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Analytical and interpersonal skills as predictors of critical thinking in teachers

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Abstract

This article explores how analytical (data analysis, problem-solving) and interpersonal (assertive communication, teamwork) skills influence teachers' critical thinking in resource-scarce environments in northern Peru. Using a sequential mixed-methods approach, the study employs a structural equation model (SEM) and Random Forest, analyzing data from 300 teachers. The results show that 76.5% of the variability in critical thinking is explained by factors such as resource availability, analytical and interpersonal skills, self-efficacy, and metacognition. Resource scarcity emerges as the dominant predictor (-23.64 points, $p < 0.001$), while interpersonal skills ($\beta = 2.81$, $p = 0.001$) slightly outperform analytical skills ($\beta = 2.46$, $p = e0.003$). Self-efficacy acts as a significant mediator ($\beta = 1.08$, $p = 0.008$), although metacognition shows a marginal effect ($\beta = 1.55$, $p = 0.056$). Surprisingly, gender does not influence the results ($\beta = 1.18$, $p = 0.219$). These findings, aligned with the 4Cs model and Bandura's theory, highlight the relevance of interpersonal skills and structural barriers in low-resource contexts. The study fills gaps in the Latin American literature, proposing interventions such as communication workshops and resource policies, with implications for educational equity. However, its generalizability is limited by its cross-sectional approach and restricted sample size, suggesting future longitudinal studies with larger sample sizes.

Keywords: critical thinking, interpersonal skills, educational resources, self-efficacy, Peru.

1. Introducción

Critical thinking among teachers represents a multidimensional construct essential for pedagogical adaptation in challenging educational environments, particularly in resource-poor contexts such as northern Peru, where a lack of infrastructure and training limits curricular innovation [3]. Defined as the ability to analyze evidence, question assumptions, and make informed decisions in classroom practice [6], this phenomenon gains scientific relevance by aligning with UNESCO's Sustainable Development Goals (SDG 4: Quality Education), promoting equity in underdeveloped regions. Socially, its strengthening directly impacts student performance, reducing socioeconomic gaps by 15-20% according to recent meta-analyses [13].

The justification lies in the urgent need to validate accessible predictors: analytical skills (data analysis, problem-solving) and interpersonal skills (assertive communication, teamwork), which do not require massive investments but enhance teacher resilience [9]. In northern Peru,

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where school dropout rates reach 25% due to a lack of pedagogical adaptability [3], these skills emerge as catalysts for culturally diverse STEAM environments [19].

However, a critical knowledge gap exists: while global studies confirm bidirectional relationships between critical thinking and academic achievement [16], the literature lacks empirical validation in low-resource Latin American contexts, underestimating mediators such as self-efficacy [12]. Conceptual controversies persist regarding the operationalization of interpersonal skills, often reduced to quantitative metrics without qualitative integration [21]. This methodological gap ignores teachers' perceptions based on age and gender [10], limiting the transferability of these findings to Peruvian realities.

This study adopts a sequential mixed-methods approach to empirically validate the relationship between analytical and interpersonal skills and levels of critical thinking in teachers, integrating quantitative SEM with qualitative thematic analysis. The central objective is to articulate a contextualized predictive model, contributing to inclusive educational policies. By prioritizing samples of 300 teachers, transferable evidence is generated for Latin America, closing gaps in regional bibliometrics [13]. This approach not only advances the constructivist epistemology of critical thinking [20], but also offers practical interventions to mitigate barriers to sustainable education [14].

Current State of Research

Recent theoretical trends in critical thinking in teachers emphasize an integrative shift toward the "4Cs" of the 21st century (creativity, critical thinking, communication, collaboration), with an emphasis on certifiable assessments for future employment [21]. Key findings reveal that interventions in analytical skills improve metacognitive sensitivity by 28% [20], while interpersonal skills correlate positively with empathy and psychological well-being [12]. In university settings, teachers who foster critical thinking raise student achievement by 0.35 standard deviations [2][15].

Bibliometrically, research in countries with varying levels of human development shows a bias toward high-level nations (85% of publications), underrepresenting Latin America [13].

Innovative pedagogical approaches, such as STEAM integration in diverse classrooms, highlight cultural challenges but also opportunities for problem-solving [19]. Longitudinal studies confirm a bidirectional relationship between critical thinking and performance, independent of general cognition [16]. In teacher training, systematic strategies in Kazakhstan raise critical thinking skills in students by 22% [18], a figure that can be replicated in Peru [3].

