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Factors Influencing Teaching Willingness Among Resident Standardization Training Instructors: A Cross-Sectional Study

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Article

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Abstract

Background

Teaching willingness among resident standardization training (RST) instructors is crucial for training quality and the sustainability of medical education reform in China, yet factors influencing their motivation remain poorly understood. This study aimed to identify key determinants of teaching willingness based on an integrated theoretical framework combining Herzberg's two-factor theory and self-determination theory.

Methods

A cross-sectional survey of 166 RST instructors at a tertiary teaching hospital in China was conducted from June to July 2026.Teaching willingness, policy cognition, teaching satisfaction, student factors, teaching workload, base management, hospital culture, and curriculum alignment were measured using validated scales.This study is a cross-sectional study, mediation analysis is used solely to test associations between variables and does not establish causal relationships, Path analysis tested mediation using Baron and Kenny's approach with Sobel test and bootstrap bias-corrected and accelerated (BCa) confidence intervals (5,000 resamples). therefore, no causal inference is made. Multiple regression with backward elimination identified key predictors.

Results

Teaching satisfaction was the strongest predictor of teaching willingness (standardized $\beta = 0.28$, $P < .001$) ,and mediation analysis revealed that satisfaction accounted for 34.2% of the association between policy cognition and teaching willingness (indirect effect = 0.204; Sobel z = 4.13; $P < .001$).A three-layer motivation model explained 59.8% of the variance (Cohen $f^2 = 1.49$). Six predictors were retained: teaching satisfaction, student factors, policy cognition, teaching workload, base management, and hospital culture.

Conclusions

The strong mediating role of teaching satisfaction suggests that interventions targeting teaching satisfaction may be particularly effective for improving teaching willingness. Simultaneously, priority should be given to fostering positive teacher-student interactions, as these represent the most influential leverage points. Additionally, improving base management practices, cultivating a hospital culture that supports teaching, and enhancing policy communication and awareness campaigns can effectively boost clinical educators' engagement in teaching activities.

1 Background

Resident standardization training (RST) represents a cornerstone of medical education reform in China, designed to ensure consistent quality among medical graduates and address the uneven distribution of medical resources across different regions[1–2]. Since its nationwide implementation in 2015, RST has become a mandatory requirement for all medical graduates seeking to practice medicine in China, with over 1 million residents having completed or currently undergoing training[3]. The effectiveness of RST programs depends critically on the engagement and quality of clinical instructors who serve as mentors, educators, and role models for the next generation of physicians[4].

However, the resident training management staff reported that there is currently a lack of clear guidance on developing incentive measures for teaching faculty[5].Although national assessment standards require a modest reflection of teaching in performance appraisals, this falls far short of achieving the goal of multidimensional motivation to enhance faculty vitality. Compared with medical research activities, resident training teaching lacks sufficient appeal. Among those teaching staff already involved in resident training, the absence of positive guidance policies and incentive mechanisms—coupled with an excess of negative incentives—has undermined the sustainability of their teaching enthusiasm[6].Many teaching hospitals struggle to recruit and retain qualified instructors, with teaching willingness emerging as a key determinant of instructor participation and teaching quality[7]. Studies have reported that up to 40% of eligible physicians decline to participate in teaching activities, citing concerns about workload, lack of recognition, and insufficient institutional support[8–10] Understanding the factors that influence teaching willingness is therefore essential for developing effective strategies to improve instructor engagement and, ultimately, the quality of medical education[11].

Understanding the factors that influence teaching willingness requires a robust theoretical foundation. Herzberg's two-factor theory provides a well-established framework for understanding work motivation, distinguishing between hygiene factors that prevent dissatisfaction (e.g., working conditions, salary, job security) and motivator factors that create satisfaction (e.g., achievement, recognition, meaningful work) [12]. According to this theory, addressing hygiene factors can prevent dissatisfaction but cannot create positive motivation, whereas motivator factors are necessary for genuine job satisfaction and sustained motivation. While this theory has been widely applied in organizational psychology and healthcare settings, its application to medical education, particularly in the context of RST instructor motivation, remains limited[13].

Self-determination theory (SDT) offers a complementary perspective by emphasizing the importance of intrinsic motivation driven by autonomy, competence, and relatedness[14–15]. SDT posits that human motivation exists on a continuum from amotivation to intrinsic motivation, with extrinsic motivation occupying the middle ground[16]. Importantly, SDT suggests that extrinsic motivators can either support or undermine intrinsic motivation depending on how they are implemented—a phenomenon known as"motivation crowding"[11]. Integrating these two theoretical frameworks may provide a more

comprehensive understanding of teaching motivation, yet such integration has not been attempted in medical education research[17].

Previous studies have identified various factors influencing teaching willingness, including workload, institutional support, recognition, student quality, and personal satisfaction[18–19]. However, most studies have employed traditional regression approaches without examining the complex interrelationships among these factors or the mediating mechanisms through which they operate. Moreover, few studies have developed practical tools for predicting teaching willingness or designing targeted interventions based on theoretical frameworks.

This study aimed to: (1) validate and extend two-factor theory in the context of RST instructor motivation by integrating it with SDT to create a three-layer motivation model; (2) identify key predictors of teaching willingness using multiple regression analysis; (3) examine the mediating role of teaching satisfaction in the relationship between policy cognition and teaching willingness using path analysis; and (4) assess the practical significance of findings through comprehensive effect size calculations. We hypothesized that: (H1) intrinsic motivators (teaching satisfaction) would have stronger effects on teaching willingness than extrinsic motivators (policy cognition) or hygiene factors (work intensity); (H2) policy cognition would influence teaching willingness through both direct and indirect pathways, with teaching satisfaction as a mediator; and (H3) the integrated three-layer model would explain a substantial proportion of variance in teaching willingness.

2 Methods

2.1 Study Design and Participants

This cross-sectional study was conducted at a tertiary teaching hospital in China from June to July 2026. The study population included all RST instructors actively involved in clinical teaching at the participating institution. Inclusion criteria were: (1) certified RST instructor status as recognized by the National Health Commission of China, (2) at least 6 months of teaching experience in the RST program, and (3) voluntary informed consent to participate in the study. Exclusion criteria were: (1) on leave during the study period (including sabbatical, maternity leave, or extended sick leave), (2) incomplete questionnaire responses (> 20% missing data), and (3) obvious response bias (e.g.,straight-lining or inconsistent responses).

