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# Curricular structure and pedagogical approaches in pre-service physical education teacher education: a comparative case study of three Chilean universities

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Physical education is recognized as a key discipline within the educational system due to its contribution to students' holistic development across physical, cognitive, social, and emotional dimensions. Therefore, pre-service physical education teacher education (PETE) holds special relevance, as it shapes the pedagogical approach that will guide future teaching practices in the school. The objective of this study was to analyze the curricular structure and pedagogical approach of PETE programs at three Chilean universities. Using a qualitative-descriptive approach, a document analysis was conducted on curricula, graduate profiles, and course syllabi from each institution, considering that these are also key elements evaluated in the accreditation processes of teacher education programs. Grounded Theory supported the analysis, which was systematized using NVivo software through open and axial coding. The information was organized into key categories: subjects, graduate competencies, pedagogical approach, innovation, sociocultural context, and assessment. The results reveal differences in how teacher education is understood. While one university presents a structure focused on technical content, another emphasizes a sociocultural approach, and the third exhibits an innovative orientation with technological integration.

## KEYWORDS

curriculum, initial teacher training, initial teacher education, physical education, pedagogical approach

# 1 Introduction

Physical education (PE) is recognized in today's educational systems as a core subject, mainly due to its contribution to the holistic development of students (beyond the physical or sports dimension) encompassing cognitive, emotional, and social aspects (Alimuuddin et al., 2024; Bamta et al., 2023). However, this impact is only possible through a pedagogical approach in which PE fosters not only motor skills acquisition but also promotes values such as respect, cooperation, inclusion, and self-regulation, all of which are key elements in the formation of active and responsible citizens (Font-Lladó et al., 2020; Pennington and Sinelnikov, 2018).

Multiple institutions have addressed the topic of physical activity, highlighting its positive impact on public health. For instance, the World Health Organization (WHO) emphasizes that regular physical activity is a cornerstone of physical and mental well-being and underscores the role of educational systems in influencing adolescents' activity levels (Hernaiz-Sánchez and Bäder-Gilabert, 2023). Furthermore, the WHO's 2021 report encourages the integration of structured physical activity into school programs to reduce sedentary behavior and childhood obesity (Van der Ploeg and Bull, 2020). However, in educational contexts, it is essential to differentiate between physical activity and physical education (Bozhok, 2024; Gea-García et al., 2020).

In the Chilean context, PE is a mandatory subject, reflecting its institutional recognition as a core component of the national curriculum (Añazco-Martínez, 2022). Nonetheless, this recognition does not necessarily translate into the subject being implemented in a way that addresses current demands for more inclusive education focused on holistic development, pedagogical reflection, educational inclusion, gender equity, and formative assessment. This issue has been documented internationally (Pérez-Pueyo et al., 2021) and within the Chilean context (Gallardo-Fuentes et al., 2022).

This tension highlights the need to strengthen the role of PE teachers as health and well-being promoters within a pedagogical framework (Pérez-Pueyo et al., 2021), which requires a broader curricular approach and improvements in teacher training practices (Medina-Villanueva et al., 2025). Indeed, pre-service physical education teacher education (PETE) must address not only technical knowledge but also foster competencies that enable future teachers to plan strategies that embrace student diversity and respond to contemporary social challenges such as sedentary lifestyles and unhealthy habits (Purnomo, 2024).

Undoubtedly, the pedagogical approaches underpinning PETE have evolved from highly traditional, teacher-centered instruction toward more student-centered and constructivist models (Kasper et al., 2024). Models such as Teaching Games for Understanding (TGfU) (Santoso et al., 2024) and Problem-Based Learning (PBL) (Hunter et al., 2025) have gained prominence in teacher training programs (Tan et al., 2012). Literature also highlights how structured sports practice under models like Sport Education supports the development of both motor skills and social competencies among students (Núñez et al., 2020). However, evidence suggests that traditional methods still dominate in the training of future PE teachers in Chile (Gallardo-Fuentes et al., 2019).

