Applications of Language Studies
jals.hmu.ac.ir

An Investigation of Iranian English Teachers' Epistemological Beliefs, Metacognitive Awareness, Critical Thinking Abilities, and Their Professional Development: A Structural Equation Modeling Approach

Meisam Moghadam[1], Tahereh Sanavi[2]

1. PhD, Faculty of Science, Fasa University, Fasa, Iran
moghaddam.m@fasau.ac.ir (corresponding author)

2. MA, Islamic Azad University, Fasa Branch, Fasa, Iran
tsanavi@yahoo.com

Abstract

This study investigates an integrated model linking Iranian English as a Foreign Language (EFL) teachers' epistemological belief, metacognitive awareness, critical thinking abilities, and their professional development. Using a structural equation modeling (SEM) approach, the research tests a hypothesized model in which epistemological beliefs and metacognitive awareness predict critical thinking, which in turn mediates their relationships with professional development. Data were collected from 150 Iranian EFL teachers using some validated instruments. After assessing the measurement model, SEM was employed to test the direct and indirect pathways. The results supported the hypothesized model, revealing that critical thinking skills significantly mediated the relationship between epistemological beliefs and professional development. Furthermore, metacognitive awareness demonstrated both a direct effect on professional development and an indirect effect through critical thinking. The findings underscore the importance of fostering metacognitive and critical thinking skills in EFL teachers to enhance their professional growth. This study contributes to the literature by elucidating the cognitive mechanisms underlying teacher development, offering practical implications for designing teacher education and professional development programs in Iran and similar contexts.

Keywords: teachers' epistemological beliefs, metacognitive awareness, critical thinking abilities, professional development, structural equation modeling

Citation: Moghadam, M., & Sanavi, T. (2026). An investigation of Iranian English teachers' epistemological beliefs, metacognitive awareness, critical thinking abilities, and their professional development: A structural equation modeling approach. *Applications of Language Studies*, *4*(1), 243–277. https://doi.org/10.22034/jals.2026.2067763.1097

Received: 2025-08-03
Revised: 2024-08-18
Accepted: 2025-12-29
Published online: 2026-02-04

P-ISSN: 2588-6975
E-ISSN: 2588-6983
Article type: Research Paper
DOI: https://doi.org/10.22034/jals.2026.2067763.1097

1. Introduction

Teachers' performance and effectiveness are shaped by multiple factors, including assessment literacy, content and pedagogical knowledge, experience, oral proficiency, personality traits, and self-efficacy (Nayernia et al., 2022). In addition to these well-documented influences, epistemological beliefs (EBs), metacognitive awareness (MA), and professional development (PD) also play crucial roles in shaping teachers' instructional practices and continuous growth (Brownlee, 2001; Msila, 2014; Walker et al., 2011). Despite the established significance of these constructs, their interconnections remain underexplored, particularly in the context of language teaching. Understanding how these cognitive and metacognitive factors interact and contribute to PD can offer valuable insights for teacher education programs and professional training initiatives.

1.1. Epistemological Beliefs

Epistemology, a branch of philosophy, examines the origins, nature, and limits of human knowledge. EBs are conceptualized as individuals' perceptions regarding the nature of knowledge and learning (Schommer, 1990). These beliefs influence how knowledge is acquired, structured, and applied, making them fundamental to cognitive and instructional processes (Hofer & Pintrich, 1997). Research indicates that EBs significantly shape motivational beliefs, learning strategies, academic performance, and self-regulatory behaviors (Shell & Husman, 2008). Since teachers' EBs influence their instructional approaches, curriculum design, and classroom interactions, understanding their role is crucial in advancing effective teaching practices (Lawrence, 1992).

Schommer (1990) proposed a multidimensional framework for EBs, consisting of five independent yet interrelated dimensions: certain knowledge, simple knowledge, omniscient authority, quick learning, and innate ability. Each dimension is conceptualized along a continuum, with naive beliefs on one end and sophisticated beliefs on the other. Certain knowledge pertains to whether knowledge is viewed as fixed or evolving, while simple knowledge refers to whether knowledge is seen as discrete facts or interconnected concepts (Schommer, 1990). Omniscient authority reflects beliefs about the external or internal origins of knowledge, whereas quick learning concerns perceptions of the speed of learning. Finally,

innate ability relates to individuals' beliefs about the extent to which learning is determined by fixed traits versus effort and strategy (Schommer, 1990).

1.2. Metacognitive Awareness

MA refers to individuals' awareness of their own cognitive processes and their ability to regulate these processes effectively. It has been defined as "thinking about knowing" or more broadly as "thinking about thinking" (Duman, 2018). Researchers, such as Muhali et al. (2019), describe metacognition as an individual's self-awareness regarding their learning processes, while Riney (2021) defines it as the ability to monitor and regulate cognition to optimize learning outcomes.

MA consists of two primary components: metacognitive knowledge and metacognitive regulation (Brown, 1987; Flavell, 1987; Metcalfe & Shimamura, 1994; Schraw, 1994). Metacognitive knowledge encompasses individuals' beliefs about personal learning abilities, task demands, and strategies, while metacognitive regulation refers to their ability to plan, monitor, and evaluate cognitive processes (Vandergrift & Tafaghodtari, 2010). Developing strong MA enables learners to identify challenges in a given learning task and employ appropriate strategies to overcome them (Vandergrift et al., 2006). However, possessing metacognitive knowledge alone is insufficient—learners must also be capable of effectively utilizing this knowledge in real-world learning scenarios (Nelson, 1996; Sternberg, 1998).

1.3. Critical Thinking

Critical thinking (CT) has been widely defined as a cognitive process that involves reasoning, analysis, and evaluation (McPeck, 1983). Bowell and Kemp (2005) argue that CT entails individuals actively engaging in decision-making and assuming responsibility for their actions. It involves the ability to define, summarize, retrieve, analyze, and synthesize information (Gomez & Gomez, 2007) and to assess the relevance and reliability of newly acquired knowledge. Black (2005), Kuhn and Dean (2004), and Schroyens (2005) emphasize that for CT to develop, individuals must engage in higher-order cognitive processes. Ennis (1985) further characterizes CT as a reflective process aimed at determining what to believe or how to act based on reasoned judgment.

1.4. Teacher Professional Development

Given the dynamic nature of education, teachers must continuously update and refine their pedagogical skills. Teacher professional development (TPD) is therefore essential for ensuring instructional effectiveness and improving student outcomes. Since PD is embedded within the complex sociocultural and institutional landscape of schools, policies, and practices (Gorozidis & Papaioannou, 2013), its conceptualization varies widely. Typically, TPD is positioned within in-service teacher education (Tan, 2014) and aims to enhance teachers' expertise through training initiatives that address both content knowledge and pedagogical strategies (Hassel, 1999). Moreover, TPD encompasses teachers' beliefs, identities, and epistemologies, influencing their ongoing professional learning and adaptation to educational changes (Hewson, 2007).

1.5. Theoretical Rationale and Hypothesized Relationships

This study proposes an integrated model in which EBs and MA shape CT, which in turn are posited as essential drivers of PD for EFL teachers. To this end, the theoretical rationale for each hypothesized path in the structural model is elaborated to specify the relationship between each latent variable.

Firstly, with respect to the teachers' EBs as a foundational psychological construct, it is known that sophisticated beliefs—viewing knowledge as complex, evolving, and constructed—are theorized to create a cognitive disposition conducive to both metacognitive regulation and critical analysis (Hofer & Sinatra, 2010). Teachers who believe knowledge is not simply received from an authority but is actively built are more likely to engage in monitoring their own understanding (metacognition) and questioning assumptions (CT) (Schraw, 2013). Therefore, it is hypothesized that sophisticated EBs may positively predict both MA and CT skills.

On the other hand, MA provides the regulatory framework for higher-order thinking. It involves the knowledge and control over one's cognitive processes during learning and problem-solving (Schraw & Dennison, 1994). In this study, it is hypothesized that teachers with high MA are better equipped to deploy CT strategies deliberately—for instance, by

planning how to analyze a new teaching method, monitoring their evaluations of student work, and evaluating the logic of a curriculum proposal (Van der Stel & Veenman, 2010). Furthermore, metacognitive teachers are more likely to be reflective practitioners, actively seeking feedback, evaluating the effectiveness of their practices, and adapting their approaches—core activities of professional growth (Richards & Farrell, 2005). Hence, a direct positive relationship between MA and PD is hypothesized.