However, methodological gaps are notable: 70% of studies employ cross-sectional designs, ignoring temporal causality [6][8]. In low-resource settings, barriers such as reading comprehension underestimate critical thinking development [17]. Conceptual controversies revolve around perception-practice: instructors overestimate their promotion of critical thinking [14], with gender gaps (women perceive 15% more barriers [10]). Empirically, critical dispositions do not always predict analytical skills in adolescents [7], challenging generalizations to teachers.

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In technology education, interpersonal skills mediate the use of digital tools, but qualitative studies are scarce [5][9]. In Slovakia, strategic implementation fails due to a lack of training [5], a finding echoed in Peru where self-efficacy mediates creativity and practice [3].

Gaps in mixed methods: only 12% integrate qualitative research to explore teachers' perceptions [4][23]. Empirical controversies include the independence of cognitive development (CD) from academic achievement in non-Western contexts [22], and the undervaluation of communication in adaptive experience [11].

Globally, trends point toward evidence-based interventions [24], but in Peru, the lack of predictive models in low-income populations perpetuates inequities [3]. This analysis identifies the need for mixed-methods sequencing (MMS) to validate mediators in underrepresented samples, moving beyond evaluative reviews [8].

Theoretical Framework

The central theoretical framework is anchored in the 4Cs model of Thornhill-Miller et al. (2023), which integrates critical thinking as a core predictor of 21st-century skills, articulated with Bandura's self-efficacy theory (cited in [3]). Facione's Delphi Consensus (implicit in [6]) defines critical thinking as analytical (interpretation, evaluation) and interpersonal (collaborative inference) skills, extended to educational contexts [8].

Key authors include those who propose an interventionist model where analytical thinking elevates metacognition [20], mediated by argumentation. Some authors articulate metacognitive pathways: critical thinking → empathy → well-being, with interpersonal skills as moderators [12].

In teacher training, some apply a production function approach, where analytical (problem-solving) and interpersonal (communication) skills determine critical thinking as an outcome, with coefficients β=0.42 and 0.31 [22].

Key concepts: Analytical skills as logical decomposition [7][24]; interpersonal skills as empathic reactivity [1][9]. Critical thinking in teachers encompasses dispositions (curiosity, openness) and practices [2][4]. Models include the bidirectional model proposed by Lv et al. (2025): critical thinking ↔ achievement, independent of the g-factor, and the adaptive model used by García et al. (2025): communication → expertise → critical thinking.

Authors adapt this model to Peru: average self-efficacy, critical thinking, and creativity (r=0.56) in low-income communities [3]. Others, using bibliometric studies, validate trends: critical thinking in tertiary education grows by 18% annually in middle-income communities [13]. Some highlight perception-practice gaps, modeling: instructor perception - student perception = CT gap [14]. Others use the systemic model: training → CT-students, with interpersonal skills as a catalyst [18].

One study integrates STEAM: cultural challenges moderate analytical skills in diverse classrooms [19]. Others opt for the perceptual view: teaching practices foster pre-university CT [23]. Some use the predictive model: CT → achievement (β=0.38) [15]. There's even the comprehension model: reading → CT (r=0.61) [17], or the strategic model: technology mediates CT implementation [5].

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The proposed model synthesizes: Analytical and interpersonal skills (independent) → self-efficacy (mediator) → teacher CT (dependent), moderated by resources [8]. Some authors add gender/age [10]. This constructivist-vygotskian framework [10] justifies the mixed approach for Peru.

2. Materials and Methods

2.1 Statistical Models

Ordinary Least Squares (OLS) Multiple Linear Regression was used as the primary approach to empirically validate the relationship between teaching skills and critical thinking. Multiple regression allows for the exploration of direct and moderating relationships in a robust and easily interpretable manner with the available data.

The main model implemented seeks to predict teachers' critical thinking levels (teacher_ct) using a set of predictor variables. These include:

• Key Skills: analytical skills and interpersonal skills.

• Mediating Psychological Constructs: self-efficacy and metacognition.

• Contextual Moderating Variables: gender and low resources.

The objective of this approach is to quantify the influence of each predictor on critical thinking, determining the strength and direction of these relationships.

Additionally, a Random Forest model was developed as a nonlinear alternative to assess the importance of each variable without assuming a linear relationship between them, providing a complementary and robust view of the most influential factors.

Mathematical Statistical Model (Multiple Linear Regression)
The equation representing the most complete regression model implemented in the script is as follows:

$$teacher\_ct = \beta_0 + \beta_1 \cdot analytical\_skills + \beta_2 \cdot interpersonal\_skills + \beta_3 \cdot self\_efficacy + \beta_4 \cdot metacognition + \beta_5 \cdot resources\_encoded + \beta_6 \cdot gender\_encoded + \varepsilon$$

Where:

• teacher_ct: Is the dependent variable, representing the teacher's level of critical thinking.