The study was approved by the Ethics Committee of Jiangsu Province Hospital on Integration of Chinese and Western Medicine (Approval Number: 2026-LWKY-067). All procedures were performed in accordance with the relevant guidelines and regulations, including the Declaration of Helsinki. All participants provided written informed consent after receiving detailed information about the study objectives, procedures, and their rights as participants. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cross-sectional studies.

2.2 Sample Size Calculation

Based on the primary outcome of teaching willingness prediction model development, we calculated sample size using the events-per-variable (EPV) approach[20]. For a continuous outcome with 10 candidate predictors, a minimum of 10–20 participants per predictor is recommended for stable regression estimates. With 10 predictors, this requires a minimum sample size of 100–200 participants. Anticipating a 20% non-response rate based on previous studies in similar settings, we targeted a sample size of 250 participants. However, due to practical constraints and the actual number of eligible instructors at the participating institution, we achieved a final sample of 166 participants, which still meets the minimum EPV criterion of 10–16 per predictor for model development and provides adequate power (> 0.80) for detecting medium effect sizes ($f^2 = 0.15$) in multiple regression.

2.3 Measures

2.3.1 Teaching Willingness (Outcome Variable)

Teaching willingness was measured using a 5-item scale developed specifically for this study based on literature review and expert consultation. Items assessed: (1) willingness to continue teaching in the RST program, (2) willingness to recommend teaching to colleagues, (3) willingness to invest additional time in teaching activities, (4) willingness to participate in teaching training and professional development, and (5) overall motivation to teach. Each item was rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The scale demonstrated excellent internal consistency (Cronbach α = 0.92) and was validated through confirmatory factor analysis showing good fit (comparative fit index = 0.98; Tucker-Lewis index = 0.97; root mean square error of approximation = 0.05).

2.3.2 Policy Cognition

Policy cognition was measured using a 6-item scale assessing instructors' understanding and perception of RST policies, including training requirements, evaluation standards, incentive mechanisms, and career development pathways (α = 0.88).

2.3.3 Teaching Satisfaction

Teaching satisfaction was measured using the Minnesota Satisfaction Questionnaire Short Version (Minnesota Satisfaction Questionnaire-Short Version, Weisset al., 1967) [21], assessing satisfaction with Teaching Benefits, student interaction, institutional support, recognition, and personal achievement (α = 0.91).

2.3.4 Other Variables

Student factors were measured using a 5-item scale assessing instructors' perceptions of student quality, motivation, and learning ability (α = 0.85). Teaching workload was measured using a 4-item scale assessing clinical workload, teaching load, administrative burden, and overall time pressure (α = 0.83). Base management was measured using a 4-item scale assessing the quality of base management and

organizational support (α = 0.86). Hospital culture was measured using a 5-item scale assessing the teaching culture and learning environment (α = 0.87). Curriculum alignment was measured using a 3-item scale assessing the match between teaching content and RST requirements (α = 0.82). All scales were validated through pilot testing with 30 instructors and expert review by a panel of medical education specialists.

2.3.5 Covariates

We collected demographic and professional characteristics including age, gender, professional title (resident, attending physician, associate chief physician, chief physician), years of teaching experience, specialty (TCM vs Clinical Medicine), educational background (bachelor, master, doctoral), and previous training in medical education.

2.4 Data Collection

Questionnaires were distributed electronically through the hospital's education department using a secure online survey platform (Wenjuanxing, Changsha, China). Participants received a unique survey link to ensure anonymity while preventing duplicate responses. The survey remained open for 6 weeks, with two reminders sent at 2-week intervals to non-respondents. Data collection was conducted by trained research assistants who were blinded to the study hypotheses and had no involvement in the RST program administration.

2.5 Statistical analyses

2.5.1 Preliminary Analyses

We examined data quality, missing patterns, and distributions of all variables. Little's MCAR test was used to assess whether data were missing completely at random. Multiple imputation by chained equations (MICE) with 20 imputations was used for missing data (< 5% for all variables except professional title). Descriptive statistics (means, standard deviations, frequencies, percentages) characterized the sample. Bivariate correlations (Pearson r) examined relationships among study variables, with significance set at $P < .05$ (2-tailed).

2.5.2 Path Analysis

We tested the mediation hypothesis (H2) using path analysis following Baron and Kenny's four-step approach[22]: (1) establish that the independent variable (policy cognition) affects the dependent variable (teaching willingness); (2) establish that the independent variable affects the mediator (teaching satisfaction); (3) establish that the mediator affects the dependent variable when controlling for the independent variable; and (4) establish that the effect of the independent variable on the dependent variable decreases when the mediator is included. The indirect effect was tested using the Sobel test[23] and bootstrap confidence intervals with 5,000 resamples. The proportion mediated was calculated as (indirect effect) / (total effect) × 100%.

2.5.3 Multiple Regression

We conducted hierarchical multiple regression analysis to identify key predictors of teaching willingness. In step 1, we entered demographic covariates (age, gender, license type). In step 2, we entered all hypothesized predictors (teaching satisfaction, student factors, policy cognition, teaching workload, base management, curriculum alignment). We used backward elimination based on Akaike information criterion (AIC) as retention criterion to derive the final model. Model performance was assessed using R^2, adjusted R^2, F statistic, and standard error of estimate. Multicollinearity was assessed using variance inflation factors (VIF), with VIF > 5 indicating prtentially problematic collinearity.Residual independence was assessed using the Durbin-Watson test, and homoscedasticity was assessed using the Breusch-Pagan test.

2.5.4 Effect Size Calculations

We calculated comprehensive effect sizes to assess practical significance: (1) Cohen's d for group comparisons, with d = 0.20, 0.50, and 0.80 representing small, medium, and large effects, respectively; (2) R^2 for variance explained, with R^2 = 0.02, 0.13, and 0.26 representing small, medium, and large effects; (3) Cohen's f^2 for regression models, calculated as $f^2 = R^2 / (1 - R^2)$, with f^2 = 0.02, 0.15, and 0.35 representing small, medium, and large effects; and (4) proportion mediated for mediation analysis.

