Rui, H., & Wu, T. (2021). Job Autonomy and Career Commitment: A Moderated Mediation Model of Job Crafting and Sense of Calling. *Sage Open*, 11(1), 21582440211004167. https://doi.org/10.1177/21582440211004167
8. Chen, J., & Lee, C.-K. J. (2022). Teacher resilience matters: a buffering and boosting effect between job driving factors and their well-being and job performance. *Teachers and Teaching*, 28(7), 890–907. https://doi.org/10.1080/13540602.2022.2116574
9. Conley, S., & You, S. (2009). Teacher role stress, satisfaction, commitment, and intentions to leave: A structural model. *Psychological reports*, 105(3), 771–786.https://doi.org/10.2466/PR0.105.3.771-786
10. Costantine, E., Mwinjuma, J. S., & Nemes, J. (2025). Examine key risk factors undermining teacher resilience in Morogoro Municipality, Tanzania: Implications for support and policy reform. *Educational Dimension*. https://doi.org/https://doi.org/10.55056/ed.848
11. Creagh, S., Thompson, G., Mockler, N., Stacey, M., & Hogan, A. (2023). Workload, work intensification and time poverty for teachers and school leaders: a systematic research synthesis. *Educational Review*, 77(2), 661–680. https://doi.org/10.1080/00131911.2023.2196607
12. Deci, E. L., & Ryan, R. M. (2012). Self-Determination Theory. 416–437. https://doi.org/10.4135/9781446249215.n21

13. Dik, B. J., & Duffy, R. D. (2009). Calling and Vocation at Work:Definitions and Prospects for Research and Practice. *The Counseling Psychologist*, 37(3), 424–450. https://doi.org/10.1177/0011000008316430
14. Dobrow, S. R., & Tosti-Kharas, J. (2011). Calling: The development of a scale measure. *Personnel psychology*, 64(4), 1001–1049.https://doi.org/10.1111/j.1744-6570.2011.01234.x
15. Dobrow, S. R., Weisman, H., Heller, D., & Tosti-Kharas, J. (2023). Calling and the Good Life: A Meta-Analysis and Theoretical Extension. *Administrative Science Quarterly*, 68(2), 508–550. https://doi.org/10.1177/00018392231159641
16. Duan, S., Chu, W., & Liu, H. (2023). "Seeking Resilience, Sustaining Development": A Self-Narrative Study of Early Career English Teacher Resilience From an Ecological Perspective. *Sustainability*, 15(16), 12386. https://doi.org/10.3390/su151612386
17. Duffy, R. D., Bott, E. M., Allan, B. A., Torrey, C. L., & Dik, B. J. (2012). Perceiving a calling, living a calling, and job satisfaction: testing a moderated, multiple mediator model. *J Couns Psychol*, 59(1), 50–59. https://doi.org/10.1037/a0026129
18. Fan, L., Ma, F., Liu, Y.-m., Liu, T., Guo, L., & Wang, L.-n. (2021). Risk Factors and Resilience Strategies: Voices From Chinese Novice Foreign Language Teachers [Original Research]. *Frontiers in Education*, Volume 5–2020. https://doi.org/10.3389/feduc.2020.565722
19. Filiz, O., Kaya, M. H., & Adiguzel, T. (2025). Teachers and AI: Understanding the factors influencing AI integration in K-12 education. *Education and Information Technologies*. https://doi.org/10.1007/s10639-025-13463-2
20. Flores-Builes, R., Caballer-Miedes, A., & Mateu-Pérez, R. (2022). Resilience in Teachers: Validation of the Spanish Version of the CD-RISC10© Scale in Early Childhood, Primary and Special Education Teachers. *Int J Environ Res Public Health*, 19(17). https://doi.org/10.3390/ijerph191711020
21. Fundi, M., Sanusi, I. T., Oyelere, S. S., & Ayere, M. (2024). Advancing AI education: Assessing Kenyan in-service teachers' preparedness for integrating artificial intelligence in competence-based curriculum. *Computers in Human Behavior Reports*, 14, 100412. https://doi.org/https://doi.org/10.1016/j.chbr.2024.100412
22. Gavin, M., McGrath-Champ, S., Wilson, R., Fitzgerald, S., & Stacey, M. (2021). Teacher Workload in Australia. 110–123. https://doi.org/10.4324/9781003145806-11
23. Giurge, L. M., Whillans, A. V., & West, C. (2020). Why time poverty matters for individuals, organisations and nations. *Nature Human Behaviour*, 4(10), 993–1003. https://doi.org/10.1038/s41562-020-0920-z
24. Gu, Q., & Day, C. (2007). Teachers resilience: A necessary condition for effectiveness. *Teaching and Teacher education*, 23(8), 1302–1316.https://doi.org/10.1016/j.tate.2006.06.006
25. Hascher, T., Susan, B., & and Mansfield, C. (2021). Teacher wellbeing and resilience: towards an integrative model. *Educational Research*, 63(4), 416–439. https://doi.org/10.1080/00131881.2021.1980416