There are substantial differences in the curricular structure and pedagogical approaches adopted by Chilean universities in their PE

programs. However, teacher education programs within a quality assurance framework must also consider both pedagogical and disciplinary standards, which serve as guidelines defining the set of skills, knowledge, and dispositions that an education professional should possess upon completion of their initial training (Rivero-Castro and Medeiros-Urzuá, 2023). This should not limit each program from imprinting its own distinctive approach to training; rather, institutions must ensure internal consistency by aligning with their mission, as well as external consistency by responding to environmental demands and challenges. Some institutions prioritize a curriculum focused on scientific and biomedical competencies, while others emphasize practical and applied approaches (Sánchez-González et al., 2022).

Today, Chilean PETE faces the challenge of overcoming its traditional legacy, which has been largely shaped by a biomedical approach centered on physical fitness tests (Moreno-Doña et al., 2014), in order to advance toward recognizing PE as a discipline capable of having a comprehensive impact on student learning, including attitudinal, cognitive, and motor domains. This concern has even reached the ministerial level, reflected in specific policy guidelines that influence key aspects of the educational process, such as assessment. One example is Decree 67, enacted by the Chilean Ministry of Education, which regulates school assessment, grading, and promotion at the national level (MINEDUC, 2018). This regulation promotes the use of formative strategies and inclusive criteria. However, there is no evidence that these elements are being rigorously integrated into PETE programs (Gallardo-Fuentes et al., 2023).

## 1.1 Research gap

Although PETE is crucial for preparing future professionals, Chilean studies have mostly offered descriptive analyses centered on isolated aspects, such as curricular content or assessment practices. Little attention has been given to explicitly addressing the imbalance in PETE programs, where technical and biomedical perspectives prevail, while constructivist approaches, formative assessment, and broader pedagogical perspectives remain underrepresented. This gap is particularly evident in the absence of comparative curricular mapping studies across Chilean universities. Such analyses are essential to identify institutional patterns and inform reforms. This study addresses this void by comparing three PETE programs in Chile. In order to address this gap, the present study seeks to answer the following research questions: (Q1) What curricular logics and pedagogical approaches prevail in PETE programs at Chilean universities, and how do they compare with international trends?; (Q2) In what ways do PETE programs integrate (or fail to integrate) constructivist perspectives, formative assessment, inclusion, and interdisciplinarity into their curricular designs?; (Q3) What implications do the differences and weaknesses identified in PETE programs have for curricular redesign and the improvement of initial teacher education in Latin American contexts?

The objective of this study is to:

Analyze the curricular structure and pedagogical approach PETE programs in three Chilean universities in order to identify similarities and differences.

## 2 Method

This study is framed within a qualitative and documentary approach (Morgan, 2022), aimed at a deep understanding of the pedagogical and epistemological meanings embedded in the curricular texts of PETE programs across three Chilean universities. Specifically, we analyzed a total of 184 study programs in force as of March 28, 2025 across the different disciplines comprising the curricula of the three universities (70 from university 1, 54 from university 2, and 60 from university 3). From an inductive, reflective, and situated perspective, a descriptive-interpretative design was adopted, emphasizing the critical reconstruction of institutionalized educational logics (Denzin and Giardina, 2022; Patton, 2002). In this sense, the research is conceived as a multiple case study (Hunziker and Blankenagel, 2021), where each university represents a unit of analysis that contributes to a comparative understanding of PETE in the Chilean context.

The methodological choice responds to the need to problematize how certain pedagogical models are structured and legitimized through curricular instruments. This approach moves beyond a merely descriptive view of content, opting instead for an analysis that explores the meanings, educational orientations, and epistemological foundations underlying teacher education programs (Morgan, 2022; Tisdell et al., 2025). As Lopes (2024) suggests, qualitative research entails a dynamic process that begins with a broad and flexible question, which evolves as the analysis progresses and new interpretive categories emerge.