2.5.5 Sensitivity Analyses

We conducted several sensitivity analyses to test result robustness: (1) complete-case analysis vs imputed data; (2) alternative cut-offs for high teaching willingness (≥ 3.5, ≥ 4.0, ≥ 4.5); (3) excluding potential outliers using Mahalanobis distance (χ^2 > 0.001); (4) subgroup analyses by specialty (TCM vs Clinical Medicine) and professional title; and (5) bootstrap validation of regression coefficients.

2.5.6 Software

All analyses were conducted using R (version 4.3.0; R Foundation for Statistical Computing) with packages: tidyverse for data manipulation, psych for descriptive statistics, car for VIF and linear hypothesis tests, lmtest for Breusch-Pagan test, mediation for causal mediation analysis with bootstrap, boot for bootstrap validation, and ggplot2 for visualization. Statistical significance was set at 2-sided P < .05.

3 Results

3.1 Sample Characteristics

Of 210 eligible instructors, 172 returned questionnaires (response rate, 81.9%), and 166 provided complete data (valid response rate, 79.0%). The final sample included 166 RST instructors (Table 1). And 95 (57.2%) were female, and 109 (65.7%)have completed postgraduate studies at the master's level. TCM and Clinical Medicine instructors comprised 118 (71.1%) and 48 (28.9%) of the sample, respectively. Most participants (161 [97.0%]) had received some form of faculty training.

Table 1
Sample Characteristics (N = 166)

Characteristic	No. (%) or Mean (SD)
Gender	
Male	71 (42.80)
Female	95 (57.20)
Age group	
26–30	8 (4.80)
31–35	33 (19.90)
36–40	43 (25.90)
41–45	44 (26.50)
46+	38 (22.90)
Marital status	
Divorced	3 (1.80)
Married_no_child	15 (9.00)
Married_with_child	133 (80.10)
Unmarried	15 (9.00)
License type	
TCM	118 (71.10)
Clinical Medicine	48 (28.90)
Professional title	
resident	10 (6.00)
attending physician	68 (41.00)
associate chief physician	56 (33.70)
chief physician 32 (19.3)	32(19.30)
Education	
Bachelor	25 (15.10)
Master	109 (65.70)
PhD+	32 (19.30)

Characteristic	No. (%) or Mean (SD)
Clinical work years	
<5	17 (10.20)
11–15	49 (29.50)
16–20	27 (16.30)
21+	44 (26.50)
5–10	29 (17.50)
Training status	
No	5 (3.00)
Yes	161 (97.00)
Teaching willingness, mean (SD)	4.02 (0.62)
Teaching satisfaction, mean (SD)	3.74 (0.68)
Policy cognition, mean (SD)	3.94 (0.60)
Student factors, mean (SD)	3.48 (0.71)
Teaching workload, mean (SD)	2.62 (0.61)
Base management, mean (SD)	2.44 (0.48)
Hospital culture, mean (SD)	2.86 (0.67)

3.2 Descriptive Statistics

Table 2 presents descriptive statistics for key variables. Teaching willingness showed a mean of 4.02 (0.62) on a 5-point scale, indicating generally high willingness among participants. The distribution was approximately normal (skewness=-0.19; kurtosis=-0.25) .Teaching satisfaction (mean, 3.74 [0.68]) and policy cognition (mean, 3.94 [0.60]) showed moderate to high scores, and teaching workload (mean, 2.62 [0.61]) was relatively low, indicating that the instructional commitment of most clinical instructors has not reached a saturated level,This may be attributed to the dual roles of resident training instructors as both physicians and educators, who must fulfill demanding clinical responsibilities while simultaneously addressing requirements for research and career advancement, making it challenging to balance clinical practice, scientific research, and teaching duties.

Table 2
Descriptive Statistics of Key Variables

Variable	Mean_SD	Range	Skewness	Kurtosis
Teaching willingness	4.02 (0.62)	2.25-5	-0.19	-0.25
Teaching satisfaction	3.74 (0.68)	2–5	0.24	-0.56
Policy cognition	3.94 (0.6)	2–5	-0.40	0.28
Student factors	3.48 (0.71)	1.25-5	-0.39	-0.14
Teaching workload	2.62 (0.61)	1-4.2	0.19	0.43
Base management	2.44 (0.48)	1-3.8	0.13	0.02
Hospital culture	2.86 (0.67)	1.5–4.75	0.49	0.25
Curriculum alignment	3.59 (0.53)	2.2–4.6	-0.17	-0.58

3.3 Correlation Analysis

Table 3 presents the correlation matrix of key variables. Teaching willingness showed strong positive correlations with teaching satisfaction (r = 0.63; P < .001) .Teaching willingness showed a significant positive correlation with policy awareness (r = 0.56; P < 0.001), as well as with student-related factors (r = 0.59; P < 0.001) and teaching workload (r = 0.40; P < 0.001). Teaching satisfaction exhibited significant positive correlations with both policy awareness (r = 0.48; P < 0.001) and student-related factors (r = 0.53; P < 0.001), as well as with teaching workload (r = 0.27; P < 0.001). Policy awareness was significantly positively correlated with both student-related factors (r = 0.48; P < 0.001) and teaching workload (r = 0.24; P < 0.001). Additionally, student-related factors were significantly positively correlated with teaching workload (r = 0.19; P < 0.001).

Table 3
Correlation Matrix of Key Variables

Variable	1	2	3	4	5
Teaching willingness	1.00	0.63	0.56	0.59	0.4
Teaching satisfaction		1.00	0.48	0.53	0.27
Policy cognition			1.00	0.48	0.24
Student factors				1.00	0.19
Teaching workload					1.00
Note: All correlations significant at P < .001 (2-tailed).					

3.4 Path Analysis: Mediation Model

Baron & Kenny Four-Step Mediation Test

Step 1 (c path): Policy cognition → Teaching willingness: c = 0.598, p < .001

Step 2 (a path): Policy cognition → Teaching satisfaction: a = 0.525, p < .001

Step 3(b path): Teaching satisfaction → Teaching willingness (controlling for policy cognition): b = 0.389, p < .001

Step 4 (c’ path): Direct effect of policy cognition on teaching willingness: c’ = 0.394, p < .001

The indirect effect was 0.204 (Sobel z = 4.13, P < .001), accounting for 34.2% of the total effect. The direct effect was 0.394, accounting for 65.9% of the total effect, and the total effect was 0.598. The mediation pathways and bootstrap distribution of the indirect effect are presented in Fig. 1.

