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Learning Engagement and Teaching Skills: Chain Mediation among Pre-Service Teachers

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Classroom teaching skills development belongs to professional preparation for potential teachers. Using Social Cognitive Theory and Self Determination Theory, the research developed a chain-meditation model to study pre-service teachers' self-evaluation and teaching self-efficacy mediate the relation between their learning engagement and classroom teaching skills. Participants were 513 pre-service teachers from three public universities in Henan Province, China. The data was analyzed by using the Structural Equation Model. The results revealed that learning engagement exhibited a robust positive effect on classroom teaching skills ($\beta = 0.484$, $p < 0.001$), teacher self-efficacy (effect size = 0.116), and self-evaluation of classroom teaching (effect size = 0.105). Each served as a partial mediator, and a sequential mediation pathway linking these two constructs was also confirmed (95% CI [0.017, 0.149], effect size = 0.055). These findings highlight the importance of fostering engagement, strengthening efficacy beliefs, and promoting reflective practices in teacher education programmes to enhance pedagogical competence and long-term professional adaptability.

Keywords: pre-service teacher development, reflective teaching, higher education, instructional competence, teacher education programs

INTRODUCTION

Higher education is an important moment to develop pre-service teachers' professional knowledge and classroom teaching skills (Cai et al., 2022; Gu et al., 2022). At this time, it has a setup program with both theoretical understandings as well application instructions (Meneses et al.,2023; Ng et al.,2022). The acquisition of classroom teaching skills is not only a prerequisite for teacher certification but also a key indicator of professional readiness, enabling prospective teachers to adapt to diverse instructional settings and sustain long-term growth (Xu et al., 2024). In recent years, teacher quality improvement initiatives in China have motivated institutions to adopt more practice-oriented training, including classroom management and reflective practices (Korthagen, 2017; Pedler et al., 2020; Sun, 2023). Despite these initiatives, an overemphasis on

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theoretical coursework has continued to hinder the systematic development of practical competencies, leaving many pre-service teachers underprepared (Dayal & Alpana, 2020; Yang & Tan, 2024). In addition, limited access to digital resources and insufficient feedback mechanisms further restrict their ability to handle complex classroom dynamics (Brown et al., 2023; Cheng et al., 2023; Timotheou et al., 2022)..

Classroom teaching skills shouldn't be seen as isolated techniques but as reflective, flexible, and context-sensitive competencies that allow teachers to make professional decisions (Meneses et al., 2023; Pang, 2022; Suh et al., 2023). Learning Engagement is an internal type of psychological resource, while teacher self-efficacy, on the other hand, is another form of internal psychological resource they both play an important role. Research has shown that reflective practices supported by structured self-evaluation help pre-service teachers refine their teaching performance (Biencinto et al., 2021; Karaman, 2024; Nissim & Simon, 2024). Likewise, learning engagement and self-efficacy can compensate for the absence of strong institutional support, enhancing teachers' confidence and persistence in professional development (Bandura, 1997; Chen & Wu, 2022; Woodcock et al., 2022).

Even though there has a policy such as "Excellent Teacher Training Program 2.0" (Chinese Ministry of Education, 2018), most of the empirical studies were about methods improvement rather than trainee teachers' duality: on one hand they are learners; on the other hand they are potential future teachers (Cai et al., 2022; Yang & Tan, 2024). Previous research has confirmed the direct impact of self-efficacy and engagement on instructional performance (Tschannen-Moran & Hoy, 2001; Zee & Koomen, 2016), but few have explored how psychological elements interact step by step to influence teaching skill (Gu et al., 2022; Miao & Ma, 2023). Current literature also lacks an integrated framework combining Self-Determination Theory and Social Cognitive Theory to account for motivation, efficacy beliefs, and reflective processes in a single explanatory model (Lee & Davis, 2023; Woodcock et al., 2022). Addressing this gap, the present study proposes a chain mediation model in which learning engagement influences classroom teaching skills through the sequential mediating roles of teacher self-efficacy and self-evaluation of classroom teaching (Biencinto et al., 2021; Karaman, 2024). This model aims to reveal the psychological mechanisms underpinning pre-service teachers' professional growth.