Furthermore, while EBs and metacognition provide the disposition and framework, CT represents the active cognitive engagement necessary for substantive professional growth. Effective PD requires teachers to critically analyze new pedagogical theories, evaluate evidence from their classroom practice, infer solutions to complex instructional problems, and make reasoned decisions about adoption (Burbank & Kauchak, 2003). It is hypothesized that the influence of foundational beliefs (EBs) on professional growth is not primarily direct, but is mediated through the cultivation of CT skills. Teachers with sophisticated beliefs are more likely to think critically, and it is this enhanced critical capacity that directly enables them to engage with, internalize, and implement professional learning effectively.

Overall, the proposed model suggests a causal chain wherein sophisticated EBs and MA foster CT abilities. These advanced cognitive resources then directly and indirectly empower teachers to pursue meaningful PD.

1.6. Research Gap and Objectives

While numerous studies have examined EBs, MA, CT, and PD separately or in dyadic relationships, there remains a lack of research investigating their combined effects. Given that these constructs are not merely linearly related but may be mediated or moderated by other factors, this study aims to explore the relationships between EBs, MA, CT, and PD among Iranian English teachers.

1.7. Research Questions

1. Is there a significant relationship between Iranian English teachers' EBs, MA, and PD?
2. Do teachers' EBs, MA, and CT abilities significantly predict their PD?

3. What is the role of CT abilities in the actualization of PD?

2. Method

2.1. Participants

The statistical sample consisted of 150 English language teachers employed in language institutes in Fasa and Shiraz, Iran. The sample size of 150 was evaluated for its adequacy for Structural Equation Modeling (SEM) using several guidelines. First, the model was considered 'complex' with four latent constructs and 15 observed indicators. While absolute sample size recommendations vary, our sample exceeds the common minimum threshold of 100-150 cases for model estimation (Kline, 2023). More importantly, we followed the recommendation to assess model adequacy through post-hoc fit indices rather than relying solely on arbitrary rules (Wang & Wang, 2020). The model's goodness-of-fit indices are robust indicators of how well the model is specified with the given sample. Furthermore, the model's parameter estimates were all statistically significant with reasonable standard errors, and the solution was proper (e.g., no negative variances, correlations not exceeding 1.0), which are empirical indicators of stability (Hair et al., 2022).

2.2. Instrumentation and data collection

To achieve the study's objectives, the following instruments were utilized for data collection:

MA Questionnaire: The 52-item MAQ (Schraw & Dennison, 1994) was used to assess participants' MA across two main components: Knowledge of Cognition (declarative, procedural, conditional) and Regulation of Cognition (planning, monitoring, evaluation). In this study, responses were collected and subsequently dichotomized. Participants initially indicated their agreement on the standard 5-point Likert scale.

However, for the purpose of analysis and to address specific concerns regarding response style in our cultural context, these responses were recoded into a binary format (0 = Disagree, encompassing original responses of 1 'Never' and 2 'Rarely'; 1 = Agree, encompassing original responses of 4 'Often' and 5 'Always'). The midpoint (3 'Sometimes') was treated as missing data to force a clear directional response, a method used to reduce ambivalence and central tendency bias, which can be pronounced in some collective cultures

(Smith, 2004). This approach prioritizes the clarity of endorsement/non-endorsement of metacognitive behaviors over gradations of frequency, aligning with a more confirmatory measurement model for the structural analysis.

EB Questionnaire: Participants' EBs were measured using a 63-item questionnaire adapted from Schommer's (1990) seminal work. The instrument is designed to tap into multiple dimensions of beliefs about knowledge and learning. In its original formulation, Schommer proposed four factors. However, subsequent research (e.g., Qian & Alvermann, 1995; Schraw et al., 2002) has often analyzed and discussed five conceptual dimensions: Innate/Fixed Ability, Simple Knowledge, Certain Knowledge, Omniscient Authority (Source), and Quick Learning. Our analysis followed this five-factor conceptual framework, which is widely used in the EFL/education literature.

Respondents indicated their agreement on a four-point Likert scale (1 = completely disagree to 4 = completely agree). The forced-choice format was employed to reduce central tendency bias. We acknowledge the documented challenges regarding the internal consistency of some EBQ subscales, as reported in previous studies (e.g., Schraw et al., 2002). To strengthen the measurement model for SEM, Construct-Level Reliability was employed in the current study. For SEM, composite reliability (CR) and average variance extracted (AVE) are more appropriate metrics than Cronbach's alpha for latent variables. These indices were reported for our final measurement model.

California Critical Thinking Skills Test (CCTST, Form B): The 34-item multiple-choice CCTST (Facione et al., 2002) was used to assess core CT skills (analysis, inference, evaluation). The Persian version, translated and validated by Davoodi and Naghsh Poor (2003), was employed. The reported Kuder-Richardson 21 (KR-21) reliability coefficient for the translated version in our study was 0.71, which is considered acceptable for group-level research and foundational scales (Nunnally & Bernstein, 1994). While this level of reliability suggests some measurement error, the CCTST remains a widely validated, objective performance-based measure of CT, which is a strength compared to self-report questionnaires. In the context of SEM, the measurement model accounts for such error through the estimation

of residual variances for the observed indicators, providing a more accurate estimate of the latent construct's relationships.

EFL Teachers' Perceptions of Professional Development Scale: To measure EFL teachers' perceptions of PD, the scale developed by Shayesteh and Baleghizadeh (2023) was employed. This instrument consists of 56 items organized under six main rubrics, providing a comprehensive assessment of teachers' views on professional growth and development.

2.3. Data Analysis

To investigate the relationships among EBs, MA, CT abilities, and PD, a multi-step data analysis approach was employed. The analyses were conducted using SPSS and AMOS for descriptive statistics, reliability testing path analysis and SEM, and R program for confirmatory factor analysis (CFA).

Descriptive statistics, including mean, standard deviation, skewness, and kurtosis, were calculated for all subscales of the latent variables. This step ensured that the data distribution met the assumptions for subsequent analyses. The Kaiser-Meyer-Olkin (KMO) Test and Bartlett's Test of Sphericity confirmed the suitability of the data for factor analysis. Components with eigenvalues greater than 1 were retained, and factor loadings exceeding 0.5 were considered significant.

In the next step, a two-step SEM approach was implemented, including a measurement model and a structural model. With respect to the measurement model, a CFA was conducted to validate the factor structure and assess goodness-of-fit indices (e.g., RMSEA, CFI, NFI, IFI). Then, to assess the internal consistency of the measurement scales, Cronbach's Alpha and Composite Reliability (CR) were calculated for each construct. A threshold of $\alpha > 0.7$ and CR > 0.7 was used to confirm adequate reliability. Convergent validity was examined using Average Variance Extracted (AVE), with values above 0.5 considered acceptable.

Then, regarding the structural model, the hypothesized relationships between EBs, MA, CT, and PD were tested using path analysis. Standardized regression coefficients (β), standard errors (SE), and critical ratios (CR) were used to assess the significance of relationships. For the sake of mediation analysis, bootstrapping with 5,000 resamples was used to test the indirect

effects of CT as a mediator between EBs, MA, and PD. The significance of mediation effects was determined using confidence intervals.

3. Results

3.1. Descriptive Statistics of Research Variables

Descriptive statistics provide an overview of the dataset by summarizing key measures such as the mean, standard deviation, skewness, and kurtosis. These statistics help determine the distributional properties of the variables, allowing us to assess whether the data meets the assumptions required for further statistical analyses. A normal distribution is essential for parametric tests, ensuring reliable and interpretable results. Table 1 presents the descriptive statistics of all subscales of latent variables, confirming that the data exhibit acceptable levels (in the range of +2 to -2) of normality.