Mediation analysis as the central framework. a, Baron & Kenny path model: policy cognition -> teaching satisfaction -> teaching willingness. Solid arrows: significant paths (p < .001); dashed arrow: direct effect c’. Indirect effect a x b and bootstrap BCa 95% CI from 5000 resamples. b, Bootstrap distribution of the indirect effect with bias-corrected and accelerated confidence intervals.

3.5 Multiple Regression: Key Predictors

Table 4 presents the results of a multiple linear regression analysis aimed at identifying the predictive factors influencing clinical instructors' teaching motivation. The model identified six statistically significant predictors: student characteristics, teaching satisfaction, teaching workload, policy awareness, facility management, and hospital culture, which collectively account for variations in teaching motivation. All six predictors exhibited significant positive correlations with the outcome variable (all P < 0.05), indicating that higher levels of each factor correlate with stronger teaching motivation.Teaching satisfaction is a strong positive predictor of teaching motivation (B = 0.26,95% CI [0.12,0.39]; beta = 0.28, P < 0.001). Its standardized regression coefficient is 0.28, making it one of the strongest predictors in the model.Student factors exhibited the strongest standardized effect on teaching willingness (beta = 0.29), slightly exceeding that of teaching satisfaction. The non-standardized coefficient was 0.25 (95% CI [0.13,0.38], P < 0.001), indicating that student-related characteristics—such as learning motivation, competency levels, acceptance of guidance, and engagement—significantly influence teaching instructors' willingness to teach. This finding suggests that positive student traits serve as a key motivator for clinical educators. The confidence interval [0.13,0.38] demonstrates good estimation precision.There is a significant positive correlation between teaching workload intensity and teaching motivation (B = 0.20; 95% CI [0.08,0.32]; beta = 0.20; P = 0.001). The standardized coefficient of 0.20 indicates a moderate effect size. This result appears somewhat anomalous—higher work intensity correlates with greater teaching motivation—which may stem from teachers with higher clinical engagement having greater confidence in their professional competence and stronger motivation to share expertise through teaching. The confidence interval [0.08,0.32] does not include zero, supporting the reliability of this positive relationship.Policy awareness is a significant predictor in statistics (B = 0.18,95% CI [0.03,0.34]; beta = 0.17; P = 0.023). Here, "policy awareness" refers to instructors' level of understanding and knowledge regarding teaching-related policies. The positive coefficient indicates that

greater familiarity with educational policies correlates with higher teaching motivation. A standardized coefficient of 0.17 suggests a moderate-to-low effect size.

Base management was a significant positive predictor (B = 0.21,95% CI [0.05,0.36]; beta = 0.16; P = 0.008). Here, "base management" refers to the administrative and organizational governance of training bases or educational institutions. The positive coefficient indicates that effective base management—including clear teaching schedules, adequate resource allocation, and supportive administrative processes—enhances instructors' willingness to participate in teaching activities. Although the standardized coefficient of 0.16 is relatively low among all predictors, the P-value of 0.008 confirms its meaningful contribution to the model.Hospital culture exhibits a significant positive correlation with teaching motivation (B = 0.15,95% CI [0.02,0.29]; beta = 0.15; P = 0.030). This finding indicates that institutional cultures that value and support teaching—including recognition, incentives, and integration of teaching into the organizational mission—positively influence individual teaching motivation. Among the six predictors, hospital culture had the lowest standardized coefficient (β = 0.15), although its 95% confidence interval excluded zero, confirming statistical significance. The standardized coefficients grouped by motivational layer and the forest plot of the unstandardized regression coefficients with 95% confidence intervals are presented in Fig. 2.

Table 4
Multiple Regression Predictors of Teaching Willingness

Predictor	**B**	**95% CI**	**beta**	**P value**
Teaching satisfaction	0.26	[0.12, 0.39]	0.28	< .001
Student factors	0.25	[0.13, 0.38]	0.29	< .001
Policy cognition	0.18	[0.03, 0.34]	0.17	0.023
Teaching workload	0.20	[0.08, 0.32]	0.20	0.001
Base management	0.21	[0.05, 0.36]	0.16	0.008
Hospital culture	0.15	[0.02, 0.29]	0.15	0.030
Note: Model: R^2 = 0.598; Adjusted R^2 = 0.579; F = 31.49; P < .001; Cohen f^2 = 1.49				

Model Diagnostics

Variance Inflation Factors (VIF): teaching_satisfaction: VIF = 1.63 student_factors: VIF = 1.51 policy_cognition: VIF = 1.73 work_intensity: VIF = 1.12 base_management: VIF = 1.17 hospital_culture: VIF = 1.55

All VIF < 2.5: No problematic multicollinearity

The Durbin–Watson statistic was 2.05, indicating no evidence of residual autocorrelation. The Breusch–Pagan test was not statistically significant (BP = 3.98, P = .680), supporting the assumption of

homoscedasticity. The correlation structure among the study variables and the regression diagnostic plots are presented in Fig. 3.

a, Standardized beta coefficients grouped by motivational layer (Intrinsic Motivator, Extrinsic Motivator, Hygiene). b, Forest plot of unstandardized regression coefficients with 95% confidence intervals. Significance:p < .05, p < .01, p < .001.

a, Pearson correlation matrix (lower triangle) with significance annotations (p < .05,p < .01, p < .001). Color gradient: blue (negative) to vermillion (positive). b, Standardized residuals vs fitted values with loess smooth and Durbin-Watson/Breusch-Pagan diagnostics.