LITERATURE REVIEW

Key Concepts and Theoretical Foundations

Pre-service teachers are university students enrolled in teacher preparation programmes who have not yet obtained certification but constitute a strategic reserve for primary and secondary education (Borg, 2010; Cai et al., 2022). Within this population, learning engagement is defined as a constructive psychological state characterised by vigour, dedication, and absorption (Fatimah et al., 2024; Schaufeli et al., 2002; Yang et al., 2025). Classroom teaching skills include classroom instruction, questioning, explanation, presentation, and classroom management etc. (Biencinto et al., 2021; Yang & Tan, 2024).

Self-Determination Theory (SDT) is concerned that autonomy, competence, and relatedness promote internal motivation. Learning engagement can be seen as behavior that demonstrates an inner drive to learn (Deci & Ryan, 1985; Ryan & Deci, 2020). Empirical studies have shown that engagement is strongly associated with academic achievement and professional competence (Chiu, 2021; Sun & Zhang, 2024).

On the other hand, Social Cognitive Theory (SCT) focuses on the triangle between cognition, behaviour, and environment, with self-efficacy serving as its central mechanism (Bandura, 1986; Collie, 2023). Teacher self-efficacy can be viewed as the extent to which a teacher can plan and carry out lessons, run a class, and help learners learn (Tschannen-Moran & Hoy, 2001). Teachers with greater efficacy beliefs are more prone to adopt new strategies, be resilient, and achieve better student outcomes (Wu & Zhan, 2017). By integrating SDT and SCT theory, it provides a comprehensive lens to examine how motivational and cognitive factors jointly shape pre-service teachers' instructional growth (Meneses et al., 2023).

The Role of Learning Engagement in Classroom Teaching Skills

Learning engagement is always considered as a thrust force in the growth of teaching capability (Gu et al., 2022; Pedler et al., 2020). For example, according to Pedler et al. (2020), it can have a positive impact on engagement and reflect practices like classroom regulations. Collie (2023) showed how supportive environments promote students' participation, leading them to improve their behavior inside classrooms. Longitudinal findings also show that high initial engagement predicts the refinement of instructional strategies over time (Collie & Martin, 2023). When pre-service teachers consolidate their professional identity, engagement initiates a cognitive–behavioural–reflective cycle, strengthening skill acquisition (Ng et al., 2022). Therefore, this study takes learning engagement as the first stage of the mediating path it proposes.

The Role of Teacher Self-Efficacy in Classroom Teaching Skills

Teacher self-efficacy, a teacher's confidence in being able to perform the role of teaching responsibilities (Bandura, 1986), was impacted by mastery experiences, persuasion, and affective states (Lazarides & Warner, 2020). From empirical research, we know that efficacy level is related to more skilled classroom leadership and innovation, as well as tackling complex classroom situations (Dilekli & Tezci, 2020). Moreover, it has been associated with stronger professional identity and resilience, which indirectly enhance teaching effectiveness (Collie, 2023). But limited research has systematically investigated its mediating role in linking learning engagement with classroom teaching skills among pre-service teachers (Cai et al., 2022). This gap demands integrating the concept of self-efficacy into the sequence explanation model.

The Role of Self-Evaluation of Classroom Teaching in Classroom Teaching Skills

Self-evaluation of classroom teaching is a type of metacognition; teachers think about their instructional practices, identify strengths and weaknesses, and adjust strategies for improvement (Layden et al., 2023). Studies have also indicated that the integration of self-evaluation together with peer feedback may enhance classroom management as well as interaction teaching skills among pre-service teachers (Brown et al., 2023;

Cheng et al., 2023; Dayal & Alpana, 2020). Standardized self-evaluations are also helpful for goal formation, setting goals, monitoring practices, and reflections, which help people develop continuously in their careers (Biencinto et al., 2021; Karaman, 2024). From these findings, it can be seen that self-evaluation benefits teachers' teaching abilities and encourages them to do self-regulated learning behavior (Miao & Ma, 2023).