26. Hirschi, A., Keller, A. C., & Spurk, D. M. (2018). Living one's calling: Job resources as a link between having and living a calling. *Journal of Vocational Behavior*, 106, 1–10. https://doi.org/https://doi.org/10.1016/j.jvb.2017.12.001
27. Hobfoll, S. E. (1989). Conservation of Resources: A New Attempt at Conceptualizing Stress. *American Psychologist*, 44(3), 513–524. https://doi.org/10.1037/0003-066x.44.3.513
28. Hoppe, A., Lopper, E., Prestele, E., Milius, M., Nitz, S., Gahrmann, C., & Reis, D. (2023). Extending and intensifying work as mediators in the relationship between weekly time pressure and fatigue: The moderating role of perfectionism. *International Journal of Stress Management*, 30(3), 298–308. https://doi.org/10.1037/str0000294
29. Hu, D., Yuan, B. E. I., Luo, J., & Wang, M. (2021). A review of empirical research on ICT applications in teacher professional development and teaching practice. *Knowledge Management and E-Learning*, 13, 1–20. https://doi.org/10.34105/j.kmel.2021.13.001
30. Huang, X., Chen, H., Gao, Y., Wu, J., Ni, Z., Wang, X., & Sun, T. (2022). Career Calling as the Mediator and Moderator of Job Demands and Job Resources for Job Satisfaction in Health Workers: A Cross-Sectional Study [Original Research]. *Frontiers in Psychology*, Volume 13–2022. https://doi.org/10.3389/fpsyg.2022.856997
31. Kahn, R. L. (1964). Organizational stress: Studies in role conflict and ambiguity. Jhon Wiley.
32. Kangas-Dick, K., & O'Shaughnessy, E. (2020). Interventions that promote resilience among teachers: A systematic review of the literature. *International Journal of School & Educational Psychology*, 8(2), 131–146. https://doi.org/10.1080/21683603.2020.1734125
33. Kim, J., Park, J., Sohn, Y. W., & Lim, J. I. (2021). Perceived Overqualification, Boredom, and Extra-Role Behaviors: Testing a Moderated Mediation Model. *Journal of Career Development*, 48(4), 400–414. https://doi.org/10.1177/0894845319853879
34. Kim, S. S., Shin, D., Vough, H. C., Hewlin, P. F., & Vandenberghe, C. (2018). How do callings relate to job performance? The role of organizational commitment and ideological contract fulfillment. *Human Relations*, 71(10), 1319–1347. https://doi.org/10.1177/0018726717743310
35. Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). Exploring generative artificial intelligence preparedness among university language instructors: A case study. *Computers and Education: Artificial Intelligence*, 5, 100156. https://doi.org/https://doi.org/10.1016/j.caeai.2023.100156
36. Kurup, S., & Gupta, V. (2022). Factors Influencing the AI Adoption in Organizations. *Metamorphosis*, 21(2), 129–139. https://doi.org/10.1177/09726225221124035
37. Lawrence, D. F., Loi, N. M., & Gudex, B. W. (2018). Understanding the Relationship Between Work Intensification and Burnout in Secondary Teachers. *Teachers and Teaching*, 25(2), 189–199. https://doi.org/10.1080/13540602.2018.1544551
38. Lee, J. C. K., & Yin, H. B. (2011). Teachers' emotions and professional identity in curriculum reform: A Chinese perspective. *Journal of educational change*, 12, 25–46.https://doi.org/10.1007/s10833-010-9149-3