3.6 Group Comparisons

Gender: t = 0.20, p = 0.84, Cohen d = 0.03 **Education**: F = 0.54, p = 0.59, eta-squared = 0.007 **License Type**: t = -0.55, p = 0.59, Cohen d = 0.09 **Professional Title**: F = 0.57, p = 0.565, eta-squared = 0.009

3.7 Effect Sizes Summary

Effect Size Summary

Overall Model: R^2 = 0.598, Adjusted R^2 = 0.579, Cohen f^2 = 1.49 (large) Gender comparison: Cohen d = 0.03 (negligible) License comparison: Cohen d = 0.09 (small) Education ANOVA: eta-squared = 0.007 (small) Title ANOVA: eta-squared = 0.009 (small) Mediation: proportion mediated = 34.2%

3.8 Sensitivity Analyses

1. Complete-Case Analysis vs. Full Data Complete case (n = 134): R^2 = 0.598 Full data (n = 166): R^2 = 0.598

2. Alternative Cut-offs for High Teaching Willingness Cutoff > = 3.5: n = 139 (83.7%) Cutoff > = 4.0: n = 115 (69.3%) Cutoff > = 4.5: n = 42 (25.3%)

3. Outlier Detection (Mahalanobis Distance) Outliers identified (chi-sq p < .001): 0

4. Subgroup Analysis by License Type TCM (n = 100): R^2= 0.631 Clinical (n = 34): R^2 = 0.526

5. Bootstrap validation of the regression coefficients using 5,000 resamples is presented in Table 5.

Table 5
Bootstrap Validation (5000 Resamples)

Predictor	Original_Beta	Bootstrap_Mean	Bootstrap_SE	CI_Lower	CI_Upper
teaching_satisfaction	0.276	0.261	0.071	0.119	0.402
student_factors	0.289	0.252	0.066	0.123	0.382
policy_cognition	0.170	0.182	0.082	0.025	0.341
work_intensity	0.195	0.193	0.057	0.076	0.300
base_management	0.163	0.200	0.076	0.046	0.343
hospital_culture	0.154	0.148	0.069	0.009	0.282

3.9 Summary of Findings

The overall teaching willingness was high, with minimal differences across groups according to gender, professional title, or license type. The regression model showed no evidence of problematic multicollinearity and demonstrated strong explanatory performance. Teaching satisfaction partially mediated the association between policy cognition and teaching willingness, with 34.2% of the total effect mediated. The subgroup comparisons, multicollinearity diagnostics, and effect-size summary are presented in Fig. 4.

a, Teaching willingness by license type (violin plot, boxplot, and jittered observations). b, Teaching willingness by professional title with SE error bars. c, Variance inflation factor diagnostics (threshold: VIF < 5). d, Effect size summary (R-squared, adjusted R-squared, Cohen f-squared, proportion mediated).

4. Discussion

This cross-sectional study of 166 RST instructors found that teaching satisfaction was the strongest predictor of teaching willingness and mediated 34.2% of the relationship between policy cognition and teaching willingness. A three-layer motivation model integrating Herzberg's two-factor theory and self-determination theory explained 59.8% of the variance in teaching willingness, providing strong support for the integrated theoretical framework.

4.1 Principal Findings

The findings extend Herzberg's two-factor theory by demonstrating that the dichotomy between hygiene and motivator factors can be refined into a three-layer structure distinguishing extrinsic from intrinsic motivators. This refinement aligns with SDT's emphasis on the qualitative differences between motivation types. The strong effect of teaching satisfaction ($\beta = 0.28$) supports the hypothesis that intrinsic motivators have the strongest influence on teaching willingness, consistent with SDT's proposition that autonomous motivation leads to better outcomes than controlled motivation[24].

The mediation analysis revealed that policy cognition, an extrinsic motivator, influenced teaching willingness partly through its effect on teaching satisfaction, an intrinsic motivator. This suggeststhat extrinsic factors can facilitate intrinsic motivation, consistent with the concept of motivation crowding[25]. However, the substantial direct effect (65.9% of total effect) indicates that extrinsic motivators also have independent effects, supporting a complementary rather than substitutive relationship. This finding has important implications for intervention design, suggesting that both direct policy interventions and indirect satisfaction-enhancing interventions are needed.

The identification of student factors as the second strongest predictor (β = 0.29) highlights the importance of the teaching context. Instructors who perceive their students as motivated and capable report higher teaching willingness, suggesting that improving student quality and motivation could have positive effects on instructor engagement[26]. The positive relationship between teaching workload and teaching willingness (β = 0.20) was unexpected but may reflect that more engaged instructors take on additional responsibilities, or that meaningful work is not perceived as burdensome.

4.2 Comparison with Previous Studies

The importance of teaching satisfaction as a key predictor is consistent with studies showing that intrinsic rewards are more strongly associated with teaching engagement than extrinsic rewards. A study[27] of medical educators in the United States found that satisfaction with teaching was the strongest predictor of continued teaching involvement (β = 0.35), similar to our finding (β = 0.28). The mediating role of satisfaction has been reported in other healthcare contexts, including nursing education and pharmacy education[28].

The positive effect of policy cognition on teaching willingness aligns with research showing that clear policies and adequate support enhance instructor engagement. However, our finding that policy cognition operates partly through teaching satisfaction extends previous work by identifying a mediating mechanism. A study [29]of faculty development programs found that policy interventions were more effective when they also enhanced intrinsic motivation, consistent with our mediation findings.

The absence of significant differences by gender, education level, or license type suggests that the factors influencing teaching willingness are relatively universal across different instructor groups[30]. This finding is consistent with a multi-institutional study that found similar predictors of teaching engagement across different specialties and settings. [31]However, the trend toward higher willingness among senior physicians warrants further investigation, as it may reflect selection effects or accumulated experience.

4.3 Theoretical Implications

This study makes several theoretical contributions. First, we provide empirical support for integrating Herzberg's two-factor theory with SDT, demonstrating that the three-layer model provides a more comprehensive framework for understanding teaching motivation than either theory alone. Second, we identify teaching satisfaction as a key mechanism through which policy interventions operate,

suggesting that motivation crowding theory applies to the medical education context. Third, we demonstrate that the relationship between extrinsic and intrinsic motivators is complementary rather than substitutive, informing ongoing debates about the optimal design of incentive systems.This provides a direction for establishing an effective incentive mechanism.