Table 1

Descriptive Statistics of all Subscales of Latent Variables

Epistemological Beliefs	3.1469	1.23053	-.263	1.904	1.49	4.49
Science	3.1142	1.28101	-.236	-1.787	1.19	4.94
Certainty	3.1147	1.29067	-.262	-1.693	1.10	4.80
Learning	3.1549	1.24351	-.250	-1.681	1.15	5.00
Fast	3.1500	1.29484	-.252	-1.689	1.20	4.90
Specialty	3.1739	1.23719	-.229	-1.720	1.09	4.82
Metacognitive Awareness	.4785	.20193	.187	-1.637	.12	.85
Declarative	.4883	.25880	.177	-1.132	.00	1.00
Procedural	.4833	.31151	.149	-.948	.00	1.00
Conditional	.4813	.28198	-.113	-.935	.00	1.00
Planning	.4790	.24557	.096	-.621	.00	1.00
Information	.4773	.25597	.169	-.963	.00	1.00
Comprehension	.4610	.24220	.342	-.618	.00	1.00
Debugging	.4733	.28513	.119	-.906	.00	1.00
Evaluation	.4856	.27303	.076	-.846	.00	1.00
Critical Thinking	.5290	.21258	-.222	-1.529	.12	.85
Assessment	.5467	.23666	-.302	-1.050	.08	1.00

Inference	.5115	.24420	-.037	-1.201	.09	1.00
Analysis	.5281	.24960	-.148	-.999	.00	1.00
Deductive	.5241	.24928	-.238	-1.269	.08	.92
Inductive	.5329	.21509	-.045	-1.095	.13	1.00
Professional Development	3.1980	1.26254	-.292	-1.886	1.46	4.63
Activities	3.1978	1.32370	-.256	-1.757	1.25	4.83
Benefits	3.1816	1.29901	-.268	-1.809	1.29	4.88
Needs	3.2358	1.25071	-.291	-1.686	1.00	5.00
Barriers	3.1896	1.26781	-.280	-1.773	1.19	4.88

3.2. Correlation Analysis

The Pearson correlation analysis was conducted to examine the relationships between EBs, metacognitive self-awareness, CT abilities, and PD. Correlation coefficients indicate the strength and direction of associations between variables, helping identify significant connections that may inform subsequent SEM. A significant correlation suggests that variables are meaningfully related, providing preliminary support for hypothesized relationships. Table 2 displays the correlation matrix, demonstrating the interconnectedness of key constructs in the study.

Table 2

Correlation Matrix for the Latent Variables

Epistemological beliefs	1			
Metacognitive awareness	.362**	1		
Critical thinking	.439**	.396**	1	
Professional Development	.594**	.454**	.493**	1

3.3. Sample Adequacy and Factor Analysis for measurement model

To ensure that the dataset was suitable for factor analysis, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were performed. The KMO test evaluates the adequacy of the sample size for factor analysis, with values above 0.7 indicating sufficient sampling adequacy. Bartlett's Test of Sphericity assesses whether correlations between variables are significant,

justifying the use of factor analysis. These tests confirm that our dataset meets the necessary assumptions for valid factor extraction and CFA, supporting the structural integrity of our measurement model. Based on the indicator obtained for the latent variables, the results of the KMO test are as follows, which shows that the number of data is suitable for factor analysis.

Table 3

KMO Test

Epistemological beliefs	0.959
Metacognitive awareness	0.728
Critical thinking abilities	0.784
Professional development	0.968

Bartlett test was used to estimate whether all of the sub-scales were correlated within themselves and with their own latent variables. It is necessary to mention that the Bartlett test result should be significant ($p < .05$). If the mean level in the Bartlett test is less than 5%, the correlation matrix will not be uniform, i.e., there is a correlation between variables, and the null statistical assumption will be rejected.

Table 4

Bartlett's Test

Epistemological beliefs	6	153.729	0.000
Metacognitive awareness	1326	2168.092	0.000
Critical thinking abilities	561	1066.311	0.000
Professional development	1540	6997.209	0.000

According to Tables 3 and 4, all of the statistics for the KMO measure were higher than .5, showing the sampling appropriateness. In addition, a confidence level of .00 for Bartlett's test confirms the appropriateness of the factor model for all of the latent variables.

3.4. Measurement Model

3.4.1. Confirmatory Factor Analysis (CFA)

The following results were obtained from a CFA conducted to validate the measurement model, assessing the relationships between observed variables (questionnaire items) and their respective latent constructs. The analysis was performed using the lavaan package in R with robust maximum likelihood estimation (MLR) on a sample of 150 observations. The model included four latent variables, and 17 factors measured by 66 observed variables. Full information maximum likelihood (FIML) was used to handle missing data.

3.4.2. Model Fit Indices

The purpose of the goodness of fit test is to determine to what extent a model is consistent with the relevant data. Therefore, this section evaluates the adequacy of the research hypothesis model to ensure its consistency with the research data and ultimately to answer the research questions. In accordance with Jöreskog and Sörbom (1996), the goodness of fit indices for the model was calculated using the maximum likelihood estimation approach in AMOS version 24. A review of the conceptual model of the facial model is acceptable.

Table 5

Model Fit Indices

CFI	0.943	(>0.90)	Excellent
TLI	0.938	(>0.90)	Excellent
RMSEA	0.037	(<0.05)	Excellent
SRMR	0.052	(<0.08)	Excellent

Based on the results depicted in Table 5, the model demonstrated acceptable fit to the data, as evidenced by the following indices. With respect to the Chi-Square Test (χ^2), the results, including $\chi^2 = 2279.95$, df = 1898, p-value = < .001, show a non-significant p-value ($p > 0.05$), which indicates that the model fits the data well, with no significant discrepancy between the hypothesized model and observed data. Moreover, the Comparative Fit Index value (CFI= 0.943) and Tucker-Lewis Index value (TLI= 0.938) indicate that these values suggest near-perfect fit, as they exceed the stringent threshold of 0.90. Also, Root Mean Square Error of Approximation (RMSEA= 0.037) is well below the cutoff of 0.05, indicating excellent fit. The p-value for RMSEA $\leq$ 0.05 was 0.031, further confirming strong model fit.

Standardized Root Mean Square Residual (SRMR = 0.052, Ideal: < 0.08) is a low value, which suggests minimal residual covariance, reinforcing the model's strong fit.

3.4.3. Factor Loadings (Standardized Estimates)

The standardized factor loadings presented in Table 6 demonstrate generally adequate measurement properties across constructs. All EB items exhibited strong loadings ranging from 0.62 to 0.88, with 67% exceeding the 0.70 threshold, indicating excellent convergent validity for these factors. The pattern of factor loadings suggests differential measurement quality across constructs. The strong loadings for EBs indicate these items effectively capture their intended latent constructs. However, MA items showed more variability, with loadings ranging from 0.20 to 0.51 and nine items falling below the 0.40 threshold. CT and PD constructs showed excellent item loadings.

Table 6

Standardized Factor Loadings for the Measurement Model

Part A: Epistemological Beliefs

Factor	Item	Loading	Interpretation
Simple Knowledge	b2	0.702	Good
	b11	0.739	Good
	b16	0.674	Good
	b17	0.749	Good
	b19	0.691	Good
	b22	0.755	Excellent
	b23	0.753	Excellent
	b33	0.754	Excellent
Certain Knowledge	b1	0.877	Excellent
	b5	0.720	Good
	b36	0.740	Good
	b40	0.716	Good
	b6	0.738	Good
	b7	0.765	Excellent
	b13	0.731	Good
	b31	0.833	Excellent

Innate Ability	b26	0.737	Good
	b32	0.740	Good
	b43	0.753	Excellent
	b49	0.654	Good
	b8	0.720	Good
	b47	0.747	Good
	b55	0.747	Good
	b57	0.730	Good
Quick Learning	b10	0.790	Excellent
	b29	0.736	Good
	b39	0.724	Good
	b50	0.735	Good
	b60	0.751	Excellent
	b20	0.778	Excellent
	b24	0.662	Good
	b51	0.756	Excellent
Omniscient Authority	b9	0.623	Good
	b27	0.684	Good
	b41	0.674	Good
	b42	0.775	Excellent
	b44	0.680	Good
	b12	0.729	Good
	b21	0.708	Good
	b30	0.749	Good

Note: Loadings ≥ 0.70 = "Excellent", 0.50-0.69 = "Good", < 0.50 = "Fair/Poor"

Part B: Metacognitive Awareness

Factor	**Item**	**Loading**	**Interpretation**
Declarative Knowledge	m5	0.410	Fair
	m10	0.395	Fair
	m12	0.340	Poor
	m16	0.513	Good
	m17	0.360	Poor
	m20	0.408	Fair
	m32	0.312	Poor
	m46	0.496	Fair

Procedural Knowledge	m3	0.413	Fair
	m14	0.465	Fair
	m27	0.476	Fair
	m33	0.354	Poor
Conditional Knowledge	m15	0.490	Fair
	m18	0.433	Fair
	m26	0.345	Poor
	m29	0.201	Poor
	m35	0.487	Fair

Part C: Critical Thinking & Professional Development

Factor	Item	Loading	Interpretation
Critical Thinking			
Assessment	assessment	0.736	Good
Inference	inferenc	0.724	Good
Analysis	Analysis	0.735	Excellent
Deductive Reasoning	Deductive	0.751	Excellent
Inductive Reasoning	Inductive	0.736	Good
Professional Development			
PD Activities	Activities	0.755	Excellent
PD Benefits	Benefits	0.753	Excellent
PD Needs	Needs	0.754	Excellent
PD Barriers	Barriers	0.877	Excellent

3.4.4. Reliability and Variance Explained

Reliability and validity indices (Table 7) showed differential performance across constructs. EB factors demonstrated excellent reliability (α = .885-.917, CR = .887-.919) and adequate convergent validity (AVE = .496-.588). MA factors showed acceptable to poor reliability (α = .462-.608, CR = .472-.611) and suboptimal convergent validity (AVE = .165-.185), falling below the recommended 0.50 threshold. CT and PD factors yielded acceptable to excellent reliability and validity.