Research Objectives and Hypotheses

Drawing on SDT and SCT, this study constructs a chain mediation model to examine how learning engagement, teacher self-efficacy, and self-evaluation of classroom teaching interact to influence classroom teaching skills (see Figure 1). The following hypotheses are proposed:

H1: Learning engagement positively predicts teacher self-efficacy.

H2: Learning engagement positively predicts self-evaluation of classroom teaching.

H3: Teacher self-efficacy positively predicts self-evaluation of classroom teaching.

H4: Self-evaluation of classroom teaching positively predicts classroom teaching skills.

H5: Teacher self-efficacy positively predicts classroom teaching skills.

H6: Learning engagement positively predicts classroom teaching skills.

H7: Learning engagement is the strongest predictor of classroom teaching skills.

H8: Teacher self-efficacy mediates the relationship between learning engagement and classroom teaching skills.

H9: Self-evaluation of classroom teaching mediates the relationship between learning engagement and classroom teaching skills.

H10: Teacher self-efficacy and self-evaluation jointly exert a chain-mediating effect between learning engagement and classroom teaching skills.

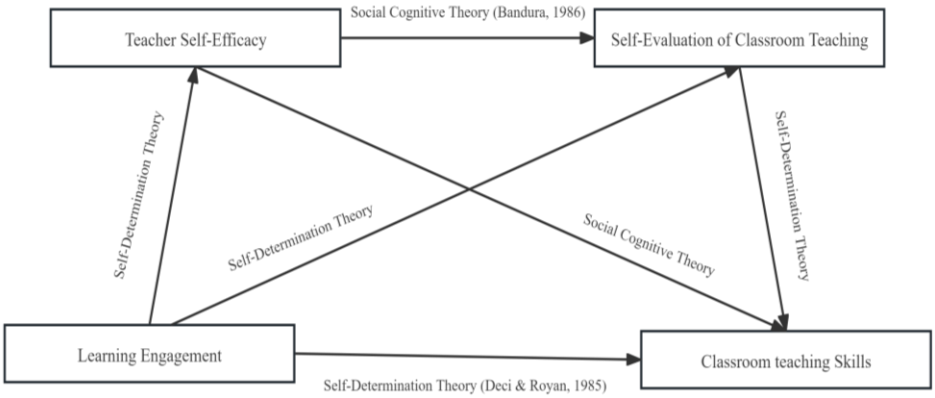

Figure 1
Chain mediation model

METHOD

Research Design

This study adopted a cross-sectional design and employed self-administered questionnaires to investigate the predictive effect of learning engagement on classroom teaching skills and to test the sequential mediating roles of teacher self-efficacy and self-evaluation of classroom teaching. Structural equation modelling (SEM) was used to validate the hypothesised model, which can simultaneously control measurement errors while comprehensively testing the direct effects, indirect effects, and chain mediation paths between latent variables (Rein et al., 2024). The sample consisted of 513 pre-service teachers from three public universities in Henan Province, China, including both undergraduate and graduate students, which enhanced representativeness. The study complied with ethical standards and was approved by the institutional review board. All participants provided informed consent and were free to withdraw at any point.

Sampling and Participants

A stratified random sampling strategy was applied in three stages. First of all, Henan province was randomly selected among the 31 provinces on China's mainland. Second, randomly chose three universities offering teacher education programmes from the nine available. Finally, questionnaires were distributed using proportional sampling according to enrolment numbers. Sample adequacy was assessed using G*Power (effect size $f^2 = 0.15$, power = 0.80, $\alpha = 0.05$), which indicated a minimum of 109 participants. Following Krejcie and Morgan's recommendations (1970), the minimum threshold was set at 384. To allow for attrition, the basic sample size was increased by 50% (Bartlett, 2001); 576 questionnaires were distributed, of which 513 were valid, yielding a response rate of 89.1%.

Ethical Considerations

The study has been reviewed and approved by the Ethics Review Board (Approval code: IEC-2024-FOSSLA-02221, 3 December 2024). Participants were briefed on the objectives and procedures before data collection and provided written consent. Confidentiality was strictly maintained, and all data were used solely for research purposes.