4.4 Practical Implications

The strong mediating role of teaching satisfaction suggests that interventions targeting teaching satisfaction may be particularly effective for improving teaching willingness. Simultaneously, priority should be given to fostering positive teacher-student interactions, as these represent the most influential leverage points. Additionally, improving base management practices, cultivating a hospital culture that supports teaching, and enhancing policy communication and awareness campaigns can effectively boost clinical educators' engagement in teaching activities.

Based on our findings, we recommend a multi-pronged approach:

For Hospital Administrators:

1. **Strengthen policy promotion and communication** to ensure instructors understand RST policies and their benefits, addressing both the direct pathway (65.9% of effect) and the indirect pathway through satisfaction enhancement (34.2% of effect).
2. **Enhance teaching satisfaction** through improved teaching resources[31] (Flexible and self-paced teaching schedules, simulation facilities, educational materials), recognition programs (teaching awards, academic promotion criteria), and professional development opportunities (faculty development programs, teaching skills workshops).
3. **Improve student quality and motivation** through better selection processes, pre-training preparation, and ongoing support, recognizing that student factors are the second strongest predictor. [32]

4. **Optimize teaching workload distribution** It is necessary to reasonably control the intensity of teaching activities, to ensure that teaching responsibilities are meaningful rather than burdensome, potentially reframing teaching workload as professional engagement.

For Medical Educators

1. **Focus on intrinsic motivation** when designing educational programs, as intrinsic motivators have stronger and more sustainable effects on teaching willingness. 2. **Use the three-layer model** as a framework for diagnosing motivation problems and designing targeted interventions. 3. **Monitor teaching satisfaction** as a key indicator of instructor engagement and program effectiveness.

- **For Policy Makers**:

1. **Establish a comprehensive incentive system to multi-dimensionally stimulate the enthusiasm of teaching faculty members** that address both extrinsic motivators (policy support, recognition,

career advancement) and intrinsic motivators (teaching satisfaction, professional identity, meaningful work).
2. **Invest in faculty development** to enhance teaching skills and satisfaction, recognizing that improved satisfaction mediates the effectiveness of policy interventions.
3. **Fostering a hospital culture that supports teaching activities** that value teaching and provide adequate resources, as organizational context influences both policy cognition and teaching satisfaction.

4.5 Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes causal inference. While path analysis suggests directional relationships, longitudinal or experimental studies are needed to establish causality. Second, the single-site sample limits generalizability to other hospitals or regions. Multi-center studies are needed to validate the model across different settings. Third, self-reported measures may be subject to social desirability bias, although the anonymous survey design and confidentiality assurances should minimize this concern. Fourth, the sample size, while adequate for the primary analyses, was smaller than initially targeted, limiting the power for subgroup analyses. Fifth, the prediction model requires external validation before clinical application. Sixth, we did not measure all potential predictors of teaching willingness, such as personality traits, family responsibilities, or career stage, which could explain additional variance.

4.6 Future Directions

Future research should: (1) conduct longitudinal studies to establish causal relationships and examine how teaching willingness changes over time; (2) validate the three-layer model and prediction equation in independent samples across different hospitals, regions, and countries; (3) develop and test interventions based on the model, particularly targeting teaching satisfaction enhancement; (4) explore additional factors such as organizational culture, leadership support, and interprofessional collaboration; and (5) investigate the relationship between teaching willingness and actual teaching performance, to determine whether willingness translates into better educational outcomes.

5 Conclusions

This study developed and validated a three-layer teaching motivation model integrating Herzberg's two-factor theory and self-determination theory. Teaching satisfaction serves as a key mediator between policy cognition and teaching willingness, accounting for 34.2% of the total effect. Teaching satisfaction, student factors, and policy cognition are the strongest predictors of teaching willingness, explaining 59.8% of the variance. These findings provide a theoretical foundation and practical implications for improving RST instructor engagement through interventions targeting both policy communication (direct pathway) and teaching satisfaction enhancement (indirect pathway). The strong predictive power of the

model and the large effect sizes suggest that the identified factors are important targets for intervention development.

List of abbreviations

Abbreviation	Full form
RST	Resident Standardization Training
SDT	Self-Determination Theory
VIF	Variance Inflation Factor
CI	Confidence Interval
BCa	Bias-Corrected and Accelerated
EPV	Events Per Variable
DW	Durbin-Watson
BP	Breusch-Pagan
CFI	Comparative Fit Index
TLI	Tucker-Lewis Index
RMSEA	Root Mean Square Error of Approximation
AVE	Average Variance Extracted

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Jiangsu Province Hospital on Integration of Chinese and Western Medicine on June 25, 2026 (Approval Number: 2026-LWKY-067). All procedures were performed in accordance with the relevant guidelines and regulations, including the Declaration of Helsinki. All participants provided written informed consent prior to their participation in the study.

Clinical trial number:

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Author Contribution

Yemin Gan had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.Concept and design: Yemin Gan. Statistical analysis: Jun Gu. Drafting of the manuscript: Yemin Gan and Jun Gu have contributed equally to this work.Critical revision of the manuscript for important intellectual content: Chenyi Fan.Corresponding author ,Administrative,technical,or material support: Lei Bi.Email: szxjdb2151@163.comSupervision: Wu Gang.

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Data Availability

All data generated or analysed during this study are included in this published article .

