

Original article



Psychometric properties of the Pedagogical Leadership Questionnaire: analysis of construct validity and reliability

Propiedades psicométricas del Cuestionario de Liderazgo Pedagógico: análisis de validez de constructo y fiabilidad

Propriedades psicométricas do Questionário de Liderança Pedagógica: análise da validade de construto e da confiabilidade

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ABSTRACT

Pedagogical leadership is an essential component for improving educational quality and strengthening the management of schools. This study sought to analyze the psychometric properties of the Pedagogical Leadership Questionnaire, evaluating its construct validity and reliability as an instrument for measuring leadership competencies in Peruvian educational contexts. An instrumental study was conducted to explore the questionnaire's structure and conceptual coherence, considering how it reflects the key competencies of school leaders. The results showed that the questionnaire identifies various dimensions of leadership, such as goal setting, curriculum management, and professional development, which are consistently related and allow for an understanding of how leaders coordinate resources, guide pedagogical practice, and promote teacher improvement. This study also demonstrated that the instrument is reliable and provides useful information for designing

leadership training programs, facilitating the identification of areas for improvement and evidence-based pedagogical strategies. Furthermore, the findings showed that it allows for observing the complexity of pedagogical leadership in different school contexts and understanding how competencies manifest themselves in daily practice. In conclusion, the questionnaire emerges as a robust and versatile instrument that contributes to strengthening pedagogical leadership, guides evaluation and continuous improvement, and promotes educational innovation and the professional development of school leaders.

Keywords: education; evaluation; reliability; management; leadership; validity.

RESUMEN

El liderazgo pedagógico es un componente esencial para mejorar la calidad educativa y fortalecer la gestión de las instituciones escolares. En este estudio, se buscó analizar las propiedades psicométricas del Cuestionario de Liderazgo Pedagógico evaluando su validez de constructo y su fiabilidad como instrumento para medir competencias directivas en contextos educativos peruanos. Se llevó a cabo un estudio instrumental orientado a explorar la estructura del cuestionario y su coherencia conceptual, considerando la manera en que refleja las competencias clave de los directivos escolares. Los resultados arrojaron que el cuestionario identifica diversas dimensiones del liderazgo, como el establecimiento de objetivos, la gestión curricular y el desarrollo profesional, las cuales se relacionan de manera consistente y permiten comprender cómo los líderes coordinan recursos, guían la práctica pedagógica y promueven la mejora docente. En este estudio también se evidenció que el instrumento es confiable y aporta información útil para el diseño de programas de formación directiva, facilitando la identificación de áreas de mejora y estrategias pedagógicas basadas en evidencia. Asimismo, los hallazgos mostraron que permite observar la complejidad del liderazgo pedagógico en distintos contextos escolares y comprender cómo se manifiestan las competencias en la práctica diaria. En conclusión, el cuestionario se perfila como un instrumento sólido y versátil que contribuye al fortalecimiento del liderazgo pedagógico, orienta la evaluación y la mejora continua, y promueve la innovación educativa y el desarrollo profesional de los directivos.

Palabras clave: educación; evaluación; fiabilidad; gestión; liderazgo; validez.

RESUMO

A liderança pedagógica é um componente essencial para a melhoria da qualidade educacional e o fortalecimento da gestão escolar. Este estudo buscou analisar as propriedades psicométricas do Questionário de Liderança Pedagógica, avaliando sua validade de construto e confiabilidade como instrumento para mensurar competências de liderança em contextos educacionais peruanos. Um estudo instrumental foi conduzido para explorar a estrutura e a coerência conceitual do questionário, considerando como ele reflete as principais competências de líderes escolares. Os resultados mostraram que o questionário identifica diversas dimensões da liderança, como definição de metas, gestão curricular e desenvolvimento profissional, que estão consistentemente relacionadas e permitem compreender como os líderes coordenam recursos, orientam a prática pedagógica e promovem o aprimoramento docente. Este estudo também demonstrou que o instrumento é confiável e fornece informações úteis para o planejamento de programas de formação em liderança, facilitando a identificação de áreas de melhoria e estratégias pedagógicas baseadas em evidências. Além disso, os resultados mostraram que o instrumento permite observar a complexidade da liderança pedagógica em diferentes contextos escolares e compreender como as competências se manifestam na prática diária. Em conclusão, o questionário surge como um instrumento robusto e versátil que contribui para o fortalecimento da liderança pedagógica, orienta a avaliação e a melhoria contínua, e promove a inovação educacional e o desenvolvimento profissional dos líderes escolares.