39. Li, Q., Pei, L., & Wu, D. (2014). The structure and influencing factors of teachers' psychological resilience. *Journal of Education*, 10(2), 70–76. https://doi.org/10.14082/j.cnki.1673-1298.2014.02.013
40. Li, Q., Qing, G., & and He, W. (2019). Resilience of Chinese Teachers: Why Perceived Work Conditions and Relational Trust Matter.*Measurement: Interdisciplinary Research and Perspectives*, 17(3), 143–159. https://doi.org/10.1080/15366367.2019.1588593
41. Liu, H., & Chu, W. (2022). Exploring EFL teacher resilience in the Chinese context. *System*, 105, 102752. https://doi.org/https://doi.org/10.1016/j.system.2022.102752
42. Liu, T., & WANG, Q. (2024). The Longitudinal Association between Stress Mindset and Emotional Exhaustion among Teachers: The Mediating Effect of Time Poverty. *Educational Science Research*, 347(2), 51–57.
43. Liu, T., Na, R., Yang, X., & Wang, Q. (2025). The Longitudinal Association Between Stress Mindset and Mental Health Among Teachers: The Mediating Effect of Time Poverty. *The Asia-Pacific Education Researcher*. https://doi.org/10.1007/s40299-025-00974-2
44. Liu, T., Yang, X., Meng, F., & Wang, Q. (2023). Teachers Who are Stuck in Time: Development and Validation of Teachers' Time Poverty Scale. *Psychology Research and Behavior Management*, 16, 2267–2281. https://doi.org/10.2147/PRBM.S414132
45. Lu, J., Chen, J., Li, Z., & Li, X. (2024). A systematic review of teacher resilience: A perspective of the job demands and resources model. *Teaching and Teacher Education*, 151, 104742. https://doi.org/https://doi.org/10.1016/j.tate.2024.104742
46. Luthans, F., Vogelgesang, G. R., & Lester, P. B. (2006). Developing the psychological capital of resiliency. *Human resource development review*, 5(1), 25–44.https://doi.org/10.1177/1534484305285335
47. Maas, J., Schoch, S., Scholz, U., Rackow, P., Schüler, J., Wegner, M., & Keller, R. (2021). Teachers' perceived time pressure, emotional exhaustion and the role of social support from the school principal. *Soc Psychol Educ*, 24(2), 441–464. https://doi.org/10.1007/s11218-020-09605-8
48. Mansfield, C. F., Beltman, S., Price, A., & McConney, A. (2012). "Don't sweat the small stuff:" Understanding teacher resilience at the chalkface. *Teaching and Teacher Education*, 28(3), 357–367. https://doi.org/https://doi.org/10.1016/j.tate.2011.11.001
49. Nadeem, T., Hamid, S., Bhamani, S. S., Pirani, S., Mughal, F. B., Shahid, A., & Asad, N. (2024). Testing an educational intervention to enhance resilience and self-efficacy among schoolteachers in Karachi Pakistan. *BMC Research Notes*, 17(1), 24. https://doi.org/10.1186/s13104-024-06683-1
50. Nielsen, J. D., Thompson, J. A., Wadsworth, L. L., & Vallett, J. D. (2020). The moderating role of calling in the work–family interface: Buffering and substitution effects on employee satisfaction. *Journal of Organizational Behavior*, 41(7), 622–637. https://doi.org/https://doi.org/10.1002/job.2469
51. Osman, K., Halim, L., Husnin, H., Chyee Chen, C. W., & Choi, M. Y. From teacher policy to quality teachers: a training manual.