Instruments

Learning Engagement. Learning engagement was measured with the Chinese version of the Utrecht Work Engagement Scale for Students (UWES-S; Schaufeli et al., 2002; Fang et al., 2008). The 17 items include three dimensions: vigour, dedication, and absorption. The response scale was a seven-point Likert scale from 1 (never) to 7 (always). In this study, Cronbach's a was .95, and confirmatory factor analysis (CFA) suggested adequate validity ($\chi^2/df = 2.21$, CFI = .97, RMSEA = .05).

Teacher Self-Efficacy. The 12-item self-efficacy scale from Wu and Zhan (2017) was used. It includes efficacy for classroom management and efficacy for teaching & learning. Each item has a 9-point Likert-type scale where 1 = none at all, 9= extremely

strong. The scale demonstrated high reliability (α = .98) and good construct validity (χ^2/df = 2.58, GFI = .96, RMSEA = .06).

Self-Evaluation of Classroom Teaching. Yu et al. (2014)'s 22-item self-evaluation was adopted, which involved teaching performance, student learning, and instruction effect. The items were measured on a six-point Likert scale with the options of 1 being "strongly disagree" and 6 being "strongly agree." The scale demonstrated high reliability (α = .94) and good construct validity (χ^2/df = 1.73, CFI = .98, RMSEA = .04).

Classroom Teaching Skills. Classroom teaching skills were measured using Sun's (1997) 27-item instrument, which evaluates nine domains, including set induction, questioning, lecturing, blackboard writing, language, presentation, variation, closure, and classroom management. Responses were given on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Internal reliability was high (α = .95), with excellent construct validity (χ^2/df = 1.26, CFI = .99, RMSEA = .02).

Data Analysis

Data analysis was done by SPSS 27.0 and AMOS 24.0. Firstly, descriptive statistics, normality tests, and Pearson correlations were run. Harman's single-factor test was applied to assess common method bias: all 78 items entered into an unrotated factor analysis yielded a first factor explaining 24.98% of the variance. This is less than 40%, so no problem with common methods bias (Podsakoff et al., 2012). Secondly, CFA was applied in order to evaluate construct validity. Then, SEM was conducted to test the hypothesized model. Model fitting was measured through χ^2/df, CFI, TLI, RMSEA, and SRMR. Finally, bootstrapping was performed using 5000 resamples and bias bias-corrected 95% confidence interval to test the indirect effect. The mediation would be considered statistically significant if the CI did not contain zero.

FINDINGS

Sample Characteristics and Descriptive Statistics

In order to know the demographic features of these 513 valid responses, descriptive analysis was done. Female participants made up 82.1% (n = 421), and male participants were only 17.9% (n = 92). This is consistent with the general fact that there are more female students than males in pre-service teacher programs. Regarding academic level, the sample comprised 148 freshmen (28.8%), 80 sophomores (15.6%), 74 juniors (14.4%), 113 seniors (22.0%), 37 first-year graduate students (7.2%), 45 second-year graduate students (8.8%), and 16 third-year graduate students (3.1%). Most of the participants belonged to the age group 18-21, which was 65.5%, then people who were older than 22 years had 25.1% and those below 17 years of age were only 48 people. About 83% indicated an intention to pursue teaching, and 95.5% (n = 490) come from rural areas. It can be seen that rural students have a great aspiration for a career path as teachers.

Confirmatory Factor Analysis (CFA)

CFA was carried out by using AMOS 24.0 for the evaluation of construct validity (Figure 2). All factor loading values were over .70, which indicates very strong

convergent validity. Fit indices indicated a satisfactory model fit ($\chi^2/df = 1.25$, GFI = .97, RMR = .02, NFI = .95, CFI = .99). These results confirm that it has 4 factors and discriminant validity, which shows that the measurement model is ok.