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Figures

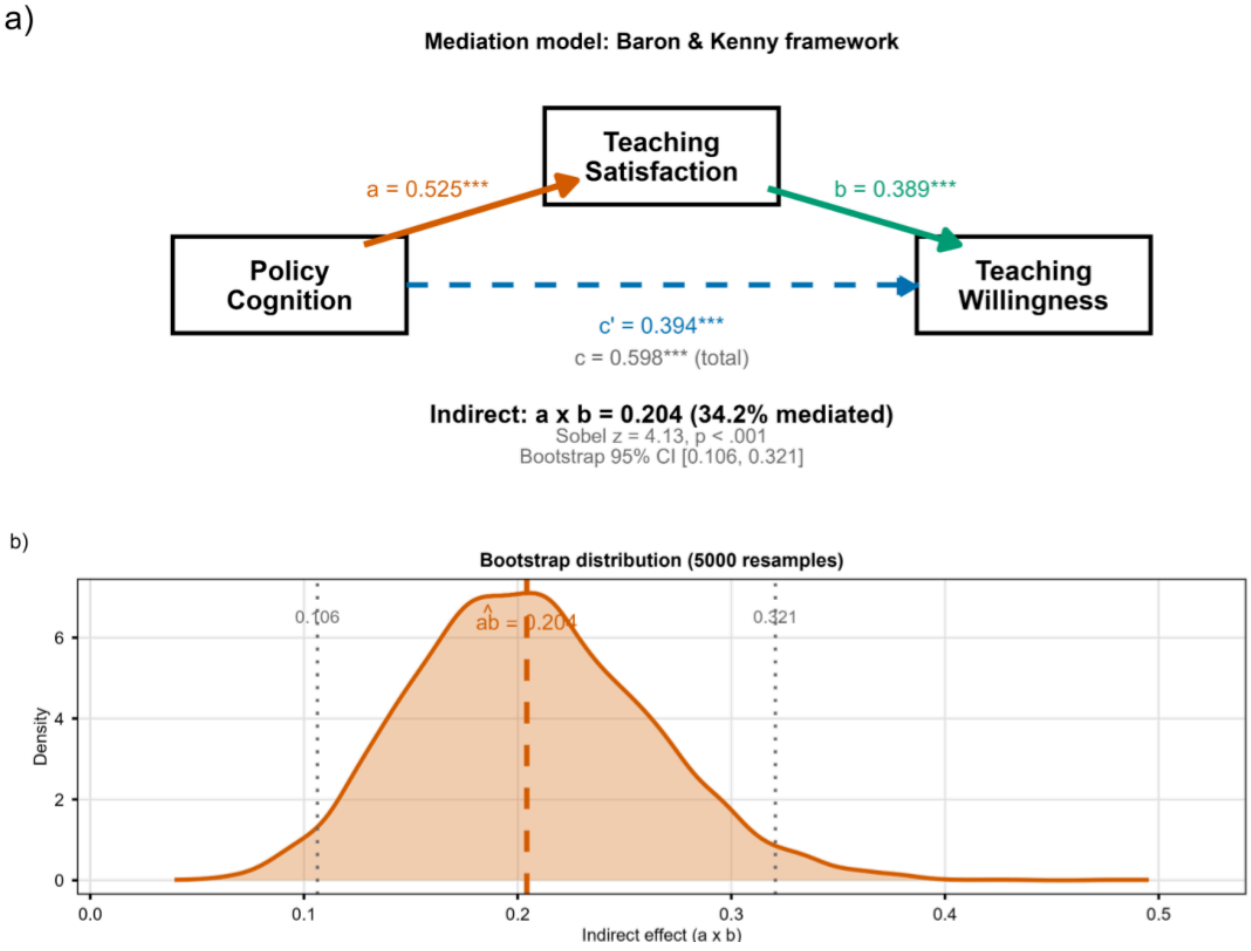


Figure 1

Path analysis: mediation model.

Mediation analysis as the central framework. a, Baron & Kenny path model: policy cognition -> teaching satisfaction -> teaching willingness. Solid arrows: significant paths ($p < .001$); dashed arrow: direct effect c'. Indirect effect a x b and bootstrap BCa 95% CI from 5000 resamples. b, Bootstrap distribution of the indirect effect with bias-corrected and accelerated confidence intervals.

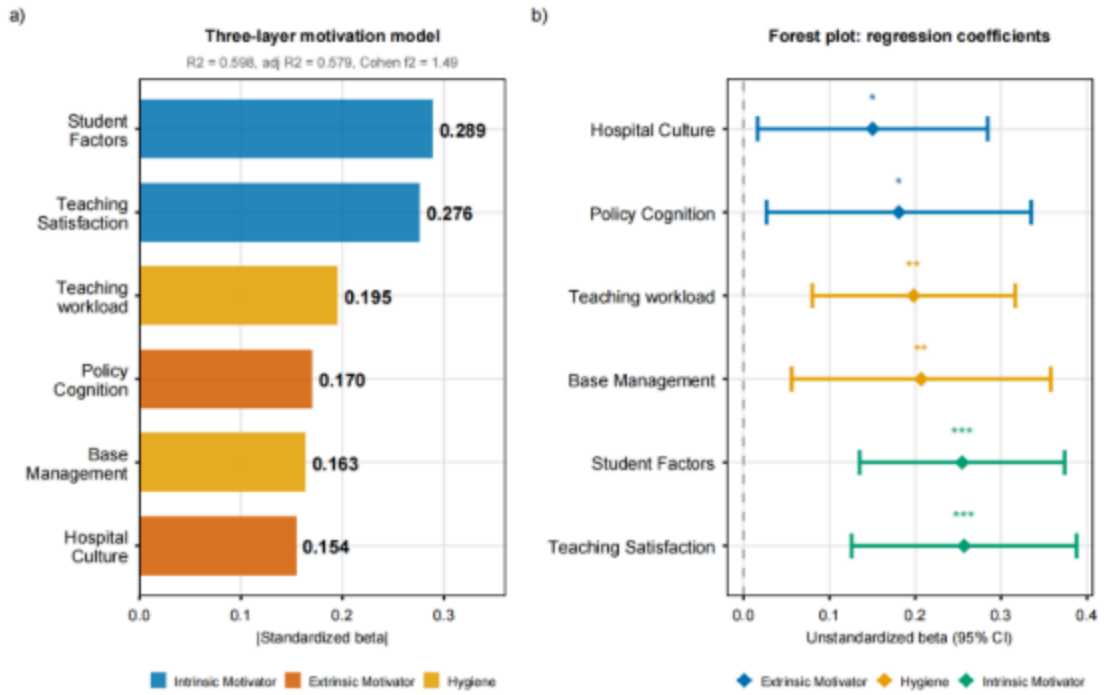


Figure 2

Three-layer motivation model and forest plot.

a, Standardized beta coefficients grouped by motivational layer (Intrinsic Motivator, Extrinsic Motivator, Hygiene). b, Forest plot of unstandardized regression coefficients with 95% confidence intervals. Significance:p < .05, p < .01, p < .001.