All in all, the CFA results support the validity and reliability of the measurement model with excellent model fit across all indices (CFI, TLI, RMSEA, SRMR), strong factor loadings, confirming convergent validity and significant correlations among constructs, aligning with

theoretical expectations. Checking the measurement model, the structural equation model is presented to specify the path analysis between the latent variables.

Table 7

Reliability and Validity Indices

Factor	**Items**	**α**	**CR**	**AVE**	**Interpretation**
Epistemological Beliefs					
Simple Knowledge	8	.900	.900	.530	Good
Certain Knowledge	8	.917	.919	.588	Good
Innate Ability	8	.900	.901	.532	Good
Quick Learning	8	.907	.907	.551	Good
Omniscient Authority	8	.885	.887	.496	Acceptable
Metacognitive Awareness					
Declarative Knowledge	8	.608	.611	.168	Acceptable
Procedural Knowledge	4	.471	.472	.185	Needs improvement
Conditional Knowledge	5	.462	.478	.165	Needs improvement
Critical Thinking					
Assessment	1	.800	.900	.630	Acceptable
Inference	1	.917	.919	.688	Acceptable
Analysis	1	.870	.901	.732	Acceptable
Deductive Reasoning	1	.907	.907	.551	Acceptable
Inductive Reasoning	1	.885	.887	.696	Acceptable
Professional Development					
PD Activities	12	.900	.900	.630	Acceptable
PD Benefits	17	.917	.919	.770	Acceptable
PD Needs	11	.900	.901	.642	Acceptable
PD Barriers	15	.907	.907	.7	Acceptable

*Note: α = Cronbach's alpha, CR = Composite Reliability, AVE = Average Variance Extracted

3.4.5. Structural Equation Model (SEM) Analysis

The research model was tested using SEM, and both the non-standard and standardized regression coefficient models are presented in Figures 1 and 2. SEM was employed to test the hypothesized relationships among EBs, metacognitive self-awareness, CT, and PD. SEM is particularly useful in examining complex models with multiple dependent and independent

variables, as it accounts for measurement errors and evaluates direct and indirect effects simultaneously. The standardized regression coefficients provide insights into the strength and direction of the relationships among variables. This figure also shows the standardized path correlations between the latent variables along with their sub-scales.

Figure 1

The Non-Standard Regression Coefficient Model of the Research Model

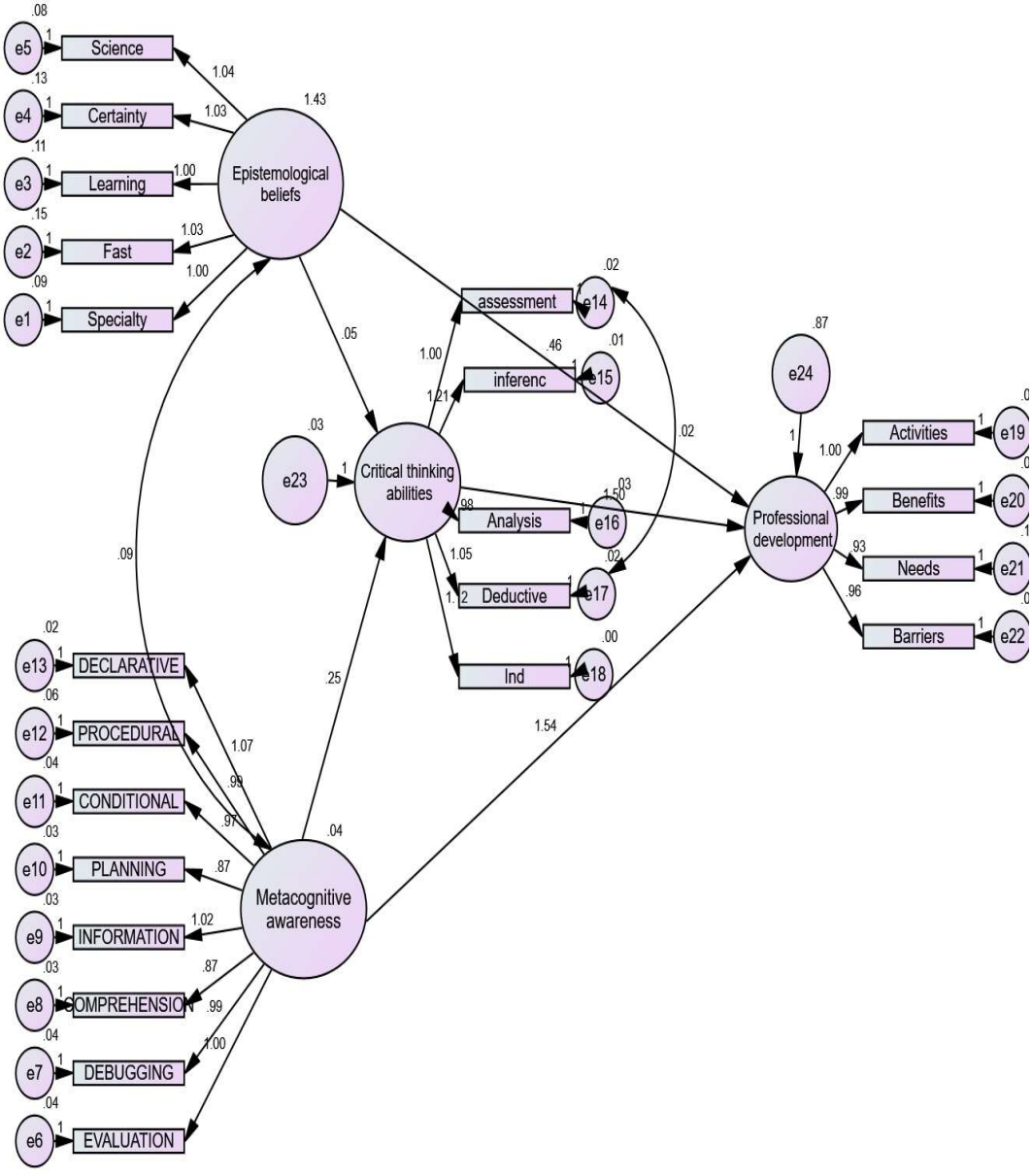
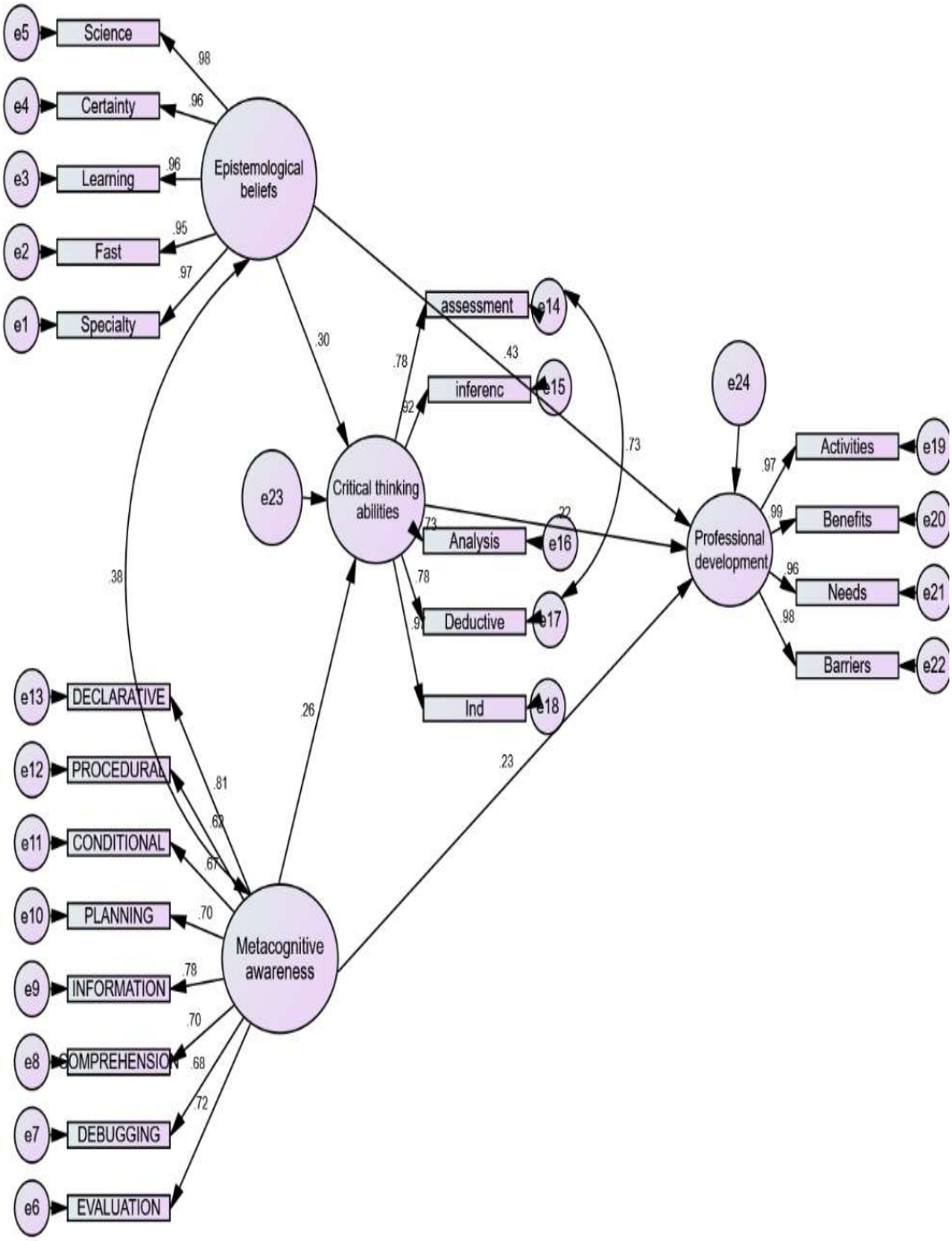