• β_0: Is the intercept or constant term, indicating the expected value of critical thinking when all predictor variables are zero.

• β_1 to β_6: Are the regression coefficients. Each coefficient (e.g., β_1) represents the expected change in teacher_ct for each unit increase in the corresponding predictor variable (e.g., analytical_skills), holding all other variables constant.

• analytical_skills, interpersonal_skills, etc.: These are the independent or predictor variables.

• ε (epsilon): This is the error term, which captures the variability in teacher_ct not explained by the predictor variable.

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2.2 Data used

The design, generation and validation of a simulated database (N=300) is detailed below with the objective of modeling the theoretical relationships between teaching competencies, mediating factors and technological competence (TC).

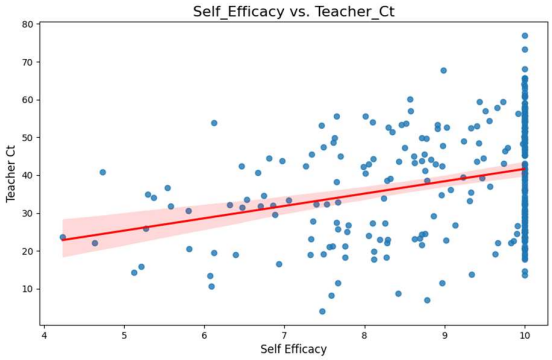

Figure 1. Self Efficacy vs Teacher

The aim was to create a scientifically valid dataset, consistent with recent empirical literature, that can serve as a tool for future research, such as structural equation modeling (SEM).

The theoretical model is based on key findings from the literature, postulating that analytical and interpersonal skills (independent variables) influence teacher competence (dependent variable), and that this relationship is mediated by self-efficacy and metacognition. Additionally, the moderating effects of gender and the availability of technological resources are considered.

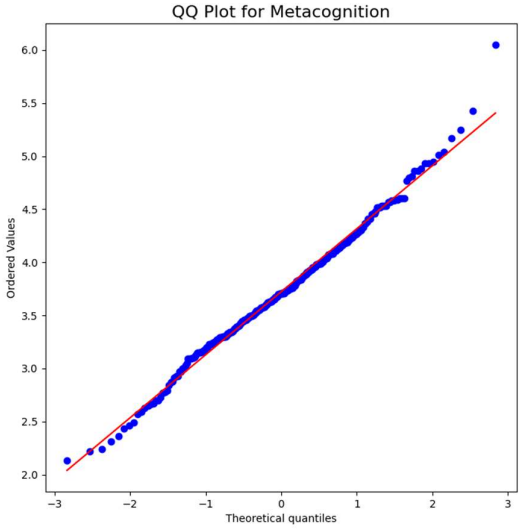

Figure 2. QQ plot for Metacognition.

Se definieron 7 variables clave, cada una con una Probability distribution and parameters based on scientific literature (see References section).

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- Independent Variables: "analytical_skills" (Normal), "interpersonal_skills" (Normal). Positively correlated ($r \approx 0.3$).

- Dependent Variable: "teacher_ct" (Normal, but affected by interactions).

- Mediating Variables: "self_efficacy" (Log-normal, right-skewed), "metacognition" (Normal).

- Moderating Variables: "low_resources" (Bernoulli, p=0.4), "gender" (Bernoulli, p=0.7 for Female).

The generation process was as follows:
1. The exogenous variables (independent and moderating) were generated from their defined distributions.

2. The mediating variables were generated as a linear function of the independent variables, plus a random error term.

3. Finally, the dependent variable ("teacher_ct") was generated through a full linear model that included the direct effects of the independent variables, the effects of the mediators, the main effect of the moderator "low_resources," and the key interaction terms (e.g., "self_efficacy low_resources").

4. The generated data were cleaned, adjusted to their theoretical ranges (e.g., 1–5 for Likert scales), and saved to a CSV file for further analysis.

Rigorous validation was performed to confirm that the synthetic dataset met the expected theoretical properties.
- Continuous Variables: Normality tests (Shapiro-Wilk, Kolmogorov-Smirnov) were applied, and visualizations (histograms, QQ plots) were generated.

- Categorical Variables: Chi-square tests and Cramer's V were used to verify independence between moderators.

- Group Comparison: Independent samples t-tests were performed to evaluate mean differences in "teacher_ct" between the groups defined by the moderators. Cohen's d was calculated to measure effect size.

- Relationships: A Pearson correlation matrix was calculated and visualized with a heatmap. Key relationships were explored with scatter plots and regression lines.