52. Peixoto, F., Silva, J. C., Pipa, J., Wosnitza, M., & Mansfield, C. (2020). The Multidimensional Teachers' Resilience Scale: Validation for Portuguese Teachers. *Journal of Psychoeducational Assessment*, 38(3), 402–408. https://doi.org/10.1177/0734282919836853
53. Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879. https://doi.org/10.1037/0021-9010.88.5.879
54. Polly, D., Martin, F., & Guilbaud, T. C. (2021). Examining barriers and desired supports to increase faculty members' use of digital technologies: perspectives of faculty, staff and administrators. *Journal of Computing in Higher Education*, 33(1), 135–156. https://doi.org/10.1007/s12528-020-09259-7
55. Pöysä, S., Noona, K., Matilda, S., Marja-Kristiina, L., & and Pakarinen, E. (2025). Profiles of teachers' resilience and work burnout: the role of individual and contextual factors. *Scandinavian Journal of Educational Research*, 1–17. https://doi.org/10.1080/00313831.2025.2471355
56. Ramazanoglu, M., & Akın, T. (2024). AI readiness scale for teachers: Development and validation. *Education and Information Technologies*, 1–29.https://doi.org/10.1007/s10639-024-13087-y
57. Ramazanoglu, M., & Akın, T. (2025). AI readiness scale for teachers: Development and validation. *Education and Information Technologies*, 30(6), 6869–6897. https://doi.org/10.1007/s10639-024-13087-y
58. Seco, V. M. M., & Lopes, M. P. (2013). Calling for Authentic Leadership: The Moderator Role of Calling on the Relationship Between Authentic Leadership and Work Engagement. *Open Journal of Leadership*, 02(04), 95–102. https://doi.org/10.4236/ojl.2013.24015
59. Seo, S., & Yuh, J. (2022). Mindfulness and Resilience as Mediators in the Relationship Between Job-Related Stress and Teacher–Child Interaction Among Early Childhood Educators. *Early Childhood Education Journal*, 50(7), 1209–1219. https://doi.org/10.1007/s10643-021-01250-w
60. Stavraki, C., & Karagianni, E. (2020). Exploring Greek EFL teachers' resilience. *The Journal for the Psychology of Language Learning*, 2(1), 142–179.
61. Su, H., Zhang, J., Li, P., Pu, D., & Shang, L. (2024). The relationships between Chinese teachers' emotions, professional identity, and teaching for creativity: The mediating role of emotional intelligence. *Thinking Skills and Creativity*, 52, 101531.https://doi.org/10.1016/j.tsc.2024.101531
62. Tang, D., & Wen, Z. (2020). Statistical approaches for testing common method bias: Problems and suggestions. *Journal of Psychological Science*, 43(1), 215–223. https://doi.org/10.16719/j.cnki.1671-6981.20200130
63. Tedeschi, R. G., & Calhoun, L. G. (2004). " Posttraumatic growth: conceptual foundations and empirical evidence". *Psychological inquiry*, 15(1), 1–18.https://doi.org/10.1207/s15327965pli1501_01
64. Thompson, G., Creagh, S., Stacey, M., Hogan, A., & Mockler, N. (2023). Researching Teachers' Time Use: Complexity, Challenges and a Possible Way Forward. *The Australian Educational Researcher*, 51(4), 1647–1670. https://doi.org/10.1007/s13384-023-00657-1