Figure 2

Standardized Regression Coefficient Model of the Research Model



3.4.6. Structural Model

The structural model evaluates the direct and indirect effects of EBs and MA on professional development through CT. Regression coefficients were examined for hypothesis testing.

Table 8

Regression Coefficients of Research Hypothesis Variables

The first hypothesis	critical thinking abilities	<	epistemological beliefs	.297	.013	3.494	0.000
The second hypothesis	critical thinking abilities	<	metacognitive self-awareness	.263	.085	2.909	.004
The third hypothesis	Professional test development	<	critical thinking abilities	.216	.504	2.975	0.003
The fourth hypothesis	Professional development	<	metacognitive self-awareness	.235	.496	3.108	0.002
The fifth hypothesis.	Professional development	<	epistemological beliefs.	.428	.076	6.046	0.000

According to Table 8, the regression coefficient sign shows the positive effect of two variables. In general, if the value of the critical area is greater than 1.96, it indicates that the effect is significant. Considering the critical area value and P-value, EBs have a significant effect on CT abilities (P = 0.000), MA has a significant effect on CT abilities (P = 0.004), CT abilities have a significant effect on PD (P = 0.003), MA has an impact on PD (P = 0.002), and EBs have a significant effect on CT abilities (P = 0.000).

Hypothesis #1: EBs have a positive and significant effect on CT abilities.

According to the table, the regression coefficient of EBs on CT abilities is equal to 0.297, and the value of the critical area is equal to 3.494 (more than 1.96), indicating that this coefficient is significant at the 5% significance level. In general, the results from the model estimation indicate that EBs have a positive and significant effect on CT abilities.

Hypothesis #2: MA has a positive and significant effect on CT abilities.

According to the table, the regression coefficient of MA on CT abilities is equal to 0.263, and the value of the critical area for this coefficient is equal to 2.909 and more than 1.96, which shows that this coefficient is significant at the 5% error level. In general, the results from the model estimation indicate that MA has a positive and significant effect on CT abilities.

Hypothesis #3: CT abilities have a positive and significant effect on teachers' PD.

According to the table, the regression coefficient of CT ability as a variable on PD is equal to 0.216, and the value of the critical area for this coefficient is equal to 2.975 and more than 1.96, which shows that this coefficient is significant at the 5% error level. In general, the results from the model estimation indicate that CT abilities have a positive and meaningful effect on PD.

Hypothesis #4: MA has a positive and significant effect on PD.

According to the table, the regression coefficient of MA on PD is equal to 0.235, and the value of the critical area for this coefficient is equal to 3.108 and more than 1.96, which shows that this coefficient is significant at the 5% error level. In general, the results from the model estimation indicate that MA has a positive and significant effect on PD.

Hypothesis #5: EBs have a positive and significant effect on PD.

The regression coefficient for the impact of EBs on PD stands at 0.428, with a critical area value of 6.046 and greater than 1.96, indicating its significance at the 5% error level. In general, the results from the model estimation indicate that EBs have a positive and significant effect on PD.

3.4.7. Mediation Analysis

To examine the indirect effects of CT abilities, bootstrapping was applied. The results confirm that CT significantly mediates the relationship between EBs, MA, and PD.

In summary, it can be said that EBs have a strong direct effect on PD, meaning that teachers' beliefs about knowledge influence their professional growth. Moreover, MA impacts both CT and PD, suggesting that metacognitive skills help enhance educators' reflective practices, while CT plays a partial mediating role, reinforcing its importance in professional

learning. The high model fit indices validate the structural framework, confirming that the proposed model effectively explains teachers' PD dynamics.

Table 9

Examining the Indirect Effects or Mediating Role of CT Based on Bootstrapping

Epistemological beliefs > Critical thinking abilities > Professional development	.069	0.008	.150	.019
Metacognitive awareness > Critical thinking abilities > Professional development	.373	.030	.913	.028

4. Discussion

4.1. Interpretation of Findings

This study explored the relationships between EBs, MA, CT abilities, and PD using the SEM approach. The results revealed that EBs significantly influence both CT and PD, which is consistent with prior research highlighting the role of EBs in shaping cognitive processing and learning behaviors (Hofer & Pintrich, 1997; Schommer, 1998). Specifically, the subscales of EBs (science/simplicity, certainty, learning, fast learning, and specialty) played distinct roles in predicting PD outcomes. These findings align with previous studies indicating that teachers' beliefs about knowledge and knowing impact their instructional strategies and professional growth (Alexander & Dochy, 1995; Brownlee, 2001).

The findings confirm the findings by Bath and Smith (2009), who noted the epistemological perspectives of individuals as a variable that can affect the improvement of lifelong learning skills. In the same line, Mataka et al. (2019) confirmed that understanding teachers' EBs can serve as a vehicle in terms of mobilizing appropriate resources for PD. Moreover, Hofer and Pintrich (1997) justified that teachers' understanding and beliefs about learning and knowledge significantly influence their lifelong learning and enhance the understanding of the process of PD.

Regarding the factors that affect TPD, Kwakman (2002) provided much relevant information on the model of factors that have an impact on teachers' participation in PD. According to Kwakman, there are 13 different factors, including 5 personal factors including teachers' beliefs, five task-related factors, and three contextual factors. McLaughlin and Talbert (2006), Torff and Sessions (2009), and Yamagata-Lynch and Haudenschild (2009) believed that teachers' perception is among the internal factors which affect TPD. Furthermore, Lohman (2006) stated that teachers' beliefs are the main internal factor that affects TPD.

MA was also found to be a strong predictor of both CT and PD, supporting prior research emphasizing the importance of self-regulated learning and metacognitive control in educational settings (Balcikanli, 2011; Jaleel, 2016). The significant effect of MA on PD suggests that teachers with greater awareness of their cognitive processes are more likely to engage in reflective practices and continuous learning (Dogra, 2016; Yildiz & Akdag, 2018).

Concina (2019) and Kosior et al. (2019) enumerated MA as an essential component of learning. Hughes and Partida (2020) believed that teachers with higher levels of MA maintain higher improved learning capacity and the capacity to integrate PD learning into classroom practices. In the same line, Jaleel (2016) stated that metacognition among teachers can enhance their efficacy as teachers while also improving their PD. Therefore, MA is regarded as a crucial step in the development and learning process. Karimi and Ziaabadi (2019) found that teachers' MA played a significant role in classroom procedures, improving their instruction and getting students actively involved in learning, which affects their PD.

The results of the present study contributed to the conclusions reached by Mantilla and Bustamante (2023). They explored the significant influence of MA and socialization on the teachers' professionalism. Using a correlational study, the results revealed that there was a positive significant correlation between MA and teachers' professionalism. Moreover, the results are congruent with the findings of Yildiz and Akdag (2018), that MA was helpful for teachers' professional and personal development, and that it was a significant factor in increasing success, learning throughout the life span, creative and CT, and building self-confidence.