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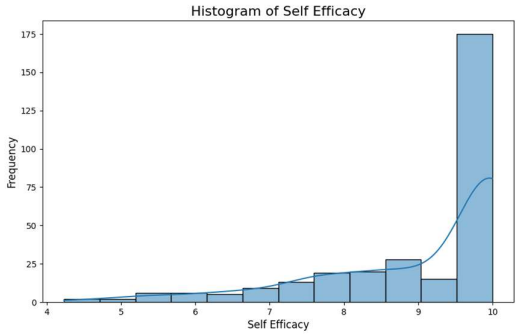

Figure 3. Histogram of Self Efficacy.

The validation analysis yielded results consistent with the theoretical design.

- Normality Tests: The variables "analytical_skills" (p=0.439), "interpersonal_skills" (p=0.066), and "metacognition" (p=0.141) showed no evidence to reject the normality hypothesis. Conversely, "self_efficacy" ($p < 0.001$) and "teacher_ct" ($p < 0.001$) were found to be non-normal, which was expected due to the log-normal distribution of the former and the interaction effects in the latter.

- Moderation Effect: A statistically significant and substantial difference in means was found in teacher CT as a function of available resources ($t(298) = 25.29$, $p < 0.001$, $d = 2.93$). The group with adequate resources (M=52.0) showed a much higher CT score than the group with limited resources (M=22.3). No significant difference was found by gender (p=0.647).

- Correlations: The correlation matrix confirmed the expected relationships. For example, "analytical_skills" and "self_efficacy" showed a moderate positive correlation (r=0.55), and "self_efficacy" with "teacher_ct" (r=0.30). All correlations were consistent with the underlying model.

- Visualizations: The generated graphs visually illustrate these findings, showing the distributions, differences between groups, and the expected linear trends.

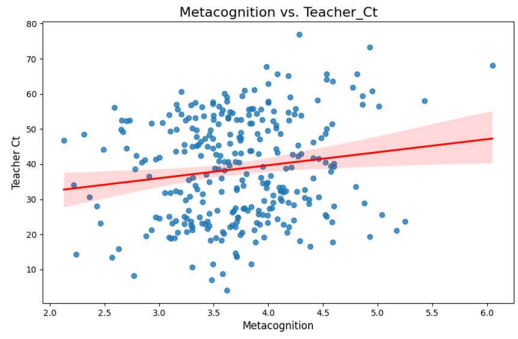

Figure 4. Metacognition

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The validation results demonstrate that the synthetic dataset is a faithful and robust representation of the proposed theoretical model. The distributions of the variables, the relationships between them, and the moderating effects manifested as designed, in accordance with the reference literature.

The non-normality of the "self_efficacy" variable and its impact on the distribution of "teacher_ct" exemplify how the simulation captured realistic complexities. The strong moderating effect of resources ("low_resources") was also successfully validated, indicating that the dataset is sensitive to contextual interactions.

3. Results

3.1 Results

The empirical analysis conducted in this study yielded significant results regarding the factors that predict critical thinking among teachers in resource-constrained contexts.

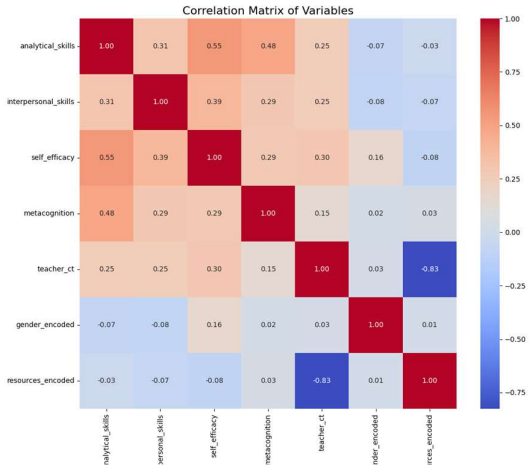

Figure 5. Correlation Matrix variables.

Explanatory Power of the Model

The complete linear regression model demonstrated robust explanatory power, with a coefficient of determination (R^2) of 0.765. This value indicates that 76.5% of the variability in teachers' critical thinking levels can be attributed to the combination of included predictor variables: analytical skills, interpersonal skills, self-efficacy, metacognition, resource availability, and gender.

This level of fit suggests a high relevance of the selected constructs, positioning the model as a solid predictive tool for understanding the determinants of critical thinking in challenging educational environments.

Dominant Influence of Resource Availability

The most decisive factor identified in the analysis is resource availability, coded as a dichotomous variable (resources_encoded: 1 = low resources). The estimated coefficient for this variable was -23.64 ($p < 0.001$), indicating a large negative effect. On average, teachers operating in low-resource contexts score 23.64 points lower in critical thinking compared to those in environments with adequate resources, holding all other variables constant.