The documentary corpus consisted of study plans. In addition to the graduate profiles, training itineraries and complementary institutional documents for public use. The selection or prioritization of these curricular elements is of great importance due to their connection with quality assurance (Reyes and Rosso, 2023) and the accreditation criteria for teacher education programs (Cerdeira-Vásquez, 2023). These were selected through purposive sampling (Bowen, 2009), focusing on sources that allow access to curricular configurations and the underlying pedagogical frameworks of each institution. The analytical procedure was conducted using qualitative document analysis, following criteria proposed by Flick (2022) and Morgan (2022) regarding the authenticity, credibility, representativeness, and meaning of the sources. NVivo 15 qualitative software was employed to facilitate open, axial, and selective coding (Trigueros-Cervantes et al., 2018), allowing the identification of patterns of meaning, convergences, and tensions among the three curricular structures, in line with the comparative strategy used by Rivas-Valenzuela et al. (2021). Ethical considerations were ensured through continuous supervision by a certified Scientific Ethics Committee. Additionally, data access procedures, translation processes, and researcher bias control strategies were carefully addressed.

The entire process was articulated with the principles of grounded theory from a constructivist perspective (Glaser and Strauss, 2017), enabling progressive and analytically rich coding, open to the emergence of conceptual categories with explanatory value. In parallel, a thematic-reflexive analysis logic was incorporated (Braun and Clarke, 2013), understood not as a mechanistic technique but as a situated interpretive path that acknowledges the researcher's subjectivity as a constitutive part of the analysis. It is important to emphasize that this methodological approach stems from a generative

question that serves as a catalyst for the research process (Krause, 1995), opening a space for exploration in which the answers are not predefined. This approach not only allows for structural comparisons of curricular documents but also facilitates an understanding of how they shape conceptions of the teaching role, visions of instruction, and ethical-political frameworks that guide professional training in the field of physical education. Thus, the methodological strategy aligns with a critical, situated, and constructivist perspective on educational research, where interpretation takes center stage as a means of unveiling the formative meanings embedded in institutional texts.

Coding and description of categories was carried out through an initial reading of the documents, respecting the language used in them (Creswell and Creswell, 2017). Subsequently, based on core categories, a hierarchical and logical structure was developed, followed by axial coding (Strauss and Corbin, 2016). The coding process was conducted independently by two researchers with expertise in qualitative educational research, who carried out the initial open coding using NVivo software. Axial and selective coding were subsequently refined through peer debriefing sessions, where divergences were discussed until consensus was reached. Although no statistical agreement indices (e.g., Cohen's  $\kappa$ ) were calculated, the credibility of the analysis was ensured through established qualitative strategies: memo writing to document analytical decisions, peer discussions to enhance reflexivity, and audit trails that tracked the evolution of codes and categories. These procedures, consistent with grounded theory principles, strengthened the transparency and trustworthiness of the study.

An analytical pattern was established to define relationships among categories. As shown in Table 1, a mixed approach combining categorical and content analysis was adopted, starting from inductive categorization supported by NVivo Release 15 software. This allowed for a cartographic approach to the initial analyses between the analytical categories and the content of the documents from the universities included in the study. All data were imported, then organized through coding in order to generate "cases" defined as observation units within the research (Rivas-Valenzuela, 2024).

### 2.1 Operational definition of intensity

In this study, the intensity of each category was calculated using NVivo software. Intensity was operationalized as the frequency of coded references (nodes) within the documents analyzed. In addition, NVivo tracks the length of each coded segment, which served as complementary information, although the primary criterion was the number of references. This operational definition ensures transparency and full replicability of the analysis, as NVivo automatically records and visualizes these frequencies through heat maps.

## 3 Results

Institutional contrasts from the heat map following the guidelines of Quivy and Campenhoudt (2005), the textual files were categorized in greater depth and detail through axial coding (Strauss and Corbin, 2016), also referred to as relational coding (Rawhani, 2023). This type of coding enabled the identification of relationships among the properties of categories, establishing connections between causal

TABLE 1 Categorical references across the three universities.