65. Thompson, G., Hogan, A., Mockler, N., Stacey, M., & Creagh, S. (2025). Time use, time poverty and teachers' work: Preliminary report on Phase 3. https://research.qut.edu.au/ttpatw/projects/
66. Thompson, J. A., & Bunderson, J. S. (2019). Research on Work as a Calling…and How to Make It Matter. *Annual Review of Organizational Psychology and Organizational Behavior*, 6(Volume 6, 2019), 421–443. https://doi.org/https://doi.org/10.1146/annurev-orgpsych-012218-015140
67. UNESCO, P. (2021). Reimagining our futures together: A new social contract for education. Paris, France: Educational and Cultural Organization of the United Nations.
68. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425–478.https://doi.org/10.2307/30036540
69. Vickery, C. (1977). The Time-Poor: A New Look at Poverty. *The Journal of Human Resources*, 12(1), 27–48. https://doi.org/10.2307/145597
70. Wang, J., Liu, A., Cai, Y., & Sun, Y. (2025). Resilience: A mediator between teachers' personal resources, contextual resources and positive outcomes of well-being and commitment. *International Journal of Educational Research*, 131, 102604. https://doi.org/https://doi.org/10.1016/j.ijer.2025.102604
71. Wang, X., Li, L., Tan, S. C., Yang, L., & Lei, J. (2023). Preparing for AI-enhanced education: Conceptualizing and empirically examining teachers' AI readiness. *Computers in human behavior*, 146, 107798. https://doi.org/https://doi.org/10.1016/j.chb.2023.107798
72. Wen, Y., Liu, F., Pang, L., & Chen, H. (2022). Proactive Personality and Career Adaptability of Chinese Female Pre-Service Teachers in Primary Schools: The Role of Calling. *Sustainability*, 14(7), 4188. https://www.mdpi.com/2071-1050/14/7/4188
73. Wen, Z., Hou, J., & Zhang, L. (2005). Comparison and application of moderating effect and mediating effect. *Acta Psychologica Sinica*, 37(2), 268–274.
74. Wrzesniewski, A., McCauley, C., Rozin, P., & Schwartz, B. (1997). Jobs, Careers, and Callings: People's Relations to Their Work. *Journal of Research in Personality*, 31(1), 21–33. https://doi.org/https://doi.org/10.1006/jrpe.1997.2162
75. Wu, J., Ghayas, S., Aziz, A., Adil, A., & Niazi, S. (2024). Relationship between teachers' professional identity and career satisfaction among college teachers: role of career calling [Original Research]. *Frontiers in Psychology*, Volume 15–2024. https://doi.org/10.3389/fpsyg.2024.1348217
76. Yang, J., Blount, Y., & Amrollahi, A. (2024). Artificial intelligence adoption in a professional service industry: A multiple case study. *Technological Forecasting and Social Change*, 201, 123251. https://doi.org/https://doi.org/10.1016/j.techfore.2024.123251
77. Zewude, G. T., Beyene, S. D., Taye, B., Sadouki, F., & Hercz, M. (2023). COVID-19 Stress and Teachers Well-Being: The Mediating Role of Sense of Coherence and Resilience. *European Journal of Investigation in Health, Psychology and Education*, 13(1), 1–22. https://www.mdpi.com/2254-9625/13/1/1
78. Zhang, L. G., Li, L., & Sun, Y. L. (2020). A study of the relationships between occupational stress career calling and occupational burnout among primary teachers [Chinese]. Zhonghua Lao Dong

Wei Sheng Zhi Ye Bing Za Zhi [Chinese journal of industrial hygiene and occupational diseases], 38(2), 107–110. https://doi.org/10.3760/cma.j.issn.1001-9391.2020.02.006

79. Zhang, S., & Luo, Y. (2023). Review on the conceptual framework of teacher resilience. *Front Psychol*, 14, 1179984. https://doi.org/10.3389/fpsyg.2023.1179984
80. Zhao, L., Wu, X., & Luo, H. (2022). Developing AI literacy for primary and middle school teachers in China: Based on a structural equation modeling analysis. *Sustainability*. https://agris.fao.org/search/en/providers/122413/records/6474af6a5eb437ddff721ece
81. Zhao, Q., Ma, R., Liu, Z., Wang, T., Sun, X., van Prooijen, J.-W., Dong, M., & Yuan, Y. (2024). Why do we never have enough time? Economic inequality fuels the perception of time poverty by aggravating status anxiety. *British Journal of Social Psychology*, 63(2), 614–636. https://doi.org/https://doi.org/10.1111/bjso.12695
82. Zheng, L., Liu, T., Feng, Y., Gu, X., & Yu, M. H. (2024). Dynamic teacher's technology adoption during the COVID-19 pandemic. *SAGE Open*, 14(2), 21582440241237858.https://doi.org/10.1177/21582440241237858
83. Zhou, Q., Ma, H., Zhu, M., Chen, H., & Gong, Q. (2025). Shadows and light: navigating teachers' time poverty and blended teaching acceptance with social support and job satisfaction in EFL teachers' voyage. *BMC Psychology*, 13(1), 551. https://doi.org/10.1186/s40359-025-02910-x
84. Zhu, M., Huang, T., Ma, H., Liu, P., & Zhang, R. (2024). The impact of time poverty on teachers' subjective well-being in the context of digital teaching: the mediating role of emotional exhaustion and the moderating role of social support. *Education and Information Technologies*, 1–25. https://doi.org/10.1007/s10639-024-13207-8