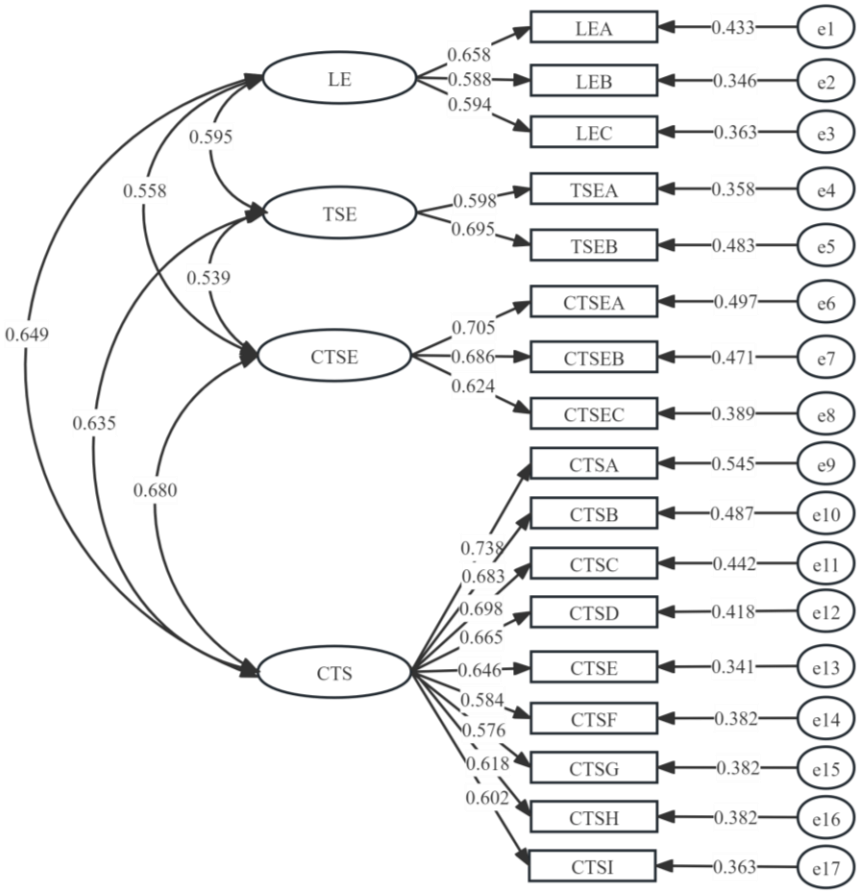

Figure 2
CFA of variables

Correlation Analysis

Pearson's correlation analysis was conducted to explore associations among the four study variables (Table 1). Learning engagement correlated positively but moderately with teacher self-efficacy (r = .373), and with pre-service teachers' self-evaluation of classroom teaching (r = .383), and also had a positive moderate relationship with classroom teaching skills (r = .484). Teacher self-efficacy correlated significantly with self-evaluation (r = .351) and classroom teaching skills (r = .457). The strongest

association was between self-evaluation and classroom teaching skills (r = .530), suggesting that teachers' reflective appraisal of their teaching plays a particularly important role in shaping classroom competencies.

Table1
Correlation analysis of four variables

Variables	LE	TSE	CTSE	CTS
LE	1			
TSE	0.373**	1		
CTSE	0.383**	0.351**	1	
CTS	0.484**	0.457**	0.530**	1

Multiple Regression Analysis

Hierarchical regression analysis was used to test predictors of classroom teaching skills, controlling for gender and age (Table 2). Multicollinearity was not an issue, with tolerance values above .75 and VIFs below 5. Results indicated that learning engagement ($\beta = .24$, $p < .001$), teacher self-efficacy ($\beta = .22$, $p < .001$), and self-evaluation of classroom teaching ($\beta = .32$, $p < .001$) were all significant predictors, explaining 43.3% of the variance in classroom teaching skills (Adjusted $R^2 = .433$). Among them, self-evaluation showed the strongest effect, indicating that reflective self-evaluation contributes more substantially than engagement or efficacy. This finding does not support the initial hypothesis that learning engagement would emerge as the strongest predictor.