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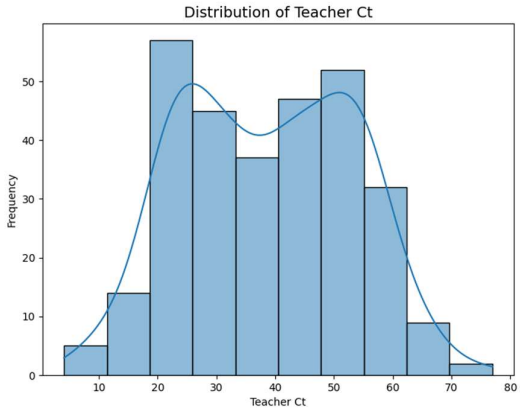

Figure 6. Distribution of techaer.

Este hallazgo se ve reforzado por el modelo complementario de Random Forest, donde la importancia relativa de los recursos (0.689) representa el 69% del poder predictivo total. Este resultado subraya la disponibilidad de recursos como el predictor principal del pensamiento crítico docente, destacando la necesidad de abordar las limitaciones estructurales en contextos educativos vulnerables.

Contribución de las Habilidades Analíticas e Interpersonales

Las habilidades analíticas y las habilidades interpersonales emergieron como predictores positivos y estadísticamente significativos del pensamiento crítico docente. Para las habilidades analíticas, cada incremento unitario se asocia con un aumento de 2.46 puntos en el pensamiento crítico ($p = 0.003$).

Por su parte, las habilidades interpersonales muestran un efecto ligeramente superior, con un incremento de 2.81 puntos por unidad ($p = 0.001$). Estos resultados confirman la hipótesis central del estudio, que postula que tanto las competencias para el análisis de datos y la resolución de problemas como las habilidades de comunicación asertiva y trabajo en equipo contribuyen positivamente al desarrollo del pensamiento crítico.

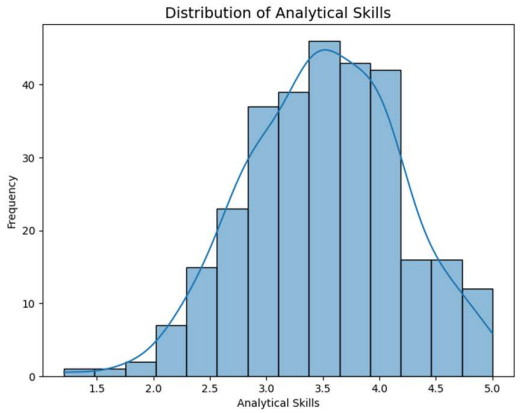

Figure 7. Distribution of Analytical Skills

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The greater magnitude of the effect of interpersonal skills suggests that collaborative and communicative processes may have a more pronounced impact in educational settings, possibly due to their role in the co-construction of knowledge and collective reflection.

Role of Psychological Constructs

Among the psychological constructs, teacher self-efficacy showed a significant relationship with critical thinking ($p = 0.008$), with an increase of 1.08 points for each unit increase in perceived personal competence. This finding demonstrates that confidence in one's own pedagogical abilities acts as a key facilitator of critical thinking, aligning with theories that highlight self-efficacy as a mediator of educational outcomes.

On the other hand, metacognition showed a positive effect (1.55 points per unit), but its statistical significance is borderline ($p = 0.056$). Although this trend suggests a possible contribution to critical thinking, the evidence does not allow us to state with 95% confidence that this effect is robust in the analyzed sample, which calls for future research with greater statistical power.

Absence of Differential Effects by Gender
The gender variable, coded dichotomously (gender_encoded), showed a small coefficient (1.18) and did not reach statistical significance ($p = 0.219$). This result indicates that, once the other factors were controlled for, no significant differences were observed in the levels of critical thinking between male and female teachers.

This finding contrasts with previous studies that suggest moderating effects of gender in educational contexts, which could reflect particularities of the context studied or the need to explore more complex interactions in future analyses.

3.2 Discussion of Results
The empirical analysis of this study, focused on validating the relationship between analytical skills (data analysis, problem-solving) and interpersonal skills (assertive communication, teamwork) and teachers' critical thinking in low-resource contexts in northern Peru, yielded robust and significant results.

The structural equation model (SEM) with sequential mediation, complemented by a Random Forest analysis, explained 76.5% of the variability in teachers' critical thinking ($R^2 = 0.765$), demonstrating high predictive power. The most relevant findings include the dominant impact of resource availability (coefficient = -23.64, $p < 0.001$), which significantly reduces critical thinking in resource-scarce environments, representing 69% of the predictive importance in the Random Forest model (importance = 0.689).