## Figures

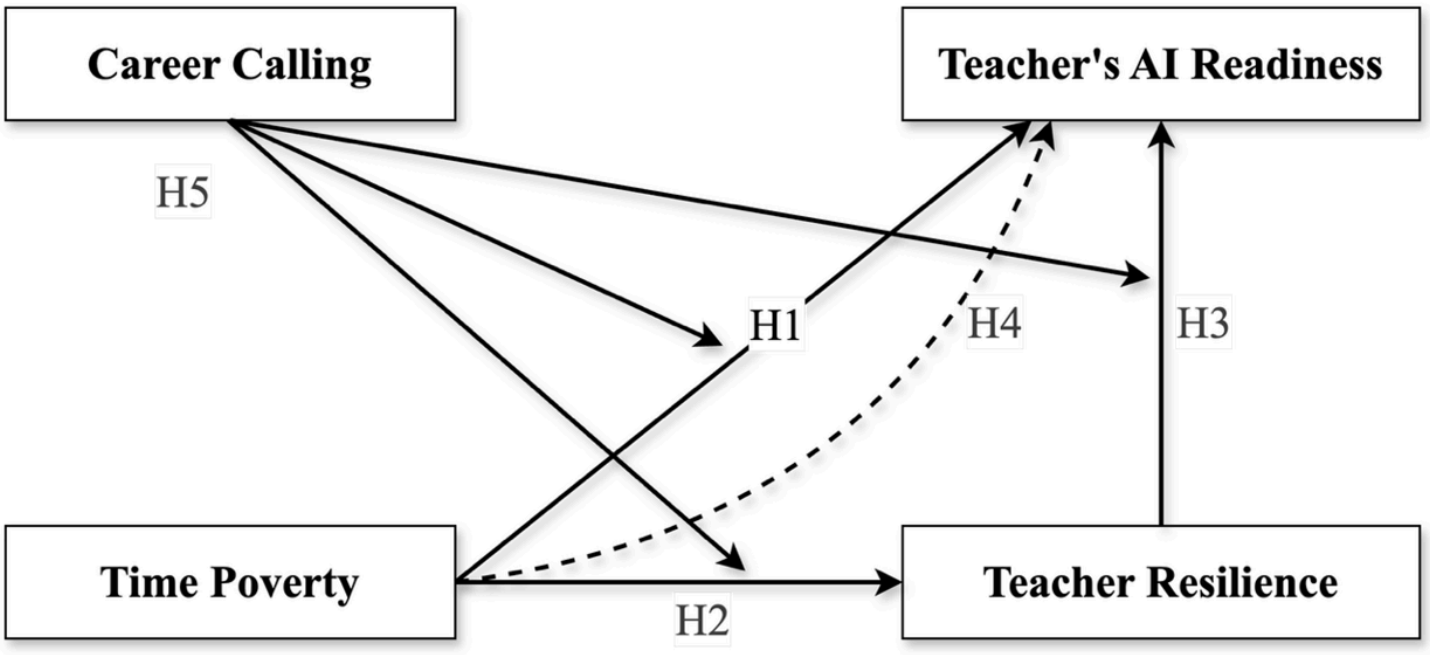


**Figure 1**

Theoretical model