Table 2
Multiple regression on LE, TSE & CTSE to CTS

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% CI for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	1.029	0.158	-	6.527	0.000	0.720	1.339	-	-
Gender	0.087	0.045	0.068	1.952	0.052	- 0.001	0.175	0.919	1.089
Age	0.105	0.031	0.120	3.349	0.001	0.043	0.166	0.863	1.158
LE	0.143	0.023	0.235	6.159	0.000	0.097	0.188	0.761	1.314
TSE	0.108	0.018	0.218	5.844	0.000	0.071	0.144	0.797	1.255
CTSE	0.277	0.033	0.320	8.498	0.000	0.213	0.341	0.779	1.283
R Square				0.439					
Adjusted R Square				0.433					
F			79.330 ($p < 0.001$)						

a. Dependent Variable: CTS

Structural Equation Modelling (SEM)

SEM further tested the hypothesised model (Figure 3). The indices indicated an excellent fit: $\chi^2/df = 1.25$, GFI = .97, RMR = .02, RMSEA = .02, NFI = .95, TLI = .99,

and CFI = .99 (Table 3) (Hu & Bentler, 1999). All path coefficients were significant ($p < .001$). The results demonstrate that learning engagement has both direct and indirect effects on classroom teaching skills, with teacher self-efficacy and self-evaluation functioning as mediators.

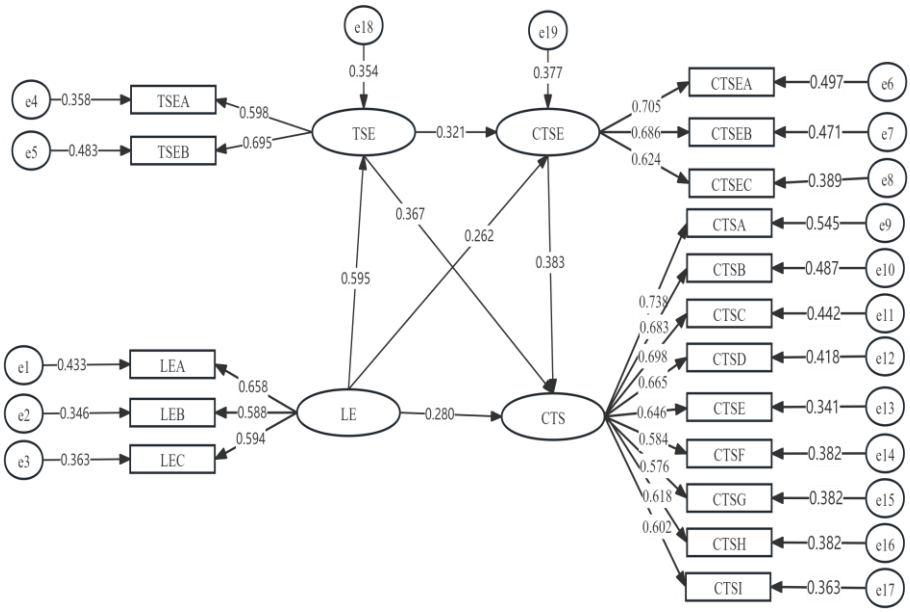

Figure 3
Structural model

Table 3
Model fit of SEM

Model Fit Index	Chi-Square/*df*	GFI	RMR	RMSEA	NFI	TLI	CFI
Inspection Results	1.248	0.969	0.020	0.019	0.948	0.987	0.989
Evaluation Criteria	< 5	> 0.9	< 0.08	< 0.08	> 0.9	> 0.9	> 0.9

Bootstrapping with 5,000 resamples confirmed the mediating mechanisms (Table 4). Teacher self-efficacy partially mediated the link between learning engagement and classroom teaching skills (indirect effect = .116, 95% CI [.045, .276]), accounting for 35.7% of the total effect. Similarly, self-evaluation of classroom teaching mediated the relationship (indirect effect = .105, 95% CI [.032, .241]), accounting for 33.4%. In addition, a sequential mediation pathway—learning engagement → teacher self-efficacy → self-evaluation → classroom teaching skills—was validated (indirect effect = .055, 95% CI [.017, .149]), contributing 20.8% of the overall effect. All confidence intervals excluded zero, meaning the robustness of these mediating effects.