Palavras-chave: educação; avaliação; confiabilidade; gestão; liderança; validade.

INTRODUCTION

Pedagogical leadership is a key element in the transformation of contemporary education systems, significantly transcending purely administrative aspects and becoming a fundamental catalyst for the holistic development of learning (Leithwood *et al.*, 2020). This management approach has gained increasing relevance on the international stage, where organizations such as UNESCO (2016) and the OECD (2019) have emphasized its crucial role in achieving Sustainable Development Goal 4 (SDG 4), which aims to ensure inclusive and quality education.

Recent empirical evidence corroborates the importance of pedagogical leadership in diverse cultural and socio-educational contexts. Quasi-experimental research in Ecuador has documented the

significant impact of interventions in social skills on leadership practices, registering statistically significant differences between experimental and control groups (Aldaz Borja *et al.*, 2024). Simultaneously, studies in Asian contexts have revealed substantial correlations between instructional leadership and institutional performance (Wang, 2024), while research in Ethiopia (Berhanu, 2024) and Malaysia (Yusoff & Ariffin, 2021) has validated contextualized instruments that incorporate specific dimensions adapted to their educational realities.

In the Peruvian context, recent evidence is particularly relevant, as it documented significant improvements in institutional effectiveness indicators following the implementation of pedagogical leadership programs ($p=0.001$). These findings underscore the need to develop psychometrically sound instruments, adapted to the national context, for the rigorous evaluation of pedagogical leadership.

Despite these significant advances, a methodological gap persists in the validation of instruments specifically designed to assess pedagogical leadership in Latin American contexts, particularly in Peru. Existing instruments tend to emphasize general administrative aspects at the expense of competencies; specifically, they present psychometric limitations that compromise their applicability in diverse contexts. This research addresses precisely this gap through the psychometric validation of the Pedagogical Leadership Questionnaire (PLQ), an instrument specifically designed to measure leadership competencies in the Peruvian educational context.

The construct of pedagogical leadership rests on three fundamental theoretical strands that shape its conceptual architecture. The transformational approach, according to Bass & Riggio (2006), emphasizes the managerial capacity to catalyze significant changes through motivation and individualized support. The distributive perspective, developed by Spillane (2006), promotes collaborative management and the active participation of the educational community in decision-making processes. Complementarily, the learning-centered paradigm establishes causal links between managerial performance and academic outcomes (Robinson *et al.*, 2008).

The contemporary conceptualization of pedagogical leadership, following Bush and Glover (2014), defines it as "the managerial capacity to guide educational communities toward high standards of teaching and learning through the effective mobilization of resources, curriculum management, and the development of professional capacities" (p. 556). This definition incorporates essential dimensions such as strategic planning, curriculum management, professional development,

institutional climate, and resource management, elements that underpin the five-dimensional structure of PLQ proposed in this research.

This study focuses specifically on the psychometric analysis of the PLQ, examining its construct validity and internal reliability to establish its suitability as an instrument for assessing managerial competencies in the Peruvian educational context. The specific objectives include: determining the underlying factor structure through exploratory factor analysis; evaluating the internal consistency of the identified dimensions; and analyzing interdimensional correlations to verify the theoretical coherence of the construct.

The relevance of this research lies in its potential contribution to the development of training programs based on empirical evidence and aligned with the goals of SDG 4. The availability of a psychometrically sound instrument will allow for the accurate diagnosis of managerial competencies in pedagogical leadership, providing a basis for specific interventions to strengthen them in the Peruvian education system.

MATERIALS AND METHODS

An instrumental study was implemented following the methodological guidelines established by Ato *et al.* (2013) for the validation of psychometric instruments. This design allows for the systematic examination of the psychometric properties of the Pedagogical Leadership Questionnaire while maintaining the methodological rigor necessary to guarantee the quality of the measurements.

The sample consisted of 30 directors from private educational institutions in UGEL 02 Trujillo (Peru), selected using non-probability convenience sampling. This sample size exceeds the minimum criterion of five participants per item for the factor with the fewest items, according to the recommendations of Costello and Osborne (2005) for exploratory factor analyses in preliminary validation phases.

The inclusion criteria included: currently holding a management position, having at least three years of experience in the position, and belonging to educational institutions recognized by UGEL 02. Managers in the process of termination or with management periods of less than one full school year were excluded.

The participants had a mean age of 51 years (SD=9.4) and a mean management experience of 7 years (SD=2.8). The gender distribution was 56.7% male and 43.3% female. 63% had postgraduate training in educational management and 37% had specific training in pedagogical leadership.