Qualitative analysis categories					
Name			References		
University programs	Subjects in the degree programs	Anatomy	3.381	422	10
		Anthropology			16
		Arts			20
		Athletics			16
		Dance			26
		Handball			10
		Basketball			9
		Biology			29
		Biomechanics			22
		Physiology			49
		Soccer			11
		English			15
		Nutrition			19
		Planning			113
		Psychology			21
		Aquatic course			24
		Volleyball			12
	Graduate competencies	Attitudinal		668	161
		Procedural			93
		Transversal			33
		Values-based			173
		Graduate profile			208
	Sociocultural context	Cultural and social diversity		293	229
		Educational inclusion			64
	Course program design	Structural design		360	225
		Theoretical and practical modules			135
	Pedagogical approach of the degree programs	Constructivism		114	51
		Critical pedagogy			63
	Degree program approaches	Human motor skills		822	403
		Health and well-being			177
		Ethical and social education			242
	Assessment and learning outcomes	Formative assessment		468	53
		Expository			103
		Remedial and summative			115
		Rubrics and portfolio			67
		Workshops			130
	Innovation in learning	Activities in natural settings		234	125
		Technological innovation			109

conditions, contextual and intervening factors, institutional strategies, and their formative consequences through a paradigmatic model (Rivas-Valenzuela, 2024). Table 2 presents a heat map that visualizes the discursive intensity of the core categories in the teacher education programs of the three Chilean universities included in the study. The color depth indicates the referential and interpretive density with

which each category was addressed in the curricular documents, allowing for the inference of emphases, omissions, and prevailing orientations in each institution.

When analyzing university 1, it shows a high intensity in the category “Curricular Subjects,” indicating a strong curricular structure focused on disciplinary content. This emphasis suggests a causal

condition centered on academic planning and the prescription of knowledge, guiding an institutional action strategy based on the technical sequencing of knowledge. Simultaneously, medium intensity is observed in “Assessment and Learning Outcomes” and “Program Approaches,” which suggests a more conservative orientation, with moderate attention to student performance and formative orientation, yet with little articulation toward innovative proposals. In fact, “Innovation in Learning” appears with low intensity, revealing a model in which pedagogical strategies remain aligned with traditional and structured logics.

In contrast, university 2 stands out for its high density in the “Sociocultural Context” category, positioning this dimension as a central element of its training proposal. This intensity suggests strongly marked contextual and intervening conditions driven by inclusive concerns, cultural diversity, and social justice, which shape action strategies aimed at training teachers with an ethical-political commitment. Medium-to-high intensity is also noted in “Graduate Competencies” and “Pedagogical Approach of the Degree Programs,” indicating internal coherence between declared educational goals and the underlying pedagogical conceptions. However, similar to the previous institution, “Innovation in Learning” remains marginal, which may be interpreted as a tension between the transformative intent of the sociocultural approach and the persistence of more traditional methodologies.

In contrast, university 3 presents a more balanced distribution across categories, with high intensity in both “Curricular Subjects” and “Graduate Competencies,” suggesting a strategy that balances curricular prescription with skills development. What sets this institution apart is its high intensity in the “Innovation in Learning” category, indicating that its training strategies are oriented toward methodological updates and the use of educational technologies or alternative learning environments. This emphasis can be seen as a consequence of intervening conditions associated with changes in teaching-learning models, promoting a more flexible and adaptive

teaching role. Meanwhile, the low intensity in “Program Approaches” and “Assessment and Learning Outcomes” may indicate less systematization of these dimensions or, alternatively, a discursive decentralization of these aspects in the institutional documents.

In relation to the curricular cartography of the courses, their patterns and emphases reveal that PETE programs of the three analyzed universities display dissimilar curricular configurations, reflecting both institutional orientations and distinct conceptions of the teaching role and embodied knowledge. These differences manifest in graduation profiles, the structure of formative paths, and especially in the place assigned to courses within the curricular architecture. This is evidenced in the reviewed official documents, which reveal approaches centered on biocultural embodiment, community inclusion, or a biomedical-technocratic rationale, depending on the institution.

It is worth noting that while many courses appear across all three programs, their presence does not necessarily imply equivalent training value. In some universities, such courses are structured in progressive sequences for example, “Team Sports I, II, and III” which indicates a deeper and more systematic approach to curricular design. This layered organization not only reinforces technical mastery but also sets an institutional standard regarding the importance assigned to specific fields of knowledge. Therefore, the apparent repetition of courses across institutions should not be interpreted as curricular homogeneity, as differences in depth, continuity, and complexity reveal distinct pedagogical approaches and educational priorities.