Table 4
Bootstrapped estimates of indirect, direct, and total effects

Path		Estimate	95.0% CI	*P*	Proportion
LE→TSE→CTS	Indirect	0.116	[0.045, 0.276]	0.005	35.69%
	Direct	0.209	[0.073, 0.399]	0.009	64.30%
	Total	0.325	[0.204, 0.509]	0.000	-
LE→CTSE→CTS	Indirect	0.105	[0.032, 0.241]	0.007	33.44%
	Direct	0.209	[0.073, 0.399]	0.009	66.56%
	Total	0.314	[0.171, 0.553]	0.001	-
LE→TSE→CTSE→CTS	Indirect	0.055	[0.017, 0.149]	0.012	20.83%
	Direct	0.209	[0.073, 0.399]	0.009	79.17%
	Total	0.264	[0.119, 0.453]	0.005	-

DISCUSSION

This paper's chained mediation model is of great theoretical importance. It studies psychological resources (Fredricks et al., 2004). Learning engagement enhances classroom teaching skills by first strengthening pre-service teachers' self-efficacy, which subsequently facilitates reflective self-evaluation (Bandura, 1977). This sequence process implies that pre-service teacher' learning engagement influences their teaching skills through enhanced perceptions and introspections, slowly assimilating into teaching conduct (Hayes, 2018). Briefly, the growth of a teacher is like a chain psychology. From motivation to beliefs, from action to reflection, this process continues until it leads to the improvement of one's skills. This discovery can help us to have more knowledge on how pre-service teachers cultivate themselves, reminding us to be mindful of connections among psychological sources, not simply separate ones (Fredricks et al., 2004). Chain-mediator models explain a larger proportion of variance compared to single mediator models, so they also have greater theoretical significance and value (Hayes, 2018). This research explores a road from participating to feeling effective to assessing to forming and discovers some hidden principles in our heads behind how professional capability develops and gives out advice on how to make lessons and train people for developing competence (Korthagen, 2017).

As for Hypothesis H7, the results show that it is self-evaluation ($\beta = .32$) that better predicts classroom teaching skills than learning engagement ($\beta = .24$). It also fits with developmental and cognitive reasoning. Self-evaluation, being a metacognitive process, facilitates teaching performance refinement through self-monitoring and experiential modification (Hattie & Timperley, 2007). Reflective practice involves the transformation of involvement into professional behavior and moves from "motivated participation" to "reflective improvement." The reflective cycle (planning–acting–evaluating) emphasized in teacher education places self-evaluation as the main driver for skill advancement (Schön, 1983). For pre-service teachers, reflection functions both as an evaluation mechanism and as a catalyst for competence development. So, self-evaluation has more direct relevance to teaching achievement than learning engagement, so it shows stronger prediction ability (Artino, 2012; Nduagbo & Casale, 2023).

Culturally speaking, unique aspects of Chinese educational culture may enhance the role of self-evaluation. Rooted in Confucian traditions, teaching emphasizes "self-cultivation" and "reflection," regarding reflection as a key way to achieve self-improvement (Watkins & Biggs, 1996). China's collectivist learning environment further promotes advancement through self-reflection and self-criticism rather than open peer feedback (Tweed & Lehman, 2002). These inclinations might also raise how important reflecting is to make progress in teaching well. In contrast, teacher education in an individualistic context pays more attention to teachers' independent exploration, experience exchange, so the relationship among factors in the mediating model is different from this paper. Future research should explore cross–cultural variations and generalisability (Korthagen, 2017).

Compared to previous research on a single mediator, this chained mediation model takes into account more variance in teaching skills, and it also explains the sequence logic among psychological resources. Theoretically speaking, it can display the continuous psychological process of teacher growth, and practically speaking, it can give an exact intervention sequence for teacher training: first improving engagement so as to cultivate efficacy, then carrying out planned reflective practice so as to continuously improve teaching (Hayes, 2018).