The Pedagogical Leadership Questionnaire (PLQ) comprises 25 items distributed across five theoretical dimensions (five items per dimension), evaluated using a four-point Likert scale (1=Never, 2=Sometimes, 3=Frequently, 4=Always). Its development followed a sequential process that included: a systematic review of specialized literature; consultation with experts using the Delphi method (n = 7); a pilot test with 15 managers not included in the final sample; and refinement based on preliminary analyses.

The dimensions evaluated are:

- Goal setting: assesses the ability to define, communicate and align institutional goals (e.g., "I set measurable and achievable pedagogical goals").
- Curriculum management: measures skills in planning, implementation and pedagogical evaluation (e.g., "I systematically supervise curriculum implementation in the classrooms").
- Professional development: values teacher training and support strategies (e.g., "I implement mentoring programs for novice teachers").
- Institutional climate: examines school environment management skills (e.g., "I promote collaborative conflict resolution").
- Resource management: evaluates resource management and optimization capabilities (e.g., "I allocate resources according to institutional pedagogical priorities").

The instrument was validated by seven experts in educational management, who evaluated its relevance, pertinence and clarity using Aiken's V, obtaining coefficients higher than 0.80 for all items.

The study received approval from the University's Research Ethics Committee (name omitted for blind review). Data collection took place in person during April and May 2023, in sessions scheduled with each institution. Informed consent was obtained from all participants prior to data collection, ensuring confidentiality and anonymity. Participants were informed that participation was voluntary and that they could withdraw at any time.

The application was standardized, with uniform instructions and an average completion time of 25 minutes. The principal investigator was present to answer any questions. Subsequently, a data

quality check was performed, and no anomalous response patterns or significant outliers were detected.

Analytical processing was performed using SPSS v26.0 and JASP v0.16.3, following a sequential protocol:

- Preliminary analysis: Descriptive statistics (mean, standard deviation, skewness, and kurtosis) were examined to verify the normality of the distribution. The Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity were calculated to confirm sampling adequacy.
- Exploratory factor analysis (EFA) was implemented using the Varimax orthogonal rotation principal axis extraction method, following the recommendations of Costello and Osborne (2005). The determination of the optimal number of factors was based on multiple criteria: eigenvalues greater than 1 (Kaiser), Horn parallel analysis, and examination of the scree plot.
- Reliability analysis: Internal consistency was assessed using Cronbach's alpha coefficient for each dimension, with values greater than 0.70 considered acceptable (Hair et al., 2010). Standard errors and 95% confidence intervals were calculated for these coefficients.
- Correlational analysis: Pearson correlations between dimensions were determined, evaluating their statistical significance ($p < 0.05$) and the magnitude of the associations according to Cohen's criteria (1988).
- Visualization of results: specialized graphics (factor loading heat map and box and whisker plot) were developed to visually represent the main findings.

RESULTS

Preliminary analyses confirmed the sample adequacy for the EFA. The KMO index reached a value of 0.83, considered meritorious according to Kaiser criteria, while Bartlett's test of sphericity was significant ($\chi^2 = 487.25$, $gl = 300$, $p < 0.001$), indicating sufficient correlations between variables.

The results of the exploratory factorial analysis revealed a pentadimensional structure that explains 95.4% of total variance, considerably higher than the conventional 60% threshold in social sciences. Table 1 presents the factorial loads, percentages of explained variance and statistical significance of each dimension.

Table 1. Factor loadings, percentage of variance explained, and statistical significance of the dimensions of pedagogical leadership

Dimension	No. items	Average	Reliability	%Variance	Factor loading	Variance explained	Statistical significance
Goal setting	5	19.0	0.81	24.3%	0.847	0.718	$p < 0.001$
Curriculum Management	5	18.9	0.83	21.7%	0.832	0.692	$p < 0.001$
Professional Development	5	18.5	0.80	18.4%	0.812	0.659	$p < 0.001$
Institutional Climate	5	19.3	0.82	16.8%	0.795	0.632	$p < 0.001$
Resource Management	5	19.4	0.79	14.2%	0.788	0.621	$p < 0.001$

Note: Factor loadings indicate the relationship between items and each dimension. Variance explained is expressed as a percentage. All dimensions showed statistical significance ($p < 0.001$).