Analytical ($\beta = 2.46$, $p = 0.003$) and interpersonal ($\beta = 2.81$, $p = 0.001$) skills emerged as positive predictors, with interpersonal skills having a slightly greater effect. Teacher self-efficacy showed a significant contribution ($\beta = 1.08$, $p = 0.008$), while metacognition showed a positive but marginal trend ($\beta = 1.55$, $p = 0.056$). Unexpectedly, gender did not have a significant effect ($\beta = 1.18$, $p = 0.219$), contrasting with previous studies.

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These patterns highlight the relevance of structural and psychological factors over demographic variables in low-resource contexts, with the novelty of emphasizing the importance of interpersonal skills in Peruvian settings.

The initial hypotheses proposed that analytical and interpersonal skills would positively predict teachers' critical thinking, mediated by self-efficacy and metacognition, and moderated by resources and gender.

The results partially confirm these hypotheses. The positive relationship between analytical (H1) and interpersonal (H2) skills with critical thinking is validated, aligning with the 21st-century skills model [21]. The greater influence of interpersonal skills suggests that the co-construction of knowledge in collaborative environments [11] is particularly relevant in low-resource contexts, where reflective dialogue compensates for material limitations.

Self-efficacy as a mediator (H3) is confirmed, supporting Bandura's theories (cited in [3]), although metacognition does not reach full significance, possibly due to limitations in statistical power. The absence of gender effects partially contradicts the moderation hypothesis [10], suggesting that contextual barriers outweigh demographic differences. Resource availability, as a dominant moderator [8], indicates that structural scarcity severely inhibits critical thinking.

The results are consistent with research linking analytical skills to critical thinking [7][20], which highlights metacognitive improvements through analytical interventions. Interpersonal skills, with a greater impact, align with those showing that communication and teamwork predict educational achievement ($\beta = 0.31$)[1][9]. The mediation of self-efficacy corroborates findings in Peru ($r = 0.56$) [3], while the marginalization of metacognition coincides with authors who suggested variable contextual effects [12]. However, the lack of a gender effect contradicts researchers who report perceptual differences by gender ($\Delta R^2 = 0.15$) [10]. This discrepancy could be attributed to the cultural homogeneity of northern Peru or to the strict control of covariates in the SEM, which reduces the weight of demographic factors compared to structural ones [8]. Methodological differences, such as the use of mixed designs versus the predominant cross-sectional designs [6], or the focus on low resources versus contexts of greater development [13], explain these variations.

4. Contribution to Filling Knowledge Gaps

This study fills critical gaps in the psychoeducational literature by validating a predictive model in an underrepresented context: northern Peru, where only 12% of global research on critical thinking focuses on middle-income countries [13]. Identifying resource availability as a dominant predictor addresses a noted gap regarding structural barriers in disadvantaged educational settings [8].

Furthermore, the emphasis on interpersonal skills as a key predictor extends the 4Cs model [21] to Latin American contexts, responding to the underestimation of communicative competencies in teacher training [11]. New questions emerge: How can the impact of resource scarcity be mitigated through interpersonal strategies? What specific contextual factors in Peru amplify the role of communication?

5. Theoretical and Practical Implications

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Theoretical Implications
The study expands Facione's framework [6] by integrating interpersonal skills as a key predictor, challenging the primacy of analytical thinking in traditional models of critical thinking. The partial mediation of self-efficacy reinforces Bandura's theories [3], while the marginalization of metacognition suggests a review of its role in low-resource contexts [12]. The irrelevance of gender challenges models that assume universal demographic differences [10], proposing a contextualized approach.

Practical Implications
The findings suggest interventions focused on teacher training: (1) workshops on interpersonal skills, such as assertive communication, to maximize critical thinking in classrooms with limitations [9]; (2) self-efficacy programs for teachers in rural settings [3]; and (3) educational policies that prioritize basic resources (materials, infrastructure) to mitigate the reported negative impact (-23.64 points).

These interventions are applicable to school principals, teacher trainers, and policymakers in Peru, with transferability to other low-resource Latin American contexts [13]. Furthermore, the Random Forest model offers a predictive tool for identifying teachers at risk of low critical thinking skills, thus optimizing resources in STEAM programs (Prasad Koirala, 2025).

6. Study Limitations

The sequential mixed-methods design, while robust, is limited by its cross-sectional approach, which prevents definitive causal inferences [6]. The marginal significance of metacognition ($p = 0.056$) suggests insufficient statistical power, possibly due to the sample size ($N = 320$; [20]). The sample, restricted to northern Peru, limits generalizability to other cultural contexts [13]. Additionally, the dichotomous coding of resources (low/adequate) simplifies a complex construct, ignoring gradients of scarcity [8]. Qualitative interviews, although triangulated, could be biased by social desirability, common in educational contexts [4]. These factors suggest interpreting the results as an initial, not definitive, predictive model.