Virtanen et al. (2018) conducted a study in which educators stated a shared goal of advancing their PD in order to strengthen their capacity to include MA into the curriculum. In the same vein, this result supports Zeng and Goh's (2018) conclusion that having a strong MA is beneficial for both teaching and learning.

The study's findings also support Shaukat and Chowdhury's (2021) assertion that teachers who are aware of professional standards are more likely to cultivate a dedication to teaching, high standards, and a favorable attitude toward their field.

With respect to the second research question, the present study aimed to explore whether teachers' EBs, MA, and CT abilities significantly predict their PD. As seen, EB and MA have a positive and significant effect on CT abilities, and subsequently CT abilities have a positive and significant effect on teachers' PD.

Regarding the relationship between MA and CT abilities, Akyüz et al. (2015) concluded that MA in online learning environments can effectively develop CT among pre-service teachers. Furthermore, Dinçer and Çilek (2022) analyzed the relation between preservice classroom teachers' MA of reading practices and CT attitudes and concluded the significant effect of MA on CTA. Arslan (2015) found a positive correlation between CT and metacognition.

CT emerged as a significant mediating factor in the model, reinforcing its role in translating EBs and MA into meaningful professional growth. This supports studies that have emphasized the link between CT and metacognition (Akyüz et al., 2015; Arslan, 2015) and highlights the need for PD programs to incorporate CT training to enhance teachers' pedagogical effectiveness (Black, 2005; McPeck, 1983).

These inferred results are in line with the findings of the previous models that indicated the association between CT and metacognition (Arslan, 2015; Black, 2005; Choy & Cheah, 2009; Coutinho et al. 2005; Kuhn & Dean, 2004; Magno, 2010; Orion & Kali, 2005; Schroyens, 2005).

Considering the relationship between teachers' EBs and their CTA, a wide range of studies have been conducted which confirm the results concluded in the present study.

According to Hofer and Sinatra (2010), there is a link between CT and EBs. Therefore, it can be said that individuals with sophisticated EBs are likely to be more critical in the thinking process (Getahun et al., 2016). Similarly, many researchers (Bendixen & Rule, 2004; Dahl et al., 2005; Hofer, 2004; Schommer, 1990) state that individuals with sophisticated EBs have higher CT skills and dispositions because it is a fact that higher-order thinking skills like CT are required to have sophisticated EBs (Bendixen & Hartley, 2003). Moreover, many studies in the literature have concluded that EBs and CT are significantly related to each other (Başbay, 2013; Hyytinen et al., 2014; Koyunlu Ünlü & Dökme, 2017; Wyre, 2007).

Chan et al. (2011), Hofer and Sinatra (2010), and Anderson-Meger (2014) examined the relationship between epistemic beliefs and CT and concluded that teachers' EBs significantly affect their CTA. Moreover, Kuhn (1999) discussed EBs under four headings as realistic, absolutist, pluralistic, and evaluative and states that there is a significant association between these beliefs and CT.

King and Kitchener (2004), Bok (2006), and Kuhn (2005) concluded that CT skills and dispositions increase in parallel with the maturation of EBs. Hyytinen et al. (2014) concluded that EBs and CT skills are intertwined and affect each other. In short, EBs that affect many higher-order thinking skills also affect CT. CT and EBs, which are in mutual interaction, affect each other. Therefore, it is possible to say that people with sophisticated EBs will have high CT dispositions and skills (Bok, 2006; Getahun et al., 2016; King & Kitchener, 2004; Kuhn, 2005).

Previous research, including this study, indicated that EBs were significant predictors of CT dispositions. EBs have determinative effects on various variables such as individuals' ability of comprehension, their preferred study strategies, the effort and time they spend for learning, the way they interpret the new information they encounter for the first time and most importantly higher-order thinking skills like CT, creative thinking, or problem-solving (Boulton-Lewis et al., 2001; Brownlee et al. 2001; Chan, 2007). Also, many researchers have the same idea that sophisticated EBs are a prerequisite for an individual to engage in CT (Bendixen & Rule, 2004; Dahl et al., 2005; Gallagher, 1998; Hofer, 2004; Jones & Merritt, 1999) because sophisticated EBs constitute a basis for the flexible thinking which is a must for

CT (Chan et al., 2011). Therefore, it can be inferred that the individuals who have naive EBs will probably show poor CT performance. It can be said that sophisticated EBs lead to more developed cognitive strategies for learning, and naive EBs can be related to less need for cognition, which shows us the strong relationship between CT and EBs (Kuhn & Weinstock, 2002).

According to Hofer and Sinatra (2010), the cognitive process, which includes higher-order thinking skills like CT, is highly affected by the individual's beliefs about the source, development, certainty, and justification of the knowledge and learning. In other words, EBs can highly affect individuals' CT skills and dispositions. Individuals with sophisticated EBs tend to be more critical in the thinking process (Getahun et al., 2016), and more sophisticated EBs have a positive effect on the development of CT skills and dispositions (Anderson-Meger, 2014).

With respect to the proposed model as a whole, Başbay (2013) examined the partial mediating effect of MA level in the relationship between CT dispositions and EBs of university students. Results of SEM supported the proposed model and concluded that students' CT dispositions affect their EBs, and the metacognition variable is a partially mediating variable.

4.2. Contribution to the Literature

The findings of this study contribute to the existing literature in several ways. First, by integrating EBs, MA, and CT within a single SEM model, this research provides a comprehensive framework for understanding the cognitive and metacognitive factors influencing PD. While previous studies have examined these constructs separately (Gorozidis & Papaioannou, 2013; Kwakman, 2002), this study empirically demonstrates their interconnectedness, thus offering a more holistic perspective.

Second, the study's findings underscore the importance of fostering epistemological sophistication among teachers to enhance their PD. This aligns with earlier research emphasizing the need for professional training programs to focus on teachers' beliefs about knowledge and learning (Hofer & Pintrich, 1997; Schommer, 1998). Additionally, the identification of CT as a mediating variable suggests that PD initiatives should integrate CT

skills to maximize their impact on teaching effectiveness (Mataka et al., 2019; McLaughlin & Talbert, 2006).

Lastly, the study extends prior work on metacognition by demonstrating its direct and indirect effects on PD. The findings support the argument that metacognitive strategies not only enhance learning outcomes but also contribute to teachers' continuous professional growth (Bulut, 2018; Ozturk, 2017). This highlights the need for teacher education programs to incorporate metacognitive training as part of their curriculum to improve instructional practices and lifelong learning among educators.

5. Conclusions and Practical Implications

This study provides empirical evidence supporting the structural relationships among EBs, MA, CT, and PD. The results suggest that fostering sophisticated EBs and metacognitive skills can significantly enhance teachers' professional growth. Moreover, the mediating role of CT underscores its importance in translating cognitive and metacognitive attributes into meaningful professional learning. These findings have important implications for teacher training programs, educational policymakers, and future research aimed at improving teacher effectiveness and lifelong learning.

The results have significant implications for teacher education and PD. Given the strong influence of EBs and MA on professional growth, educational policymakers and institutions should design training programs that promote reflective thinking and epistemological understanding. Workshops and professional learning communities could be established to help teachers critically evaluate their beliefs about knowledge and adopt evidence-based instructional practices (Hewson, 2007; Virtanen et al., 2018).

Furthermore, the findings suggest that integrating metacognitive strategies into PD programs can enhance teachers' self-regulated learning and adaptability to new teaching methodologies (Lim et al., 2014; Vandergrift & Tafaghodtari, 2010). Training sessions focusing on self-monitoring, goal-setting, and self-reflection should be implemented to improve teachers' metacognitive skills and overall effectiveness in the classroom (Belenky et al., 1986; Mantilla & Bustamante, 2023).

Despite its contributions, this study has certain limitations. First, the study relied on self-reported measures, which may be subject to response biases. Future research could incorporate observational data or experimental designs to validate the findings. Second, the sample size, while meeting minimum thresholds for SEM and yielding a stable, well-fitting model, is modest. Although model fit indices were excellent, a larger sample would provide greater statistical power, reduce the margin of error for parameter estimates, and enhance the generalizability of the findings. Future research should aim to replicate this model with a larger and more diverse sample of EFL teachers to confirm the stability of the observed relationships (Nayernia et al., 2022; Shaukat & Chowdhury, 2021).

Additionally, while this study identified CT as a mediator, future research could explore potential moderators, such as teaching experience or institutional support, to better understand the contextual factors influencing PD (Lohman, 2006; Yamagata-Lynch & Haudenschild, 2009). Longitudinal studies could also be conducted to examine the long-term impact of EBs and MA on professional growth (Nelson, 1996; Walker et al., 2011).

Conflict of interest

The author(s) certify/certifies that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in the present research paper.