Figure 1 presents the results of the group query performed using the qualitative software NVivo 15, which enabled cross-referencing of the courses present in the curricula of the three universities. This technique allowed the visualization of links between codes (institutions) and elements (courses), revealing patterns of presence, absence, and referential density that help interpret the relative centrality of specific learning content in each program, represented through color coding.

In university 1, there is a high density of connections with courses related to specific sports activities, such as volleyball, athletics, football, and handball. This pattern reveals a training structure centered on technical mastery of traditional disciplines, where the body is constructed as an object of performance and technique. Although this curriculum offers a wide variety of subjects, its thematic fragmentation suggests a cumulative rather than integrative logic. Pedagogically, this approach tends to reproduce a classical view of the physical education teacher, oriented toward control and motor specialization. By contrast, university 2 exhibits more concentrated links to scientifically-based courses such as physiology, biomechanics, and anatomy. This pattern reflects a training rationale focused on biomedical knowledge, where the body is primarily viewed as a functional structure. While this approach offers technical rigor, it tends to favor a biological perspective of teaching, reducing pedagogical complexity to parameters of physical efficiency. This orientation aligns with a technical training model, where pedagogical intervention is subordinated to predominantly medical or physiological disciplinary expertise.

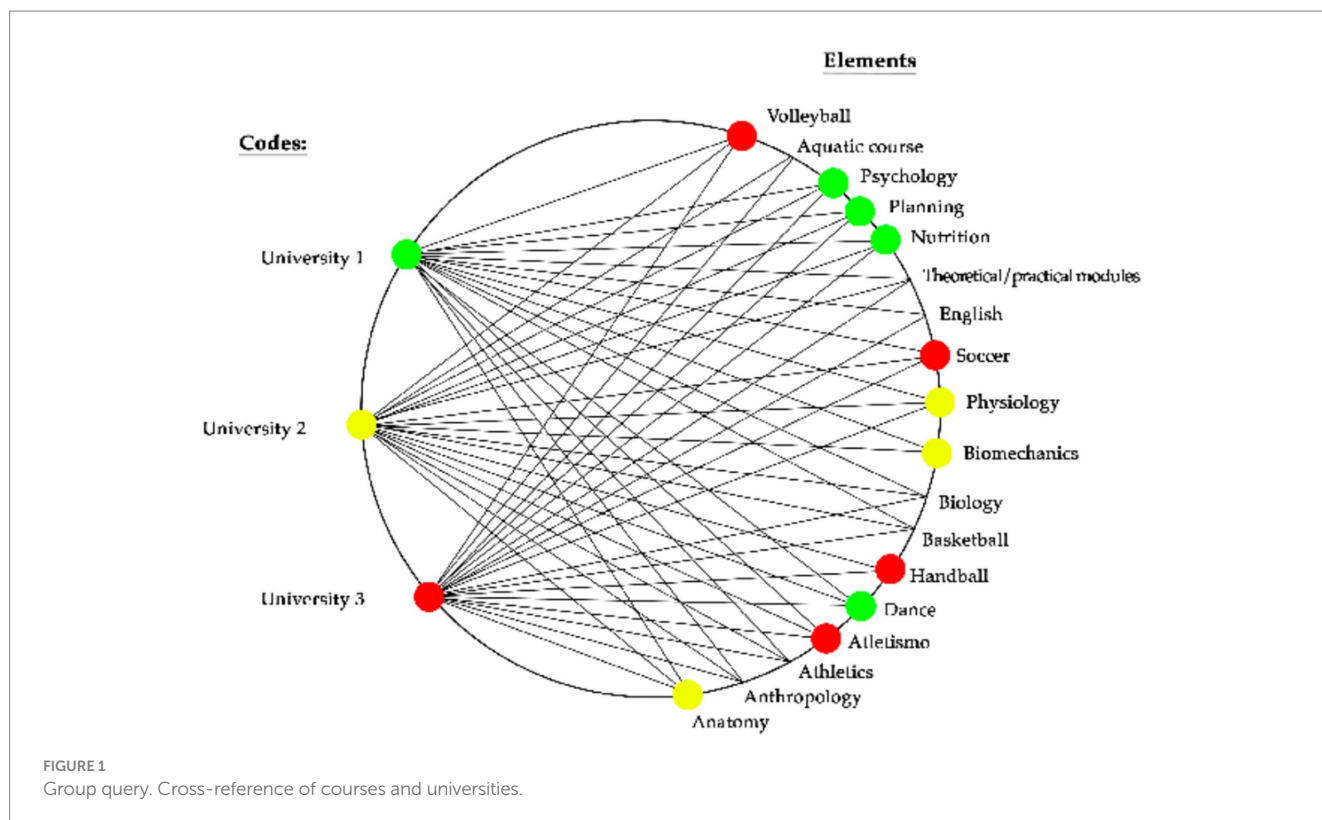
In contrast, university 3 shows significant connections with courses that integrate expressive, organizational, and psychosocial dimensions of teacher education, such as nutrition, psychology, planning, and dance. This configuration suggests a curricular structure that emphasizes the holistic development of the student-teacher and