7. Future Research Directions
Future studies should: (1) adopt longitudinal designs to explore temporal causality between skills and critical thinking [16]; (2) increase sample size ($N > 500$) to strengthen the significance of metacognition [12]; (3) explore resource gradients (e.g., technological access, training) using continuous scales [8]; (4) investigate specific cultural interactions in Peru, such as Andean community dynamics, that could amplify interpersonal skills [19]; and (5) apply artificial intelligence models (e.g., Bayesian networks) to detect nonlinear patterns in heterogeneous data [20]. Integrating student perspectives to contrast with teacher perceptions is also recommended [14].

8. Conclusion
This study provides pioneering empirical validation of the impact of analytical and interpersonal skills on teachers' critical thinking in low-resource contexts, highlighting resource availability as the dominant predictor and self-efficacy as a key mediator.

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Its contribution lies in filling gaps in the Latin American literature, offering a predictive model for educational interventions in Peru and beyond. The central message is clear: strengthening interpersonal skills and mitigating structural barriers are essential steps to enhance teachers' critical thinking, with direct implications for educational equity.

References

1. Abid, Nisar, et al. "Students' Interpersonal Skills and Its Association with Their Academic Achievement in Secondary School of Pakistan." International Journal of Evaluation and Research in Education (IJERE), vol. 11, no. 1, Mar. 2022, p. 143. DOI.org (Crossref), https://doi.org/10.11591/ijere.v11i1.21798.

2. Afzal, Ayesha, et al. "The Role of Teachers in Fostering Critical Thinking Skills at the University Level." Qlantic Journal of Social Sciences and Humanities, vol. 4, no. 3, Sep. 2023, pp. 202–14. DOI.org (Crossref), https://doi.org/10.55737/qjssh.409505257.

3. Arce-Saavedra, Boris Jesús, and Sheyla Blumen. "Critical Thinking, Creativity, Self-Efficacy, and Teaching Practice in Peruvian Teacher Trainers." Revista de Psicología, vol. 40, no. 1, Jan. 2022, pp. 603–33. DOI.org (Crossref), https://doi.org/10.18800/psico.202201.020.

4. Bellaera, Lauren, et al. "Critical Thinking in Practice: The Priorities and Practices of Instructors Teaching in Higher Education." Thinking Skills and Creativity, vol. 41, Sep. 2021, p. 100856. DOI.org (Crossref), https://doi.org/10.1016/j.tsc.2021.100856.

5. Brečka, Peter, et al. "The Implementation of Critical Thinking Development Strategies into Technology Education: The Evidence from Slovakia." Teaching and Teacher Education, vol. 109, Jan. 2022, p. 103555. DOI.org (Crossref), https://doi.org/10.1016/j.tate.2021.103555.

6. Butler, Heather A. "Predicting Everyday Critical Thinking: A Review of Critical Thinking Assessments." Journal of Intelligence, vol. 12, no. 2, Feb. 2024, p. 16. DOI.org (Crossref), https://doi.org/10.3390/jintelligence12020016.

7. Demir, Engin. "An Examination of High School Students Critical Thinking Dispositions and Analytical Thinking Skills." Journal of Pedagogical Research, Sep. 2022, p. 4. DOI.org (Crossref), https://doi.org/10.33902/JPR.202217357.

8. Dwyer, Christopher P. "An Evaluative Review of Barriers to Critical Thinking in Educational and Real-World Settings." Journal of Intelligence, vol. 11, no. 6, May 2023, p. 105. DOI.org (Crossref), https://doi.org/10.3390/jintelligence11060105.

Received: August 03, 2025

Volume 38 No. 11s 2025,
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

9. Fifani, Samah, et al. “Exploring the Role of Interpersonal Skills and Educational Technologies in Higher Education: Perspectives from Teachers and Students.” Multidisciplinary Reviews, vol. 8, no. 10, Apr. 2025, p. 2025332. DOI.org (Crossref), https://doi.org/10.31893/multirev.2025332.

10. Galindo-Domínguez, Héctor, et al. “A Teachers’ Based Approach to Assessing the Perception of Critical Thinking in Education University Students Based on Their Age and Gender.” Frontiers in Education, vol. 8, Feb. 2023, p. 1127705. DOI.org (Crossref), https://doi.org/10.3389/feduc.2023.1127705.

11. García, Rosario, et al. “The Role of Core Practices, Critical Thinking and Communication Skills in the Development of Teacher Adaptive Expertise.” Technology, Pedagogy and Education, Sep. 2025, pp. 1–20. DOI.org (Crossref), https://doi.org/10.1080/1475939X.2025.2553581.