References

Akyüz, H. A., Samsa-Yetik, S., & Keser, H. (2015). Effects of metacognitive guidance on critical thinking disposition. *Pegem Eğitim ve Öğretim Dergisi, 5*(2), 133–148.

Alexander, P. A., & Dochy, F. J. (1995). Conceptions of knowledge and beliefs: A comparison across varying cultural and educational communities. *American Educational Research Journal, 32*(2), 413–442.

Anderson-Meger, J. (2014). Epistemological development in social work education. *Journal of Ethnographic & Qualitative Research, 9*(2), 69–88.

Arslan, S. (2015). Investigating predictive role of critical thinking on metacognition with structural equation modeling. *Malaysian Online Journal of Educational Sciences, 3*(2), 1–10.

Balcikanli, C. (2011). Metacognitive Awareness Inventory for Teachers (MAIT). *Electronic Journal of Research in Educational Psychology, 9*, 1309–1322.

Bath, D. M., & Smith, C. D. (2009). The relationship between epistemological beliefs and the propensity for lifelong learning. *Studies in Continuing Education, 31*(2), 173–189.

Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986). *Women's ways of knowing: The development of self, voice and mind*. Basic Books.

Bendixen, L. D., & Hartley, K. (2003). Successful learning with hypermedia: The role of epistemological beliefs and metacognitive awareness. *Journal of Educational Computing Research, 28*(1), 15–30.

Bendixen, L. D., & Rule, D. C. (2004). An integrative approach to personal epistemology: A guiding model. *Educational Psychologist, 39*(1), 69–80.

Black, S. (2005). Teaching students to think critically. *The Education Digest, 70*(6), 42–47.

Bok, D. (2006). *Our underachieving colleges: A candid look at how much students learn and why they should be learning more*. Princeton University Press.

Boulton-Lewis, G. M., Smith, D. J. H., McCrindle, A. R., Burnett, P. C., & Campbell, K. (2001). Secondary teachers' conceptions of teaching and learning. *Learning and Instruction, 11*(1), 35–51.

Bowell, T., & Kemp, G. (2005). *Critical Thinking: A Concise Guide* (2nd ed.). Routledge.

Brown, A. L. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanisms. In F. E. Weinert & R. H. Kluwe (Eds.), *Metacognition, motivation, and understanding* (pp. 65–116). Lawrence Erlbaum Associates.

Brownlee, J. (2001). Knowing and learning in teacher education: A theoretical framework of core and peripheral epistemological beliefs. *Asia Pacific Journal of Teacher Education & Development, 4*(1), 67–190.

Brownlee, J., Purdie, N., & Boulton-Lewis, G. (2001). Changing epistemological beliefs in pre-service teacher education students. *Teaching in Higher Education, 6*(2), 247–268.

Bulut, I. (2018). The levels of classroom and pre-school teachers' metacognitive awareness. *Universal Journal of Educational Research, 6*(12), 2697–2706. https://eric.ed.gov/?id=EJ1198884

Burbank, M. D., & Kauchak, D. (2003). An alternative model for professional development: Investigations into effective collaboration. *Teaching and Teacher Education, 19*(5), 499–514.

Chan, N.-M. (2007). *Epistemological beliefs and critical thinking among Chinese students* [M.Phil. thesis]. University of Hong Kong.

Chan, N.-M., Ho, I. T., & Ku, K. Y. L. (2011). Epistemic beliefs and critical thinking of Chinese students. *Learning and Individual Differences, 21*(1), 67–77.

Choy, S. C., & Cheah, P. K. (2009). Teacher perceptions of critical thinking among students and its influence on higher education. *International Journal of Teaching and Learning in Higher Education, 20*(2), 198–206.

Concina, E. (2019). The role of metacognitive skills in music learning and performing: Theoretical features and educational implications. *Frontiers in Psychology, 10*, Article 1583. https://doi.org/10.3389/fpsyg.2019.01583

Coutinho, S., Wiemer-Hastings, K., Skowronski, J. J., & Britt, M. A. (2005). Metacognition, need for cognition and use of explanations during ongoing learning and problem solving. *Learning and Individual Differences, 15*(4), 321–337.

Dahl, T. I., Bals, M., & Turi, A. L. (2005). Are students' beliefs about knowledge and learning associated with their reported use of learning strategies? *British Journal of Educational Psychology, 75*, 257–273.

Davoodi, A., & Naghsh Poor, P. (2003). Determination of reliability, validity and norm of California critical thinking skills test, form B. *Journal of Babol University of Medical Sciences, 5*(5), 84–90.

Dinçer, B., & Çilek, G. (2022). The analysis of the relation between metacognitive awareness of reading strategies and critical thinking attitude of pre-service classroom teachers. *International Journal of Progressive Education, 18*(2), 49–70.

Dogra, A. (2016). The impact of metacognitive awareness on student's achievement in psychology. *International Education and Research Journal, 2*(8), 48–50. https://www.academia.edu/download/56909352/17-Ambalika_Dogra.pdf

Duman, B. (2018). The relationship between the entrepreneurship characteristics and metacognitive awareness levels of pre-service teachers. *Journal of Education and Training Studies, 6*(5), 30–40.

Ennis, R. H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership, 43*(2), 44–48.

Facione, P. A., Facione, N. C., & Giancarlo, C. A. F. (2002). *The California Critical Thinking Skills Test: CCTST*. The California Academic Press.

Flavell, J. H. (1987). Speculations about the nature and development of metacognition. In F. E. Weinert & R. H. Kluwe (Eds.), *Metacognition, motivation, and understanding* (pp. 21–29). Lawrence Erlbaum Associates.

Gallagher, S. A. (1998). The road to critical thinking: The Perry scheme and meaningful differentiation. *NASSP Bulletin, 82*(595), 12–20.

Getahun, D. A., Saroyan, A., & Aulls, M. W. (2016). Examining undergraduate students' conceptions of inquiry in terms of epistemic belief differences. *Canadian Journal of Higher Education, 46*(2), 181–205.

Gomez, L. M., & Gomez, K. (2007). Reading for learning: Literacy supports for 21st-century work. *Phi Delta Kappan, 89*(3), 224–228.

Gorozidis, G., & Papaioannou, A. G. (2013). Teachers' motivation to participate in training and to implement innovations. *Teaching and Teacher Education, 39*, 1–11.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage.

Hassel, B. C. (1999). *The charter school challenge: Avoiding the pitfalls, fulfilling the promise*. The Brookings Institution.

Hewson, P. W. (2007). Teacher professional development in science. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 1179–1203). Lawrence Erlbaum Associates.

Hofer, B. K. (2004). Epistemological understanding as a metacognitive process: Thinking aloud during online searching. *Educational Psychologist, 39*(1), 43–55.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*, 88–140.

Hofer, B. K., & Sinatra, G. M. (2010). Epistemology, metacognition, and self-regulation: Musings on an emerging field. *Metacognition and Learning, 5*(1), 113–120.

Hughes, A. J., & Partida, E. (2020). Promoting preservice STEM education teachers' metacognitive awareness: Professional development designed to improve teacher metacognitive awareness. *Journal of Technology Education, 32*(1), 4–19.

Hyytinen, H., Holma, K., Toom, A., Shavelson, R. J., & Lindblom-Ylänne, S. (2014). The complex relationship between students' critical thinking and epistemological beliefs in the context of problem solving. *Frontline Learning Research, 2*(5), 1–18.

Jaleel, S. (2016). A study on the metacognitive awareness of secondary school students. *Universal Journal of Educational Research, 4*(1), 165–172. https://eric.ed.gov/?id=EJ1086242

Jones, P. C., & Merritt, J. Q. (1999). Critical thinking and interdisciplinarity in environmental higher education: The case for epistemological and values awareness. *Journal of Geography in Higher Education, 23*(3), 349–357.

Jöreskog, K. G., & Sörbom, D. (1996). *LISREL 8: User's reference guide*. Scientific Software International.

Karimi, M. N., & Ziaabadi, F. (2019). Teachers' motivation to teach, teacher credibility, metacognitive awareness, and students' motivation and affective learning: A structural equation modeling analysis. *Teaching English Language, 13*(2), 57–82. http://www.teljournal.org/article_89275_f69099c2a831404128efa9233236d675

King, P. M., & Kitchener, K. S. (2004). Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood. *Educational Psychologist, 39*(1), 5–18.

Kline, R. B. (2023). *Principles and practice of structural equation modeling* (5th ed.). Guilford Press.

Kosior, K., Wall, T., & Ferrero, S. (2019). The role of metacognition in teaching clinical reasoning: Theory to practice. *Education in the Health Professions, 2*(2), 108–114.