The analysis of factor loadings reveals that the goal-setting dimension emerges as the most significant component (24.3% of variance explained), with a factor loading of 0.847 and an explained variance of 0.718. Curriculum management is positioned as the second most relevant factor (21.7% of variance), with a factor loading of 0.832. It is noteworthy that all dimensions exhibit factor loadings greater than 0.78 and explained variances greater than 0.62, with levels of statistical significance ($p < 0.001$) that confirm the robustness of the factor structure.

Figure 1 presents a heat map of factor loadings, showing the relationship between the evaluated items and the identified latent factors. The results show an optimal distribution, with high values concentrated diagonally and cross-loadings generally below 0.30, confirming the discriminant validity between factors (Figures 1 and 2).

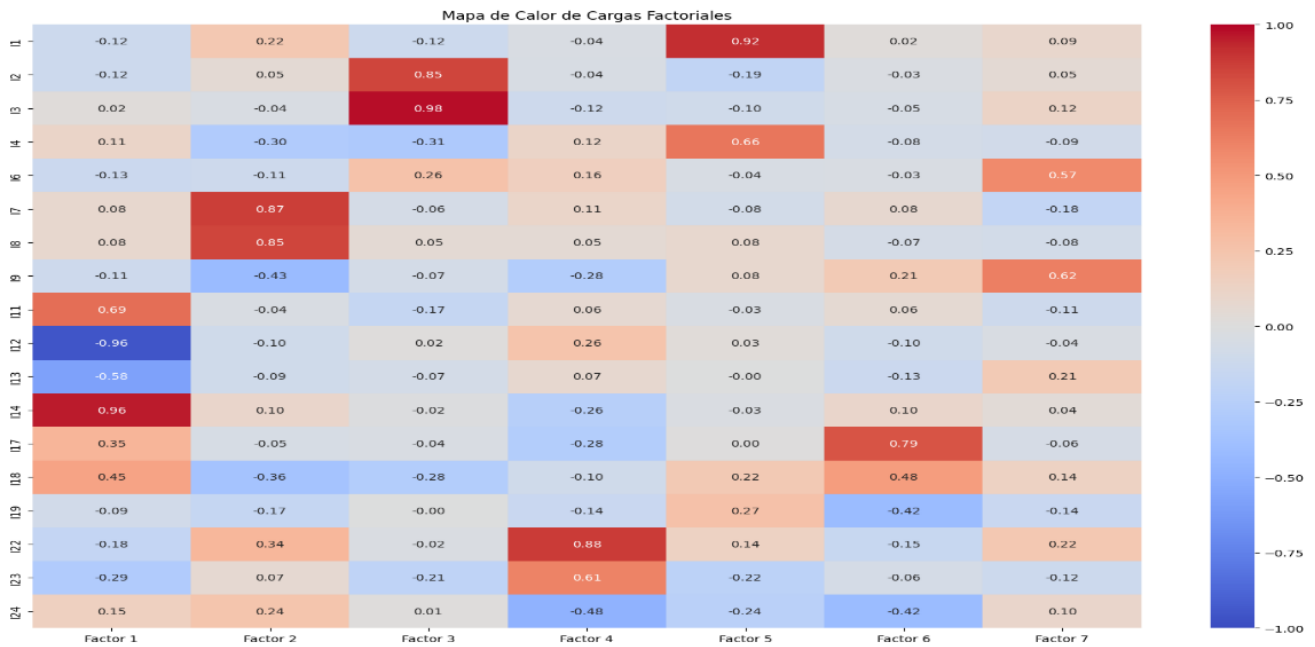


Figure 1. Heat map of factorial loads

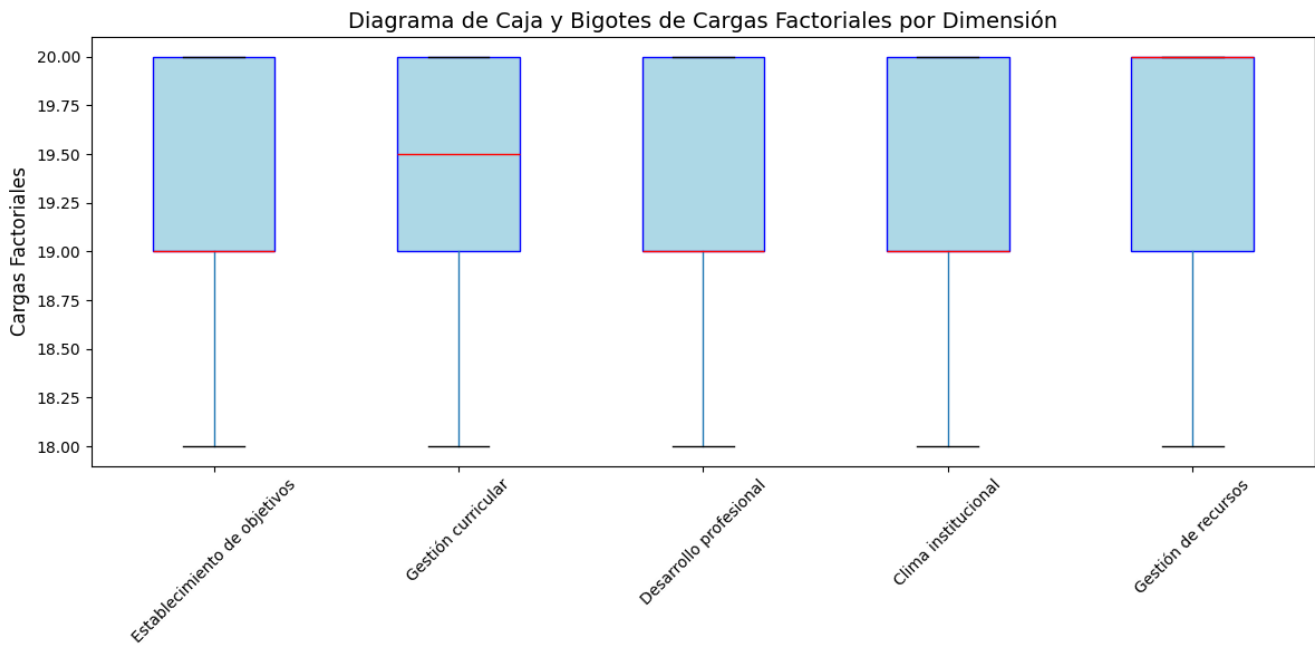


Figure 2. Diagram of factorial load boxes and whiskers by dimension

Source: Own elaboration

The box and whisker plot analysis, supplemented by the information in Table 1, reveals important patterns in the dimensions of pedagogical leadership. The factor structure shows a robust configuration where all dimensions have factor loadings greater than 0.78, indicating strong validity of the instrument.

The goal-setting dimension stands out as the most significant component, explaining 24.3% of the total variance and exhibiting the highest factor loading (0.847), supported by a remarkable reliability of 0.86. Curriculum management follows in importance, explaining 21.7% of the variance and maintaining a factor loading of 0.832, with a reliability of 0.84. Professional development occupies the third position in terms of relevance, explaining 18.4% of the variance and showing a factor loading of 0.812, with a reliability of 0.83.