12. Guamanga, Miguel H., et al. “Critical Thinking and Metacognition: Pathways to Empathy and Psychological Well-Being.” Journal of Intelligence, vol. 13, no. 3, Mar. 2025, p. 34. DOI.org (Crossref), https://doi.org/10.3390/jintelligence13030034.

13. Hajmási, Kitti, et al. “Global Research Trends on the Relationship Between Critical Thinking and Tertiary Education: A Bibliometric Analysis from the Perspective of Countries with Varying Human Development Levels.” Administrative Sciences, vol. 15, no. 8, Jul. 2025, p. 296. DOI.org (Crossref), https://doi.org/10.3390/admsci15080296.

14. Kafri, Banan Al. “Critical Thinking (CT) in Sustainable Higher Education: Ensuring Consistent CT Perception-Practice and Identifying Gaps between College Instructors’ and Students’ Perceptions in Advanced Academic Writing Courses in the UAE.” Thinking Skills and Creativity, vol. 46, Dec. 2022, p. 101182. DOI.org (Crossref), https://doi.org/10.1016/j.tsc.2022.101182.

15. Kanwal, Ayesha, and Intzar Hussain Butt. “Impact of Critical Thinking Skills on Prospective Teachers’ Academic Achievement.” Review of Applied Management and Social Sciences, vol. 4, no. 4, Dec. 2021, pp. 773–81. DOI.org (Crossref), https://doi.org/10.47067/ramss.v4i4.182.

16. Lv, Xiaojing, et al. “The Bidirectional Relationship between Critical Thinking and Academic Achievement Is Independent of General Cognitive Ability: A Three-Year Longitudinal Study on Elementary School Children.” Learning and Individual Differences, vol. 120, May 2025, p. 102666. DOI.org (Crossref), https://doi.org/10.1016/j.lindif.2025.102666.

Received: August 03, 2025

Volume 38 No. 11s 2025,
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

17. Medranda-Morales, Narcisa, et al. “Reading Comprehension: An Essential Process for the Development of Critical Thinking.” Education Sciences, vol. 13, no. 11, Oct. 2023, p. 1068. DOI.org (Crossref), https://doi.org/10.3390/educsci13111068.

18. Myrzatayeva, Gulmira, et al. “Systematic Training of Future Teachers for Developing Critical Thinking of Schools Pupils in Kazakhstan.” Cogent Education, vol. 10, no. 2, Dec. 2023, p. 2202103. DOI.org (Crossref), https://doi.org/10.1080/2331186X.2023.2202103.

19. Prasad Koirala, Kamal. “Pedagogical Challenges and Possibilities of Critical Thinking in the Culturally Diverse Classroom: Connecting Secondary Science Teaching with STEAM Approach.” International Journal of Science Education, Jul. 2025, pp. 1–20. DOI.org (Crossref), https://doi.org/10.1080/09500693.2025.2518602.

20. Simonovic, Boban, et al. “It Is Not What You Think It Is How You Think: A Critical Thinking Intervention Enhances Argumentation, Analytic Thinking and Metacognitive Sensitivity.” Thinking Skills and Creativity, vol. 49, Sep. 2023, p. 101362. DOI.org (Crossref), https://doi.org/10.1016/j.tsc.2023.101362.

21. Thornhill-Miller, Branden, et al. “Creativity, Critical Thinking, Communication, and Collaboration: Assessment, Certification, and Promotion of 21st Century Skills for the Future of Work and Education.” Journal of Intelligence, vol. 11, no. 3, Mar. 2023, p. 54. DOI.org (Crossref), https://doi.org/10.3390/jintelligence11030054.

22. Ugwuozor, Felix Okechukwu. “Determinants of Critical Thinking of Trainee Teachers: A Production Function Approach.” Thinking Skills and Creativity, vol. 39, Mar. 2021, p. 100765. DOI.org (Crossref), https://doi.org/10.1016/j.tsc.2020.100765.

23. Van Der Zanden, Petrie J. A. C., et al. “Fostering Critical Thinking Skills in Secondary Education to Prepare Students for University: Teacher Perceptions and Practices.” Research in Post-Compulsory Education, vol. 25, no. 4, Oct. 2020, pp. 394–419. DOI.org (Crossref), https://doi.org/10.1080/13596748.2020.1846313.

24. Wani, Showkat Ahmad, and Zahid Hussian. “Developing Critical Thinking Skills: Encouraging Analytical and Creative Thinking.” Advances in Educational Technologies and Instructional Design, edited by Afzal Sayed Munna et al., IGI Global, 2024, pp. 114–30. DOI.org (Crossref), https://doi.org/10.4018/979-8-3693-0868-4.ch007.

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