Findings show the complicated mechanism linking learning engagement to teaching ability. Learning Engagement is an accurate predictor of classroom teaching skills, which supports past research about teacher preparation based on motivation. Furthermore, teacher self-efficacy and reflective self-evaluation played a mediating role, among which self-evaluation had the greatest effect on predicting teaching competence, indicating that reflection was essential for professional development. The verified chain mediation further proves that engagement leads to self-efficacy, then encourages self-evaluation, thus cultivating teaching skills. Opposite to H7, it was the self-evaluation rather than learning engagement that came out as the strongest predictor. These results improve knowledge on how psychological resources work together to affect pre-service teachers' professional abilities in rural areas where dedication to the teaching profession is still strong. University managers need to create and use reflective practice classes to nurture future educators; university instructors could utilize various teaching methods to meet the different learning needs of pre-service teachers, improving their confidence and encouraging them to reflect on themselves. In this way, they can make their teaching more effective.

CONCLUSION

In accordance with 513 pre-service teachers' information and SEM, the research proved a chain mediation model where learning engagement promotes classroom teaching skills via teacher self-efficacy and self-evaluation. Engagement directly predicted instructional competence; meanwhile, self-efficacy as well as reflective self-evaluation served as mediator factors that created sequential paths. The psychological-reflexive developmental trend shows us how crucial mental and reflective sources are for the progress of educators. In terms of theory, it adds Self Determination Theory as well as Social Cognitive Theory into current models, giving us a more comprehensive idea of

how instructional ability is developed. From a practical side, findings can be good support in creating interventions and curriculum development (use case-learning methods, microteaching) to improve learning engagement and help students develop their effectiveness, and encourage student reflection. Policy-wise, these findings point out the need for system support within the preparation of teachers. As our sample consists mostly of rural residents (95%), this corresponds well with China's Rural Teacher Retention Policy (Ministry of Education of China, 2023), which emphasizes that fostering motivational and reflective capacities can better prepare prospective teachers for the challenges of classroom practice.

LIMITATIONS AND FUTURE RESEARCH

Several limitations have to be considered. Firstly, the fact that it is a cross-sectional study, which does not allow for causal inference. Even if SEM revealed some reasonable mediating processes, it could not establish an order of events. Future research will require the use of longitudinal and experimental designs to better understand the reciprocities among engagement, efficacy, reflection, and teaching competence.

Second, even though it links Self-Determination Theory with Social Cognitive Theory to give a certain level of explanation, potential conceptual overlap and culturally embedded assumptions are underexplored. In the educational environment in China, hierarchical norms, feedback ways, change what effectiveness means and reflection is too. Future research could adopt qualitative methods that take culture into account, or conduct multi-group comparisons, or study other non-Chinese cultural groups and compare them to how well this fits compared to other models, like socio-cultural or ecological ones.

Third, it's just from 3 public universities in Henan province, so its generality is restricted. Discipline, sex, and region might impact the development procedures being considered: It would have to select a broader sample that could cover different schools (e.g., vocational colleges) in different areas to make it have good external validity and comparative subgroups.

Fourth, reliance on self-reports introduces questions about common method bias and social desirability. They are good and reliable fits, but having just self-reported doesn't mean it will work in the real world. Future research should also use methods like classroom observation and mentors and peers assessments to get converging evidence and test for measurement equivalence across subgroups.

Finally, there's also a tendency to see psychological constructs as individual levers of instructional competence, thereby neglecting their situatedness within broader institutional contexts (Brown et al., 2023; Collie, 2023; Dahlan et al., 2025). Teaching effectiveness is derived from both internal and external sources, such as the calibre of supervisory oversight, the form and timing of feedback, and the design of the enacted curriculum. Subsequent investigations should embed institutional-level predictors within multilevel analytic frameworks, thereby elucidating the dynamic interplay between personal agency and systemic constraint. It would lead us to an ecologically

more appropriate picture of pre-service teachers' development, which will have policy relevance too.

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