Koyunlu Ünlü, Z., & Dökme, İ. (2017). Science teacher candidates' epistemological beliefs and critical thinking disposition. *Eurasian Journal of Educational Research, 17*(72), 185–202.

Kuhn, D. (1999). A developmental model of critical thinking. *Educational Researcher, 28*(2), 16–26.

Kuhn, D. (2005). *Education for thinking*. Harvard University Press.

Kuhn, D., & Dean, D. (2004). Metacognition: A bridge between cognitive psychology and educational practice. *Theory Into Practice, 43*(4), 268–274.

Kuhn, D., & Weinstock, M. (2002). What is epistemological thinking and why does it matter? In B. K. Hofer & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 121–144). Lawrence Erlbaum Associates.

Kwakman, K. (2002). Factors affecting teachers' participation in professional learning activities. *Teaching and Teacher Education, 19*, 149–170.

Lawrence, C. L. (1992). *Preservice teachers' development of pedagogical understandings and epistemological frameworks* [Paper presentation]. Annual Meeting of the Educational Research Association, San Francisco, CA, United States.

Lim, C. P., Tondeur, J., Nastiti, H., & Pagram, J. E. (2014). Educational innovations and pedagogical beliefs: The case of a professional development program for Indonesian teachers. *Journal of Applied Research in Education, 18*, 1–14.

Lohman, M. (2006). Factors influencing teachers' engagement in informal learning activities. *Journal of Workplace Learning, 18*(3), 141–156.

Magno, C. (2010). The role of metacognitive skills in developing critical thinking. *Metacognition and Learning, 5*(2), 137–156.

Mantilla, J. G. M., & Bustamante, R. J. (2023). Meta-cognitive awareness and socialization as predictors of teachers' professionalism. *International Journal of Innovative Science and Research Technology, 8*(12), 761–778.

Mataka, L. M., Saderholm, J. C., & Hodge, T. (2019). Faculty epistemological beliefs and the influence of professional development. *Science Education International, 30*(4), 364–372. https://doi.org/10.33828/sei.v30.i4.14

McLaughlin, M. W., & Talbert, J. E. (2006). *Building school-based teacher learning communities: Professional strategies to improve student achievement*. Teacher College Press.

McPeck, J. E. (1983). Critical thinking and education. *Teachers College Record, 85*(1), 154–157.

Metcalfe, J., & Shimamura, A. P. (Eds.). (1994). *Metacognition: Knowing about knowing*. MIT Press.

Msila, V. (2014). Teacher development, teacher beliefs and professional development: The value of classroom observations. *Mediterranean Journal of Social Sciences, 5*(8), 265–270.

Muhali, Yuanita, L., & Ibrahim, M. (2019). The validity and effectiveness of the reflective-metacognitive learning model in improving students' metacognitive ability in Indonesia. *Malaysian Journal of Learning and Instruction, 16*(2), 147–172.

Nayernia, A., Nosrati, R., & Mohebbi, H. (2022). The factors contributing to language teachers' effectiveness in an EFL learning context: A questionnaire validation study. *Profile Issues in Teachers' Professional Development, 24*(2), 63–79.

Nelson, T. O. (1996). Consciousness and metacognition. *American Psychologist, 51*, 102–116.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Orion, N., & Kali, Y. (2005). The effect of an earth-science learning program on students' scientific thinking skills. *Journal of Geoscience Education, 53*(4), 387–393. https://doi.org/10.5408/1089-9995-53.4.387

Ozturk, N. (2017). Assessing metacognition: Theory and practices. *International Journal of Assessment Tools in Education, 4*(2), 134–148. https://dergipark.org.tr/tr/doi/10.21449/ijate.298299

Qian, G., & Alvermann, D. (1995). Role of epistemological beliefs and learned helplessness in secondary school students' learning science concepts from text. *Journal of Educational Psychology, 87*(2), 282–292.

Richards, J. C., & Farrell, T. S. C. (2005). *Professional development for language teachers: Strategies for teacher learning*. Cambridge University Press.

Riney, R. (2021). Why metacognition matters more than ever before: Real lessons of 2020. *Journal of Applied Social Psychology, 51*(12), 1184–1186. https://doi.org/10.1111/jasp.12765

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82*(3), 498–504.

Schommer, M. (1998). The influence of age and education on epistemological beliefs. *British Journal of Educational Psychology, 68*(4), 551–562.

Schraw, G. (1994). The effect of metacognitive knowledge on local and global monitoring. *Contemporary Educational Psychology, 19*(2), 143–154.

Schraw, G. (2013). Conceptual integration and measurement of epistemological and ontological beliefs in educational research. *ISRN Education, 2013*, Article 327680. https://doi.org/10.1155/2013/327680

Schraw, G., Bendixen, L. D., & Dunkle, M. E. (2002). Development and validation of the Epistemic Beliefs Inventory (EBI). In B. K. Hofer & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 261–275). Lawrence Erlbaum Associates.

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*(4), 460–475. https://doi.org/10.1006/ceps.1994.1033

Schroyens, W. (2005). Knowledge and thought: An introduction to critical thinking. *Experimental Psychology, 52*(2), 163–164.

Shaukat, S., & Chowdhury, R. (2021). Pre-service teachers' perceptions of professional standards and their integration into pre-service training: A comparative study of Australia and Pakistan. *Australian Journal of Teacher Education, 46*(11), 54–68. https://search.informit.org/doi/abs/10.3316/informit.274718860667219

Shayesteh, L. A., & Baleghizadeh, S. (2023). Construction and validation of Iranian EFL teachers' perceptions of professional development questionnaire. *Language Related Research, 14*(1), 113–143.

Shell, D. F., & Husman, J. (2008). Control, motivation, affect, and strategic self-regulation in the college classroom: A multidimensional phenomenon. *Journal of Educational Psychology, 100*(2), 443–459.

Smith, P. B. (2004). Acquiescent response bias as an aspect of cultural communication style. *Journal of Cross-Cultural Psychology, 35*, 50–61. https://doi.org/10.1177/0022022103260380

Sternberg, R. J. (1998). Metacognition, abilities and developing expertise: What makes an expert student? *Instructional Science, 26*(1–2), 127–140.

Tan, A. L. (2014). In-service teacher education. In R. Gunstone (Ed.), *Encyclopedia of science education* (pp. 223–226). Springer.

Torff, B., & Sessions, D. (2009). Teachers' attitudes about professional development in high-SES and low-SES communities. *Learning Inquiry, 3*(2), 67–77.

Van der Stel, M., & Veenman, M. V. J. (2010). Development of metacognitive skillfulness: A longitudinal study. *Learning and Individual Differences, 20*(3), 220–224.

Vandergrift, L., Goh, C. C. M., Mareschal, C., & Tafaghodtari, M. H. (2006). The metacognitive awareness listening questionnaire (MALQ): Development and validation. *Language Learning, 56*(3), 431–462.

Vandergrift, L., & Tafaghodtari, M. H. (2010). Teaching L2 learners how to listen does make a difference: An empirical study. *Language Learning, 60*(2), 470–497.

Virtanen, P., Niemi, H., & Nevgi, A. (2018). Active learning and self-regulation enhance student teachers' professional competences. *Australian Journal of Teacher Education, 42*(12), 1–20. https://search.informit.org/doi/abs/10.3316/ielapa.313660196196001

Walker, S., Brownlee, J. M., Cobb-Moore, C., Boulton-Lewis, G. M., Ailwood, J., Johansson, E., & Whiteford, C. (2011). Early years teachers' epistemic beliefs and beliefs about children's moral learning. *Teachers and Teaching: Theory and Practice, 18*(2), 263–275.

Wang, J., & Wang, X. (2020). *Structural equation modeling: Applications using Mplus* (2nd ed.). Wiley.

Wyre, S. H. (2007). *Critical thinking, metacognition, and epistemological beliefs* [Doctoral dissertation, University of Phoenix]. ProQuest Dissertations & Theses.

Yamagata-Lynch, L. C., & Haudenschild, M. T. (2009). Using activity systems analysis to identify inner contradictions in teacher professional development. *Teaching and Teacher Education, 25*, 507–517.

Yildiz, H., & Akdag, M. (2018). The effect of metacognitive strategies on prospective teachers' metacognitive awareness and self efficacy belief. *Journal of Education and Training Studies, 5*(12), 30–40. https://eric.ed.gov/?id=EJ1161209

Zeng, Y., & Goh, C. C. M. (2018). A self-regulated learning approach to extensive listening and its impact on listening achievement and metacognitive awareness. *Studies in Second Language Learning and Teaching, 8*(2), 193–218. https://doi.org/10.14746/ssllt.2018.8.2.2