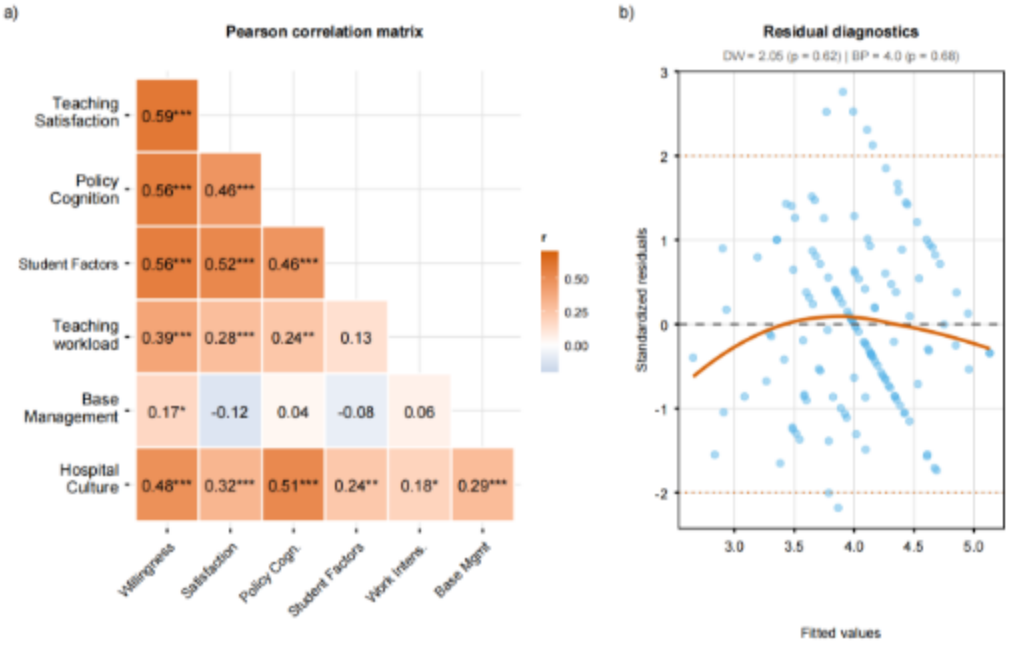


Figure 3

Correlation structure and model diagnostics.

a, Pearson correlation matrix (lower triangle) with significance annotations (p < .05,p < .01, p < .001). Color gradient: blue (negative) to vermillion (positive). b, Standardized residuals vs fitted values with loess smooth and Durbin-Watson/Breusch-Pagan diagnostics.

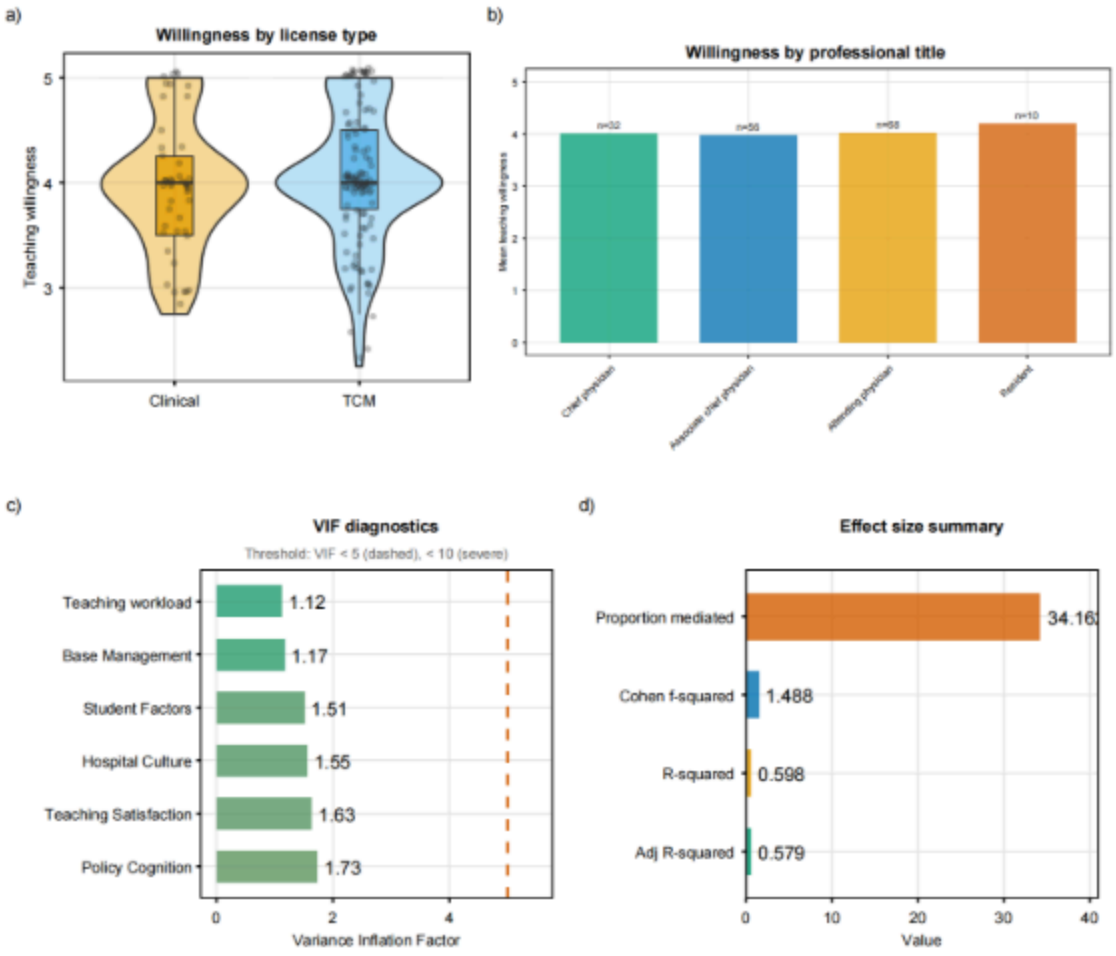


Figure 4

Subgroup comparisons and robustness checks.

a, Teaching willingness by license type (violin plot, boxplot, and jittered observations). b, Teaching willingness by professional title with SE error bars. c, Variance inflation factor diagnostics (threshold: VIF < 5). d, Effect size summary (R-squared, adjusted R-squared, Cohen f-squared, proportion mediated).