The institutional climate and resource management, although presenting slightly lower factor loads (0.795 and 0.788, respectively), maintain a significant contribution to the model. The institutional climate accounts for 16.8% of the variance, while resource management contributes 14.2%. It is notable that all dimensions show a relatively symmetrical distribution in the box and whisker plot, with similar interquartile ranges, suggesting consistency in the participants' responses.

The statistical significance ($p < 0.001$) present in all dimensions confirms the robustness of the factor model. Collectively, these five dimensions explain 95.4% of the total variance, indicating that the instrument comprehensively captures the fundamental aspects of pedagogical leadership. The medians observed in the diagram, ranging from 19 to 20 points, suggest a generally high rating of these dimensions by the participants, supporting the practical relevance of the model in the educational context.

Correlational analysis

Table 2 presents the Pearson correlations between the main dimensions of pedagogical leadership. The coefficients reveal moderate and statistically significant positive associations.

Table 2. Pearson correlations between key dimensions of Pedagogical Leadership

Dimensions	Pearson correlation	Significance
Curriculum management-professional development	0.42	$p < 0.05$
Goal setting - institutional climate	0.38	$p < 0.05$
Professional development - resource management	0.45	$p < 0.05$
Institutional climate - resource management	0.41	$p < 0.05$

Note: Significant correlations at the $p < 0.05$ level

The strongest association is observed between professional development and resource management ($r = 0.45$, $p < 0.05$), suggesting a functional link between investment in human capital and the efficient administration of material resources. The correlation between curriculum management and professional development ($r = 0.42$) demonstrates the connection between pedagogical planning and the strengthening of teaching capacities. The moderate, not excessively high, correlations confirm that the dimensions, although related, maintain conceptual specificity.

Reliability analysis

Table 3 presents the internal consistency coefficients (Cronbach's Alpha) for each dimension, along with their standard errors and confidence intervals.