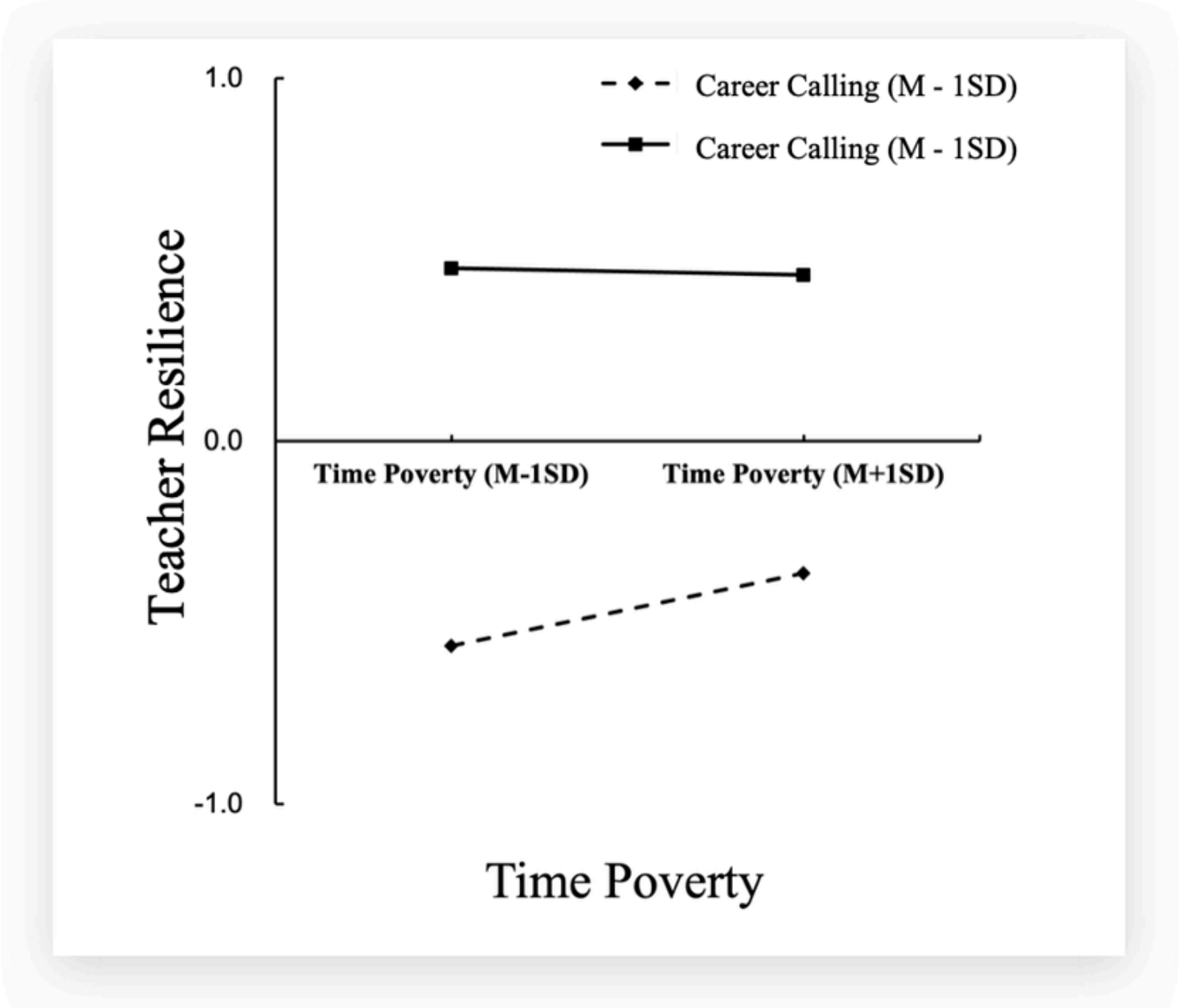



**Figure 2**

Moderation effect of career calling