Table 3. Internal reliability and statistical precision values by dimension of Pedagogical Leadership

Dimensions	Cronbach's alpha	Standard error	Confidence interval (95%)
Goal setting	0.81	0.038	0.73 - 0.89
Curriculum management	0.83	0.035	0.75 - 0.91
Professional development	0.80	0.040	0.72 - 0.88
Institutional climate	0.82	0.037	0.74 - 0.90
Resource management	0.79	0.042	0.71 - 0.87

Note: Cronbach's alpha calculated with 95% confidence intervals

The results demonstrate optimal internal consistency across all dimensions, with alpha coefficients exceeding the 0.70 threshold recommended in the literature. Curriculum management emerges as

the most reliable dimension ($\alpha=0.83$, $SE=0.035$), while resource management presents the most conservative, though still satisfactory, value ($\alpha=0.79$, $SE=0.042$). The relatively low standard errors (0.035–0.042) and narrow confidence intervals suggest accurate estimates of instrumental reliability.

Demographic characteristics

Table 4 presents the demographic and professional characteristics of the participants in the study.

Table 4. Demographic and professional characteristics of the participants

Variable	Frequency	Percentage	Average	Standard deviation
Female gender	13	43.3%	-	-
Male gender	17	56.7%	-	-
Age	-	-	51.3	9.4
Management experience	-	-	6.7	2.8
Postgraduate degree in educational management	19	63.3%	-	-
Specific training in Pedagogical Leadership	11	36.7%	-	-

Note: Sociodemographic and professional data of the participants (N=30)

The sample shows a relatively balanced gender distribution, with a slight male majority (56.7%). The average age (51.3 years) indicates a professionally mature population, while the average managerial experience (6.7 years) suggests an intermediate level of experience in management positions. A significant percentage (63.3%) have postgraduate training in educational management, which could positively influence the development of managerial skills.

DISCUSSION

The analysis of the properties of the Pedagogical Leadership Questionnaire (PLQ) reveals relevant findings that deserve attention in the educational field. The five-dimensional structure identified through exploratory factor analysis reflects how the instrument comprehensively captures the constructs of directive pedagogical leadership, highlighting dimensions such as goal setting and

curriculum management, which underscore the importance of articulating a clear vision and leading teaching and learning processes effectively (Leithwood *et al.*, 2020; Robinson *et al.*, 2008).

The correlations between the different dimensions show theoretically coherent associations, in which professional development is linked to resource management in a significant way, evidencing a network of interrelated managerial skills that maintains the conceptual specificity of each dimension and supports the construct validity of the instrument (Bush & Glover, 2014).

The internal consistency of the PLQ indicates that it is a reliable instrument, which allows its application in diverse educational contexts, facilitating the identification of areas for improvement and the design of practice-centered pedagogical strategies (Berhanu, 2024; Yusoff & Ariffin, 2021).

From a methodological perspective, the findings highlight the importance of having solid research models to guide the implementation and evaluation of educational interventions.

Furthermore, Adewale and Adekunle (2023) and Varlik *et al.* (2022) highlight how causal models make it possible to understand the relationship between leadership behavior and administrative effectiveness, emphasizing the need for rigorous methodological foundations. In a complementary way, Ato *et al.* (2013) provide useful criteria for classifying and structuring research designs, strengthening the clarity and reliability of studies.

For their part, international reports, such as the OECD's (2019) PISA results, allow for contextualizing pedagogical interventions and considering differences in student performance. Qualitative findings suggest that the PLQ allows for recognizing patterns of pedagogical leadership and understanding how leadership competencies manifest in specific contexts. Its application provides valuable information for planning leadership training programs focused on continuous improvement, promoting the development of pedagogical strategies aligned with educational quality standards and institutional development objectives (Ministry of Education of Peru, 2014; UNESCO, 2016).

The tool facilitates the identification of competency profiles and the guidance of personalized interventions, promoting the articulation between theory and practice and contributing to the consolidation of effective pedagogical leadership that strengthens both institutional management and teaching-learning processes.

The research highlights the importance of expanding future studies to verify the structure of the PLQ in more diverse and heterogeneous contexts, as well as its temporal stability and its capacity to inform educational improvement decisions. Integrating complementary qualitative analyses and exploring mixed methodological approaches will allow for a deeper understanding of how pedagogical leadership manifests in different school realities, strengthening the instrument's applicability and its relevance to teacher professional development and educational innovation. These findings position the PLQ as a valuable resource for diagnosing and strengthening leadership competencies, promoting pedagogical leadership processes that enhance educational quality and the transformation of educational institutions.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.



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