TABLE 2 Heat map: relationship between core categories and the three Chilean Universities.

Categories	University 1	University 2	University 3
Course curriculum subjects			
Graduate competencies			
Sociocultural context			
Pedagogical approach of the degree programs			
Degree program approaches			
Assessment and learning outcomes			
Innovation in learning			

The depth of the color indicates the intensity of discourse based on the results.





the fostering of transversal competencies. In this case, the body is understood not only as a biological organism but also as a site of subjectivity, social bonding, and pedagogical creation. This training design appears to align with a more holistic approach, where courses are not organized by isolated fields, but follow a modular and situated logic.

Beyond these differences, it is possible to identify certain courses that operate as curricular nodes common to all three institutions. Such is the case for psychology, planning, and theoretical-practical modules, which consistently appear in all three curricula. This convergence suggests the existence of a shared educational core, which may be considered the minimum curricular foundation necessary to support a contemporary physical education teaching profile capable of integrating organizational, cognitive, and affective aspects of the educational process. Conversely, subjects such as the arts and dance appear in only one or two universities, revealing institutional differences in the value assigned to expressive knowledge and non-sport-based bodily language. Their partial and peripheral presence raises questions about the criteria used to define which knowledge areas are deemed legitimate for teacher education and which are displaced or marginalized in curricular design.

The analysis of graduate competencies is a key dimension for understanding the formative orientations that each institution embeds in its physical education teacher education (PETE) programs. These competencies express not only the knowledge and skills expected at the end of training, but also the conceptions of the body, the teaching role, and pedagogical intervention that universities deem appropriate. In this regard, observing how competencies are distributed and prioritized in the curricula reveals institutional emphases, ethical-political priorities, and underlying pedagogical logics.

Table 3 synthesizes these data through a heat map that represents the discursive density of each competency category across the three universities. This visual resource allows for the comparison of patterns and contrasts, and serves as a critical input for interpreting the formative rationalities guiding curricular structuring in each institution. For this analysis, six dimensions were considered: (a) Attitudinal competencies, referring to values and ethical behavior in professional practice; (b) Procedural competencies, related to practical know-how; (c) transversal competencies, such as effective communication and collaborative work; (d) value-based competencies, focused on ethical principles and social justice; (e) graduate profile, as an institutional construction of the desired professional subject; and (f) interdisciplinary work, understood as the capacity to integrate diverse knowledge into pedagogical intervention.

University 1 displays a balanced coverage across several competencies, with moderate emphasis on “Attitudinal Competencies” and “Interdisciplinary Work.” However, it shows lower levels of intensity in “Procedural and Transversal Competencies,” which may indicate limited systematization of these aspects in the curricular documentation or a lower institutional priority for their explicit inclusion. University 2, in contrast, stands out for a high intensity in “Transversal and Value-Based Competencies.” This combination suggests a training approach strongly oriented toward equipping future teachers with tools applicable in diverse contexts and grounded in solid ethical principles. However, this university shows less intensity in references to the graduate profile and interdisciplinary work, which could be interpreted as a weakness in the overall curriculum integration or a lack of alignment between institutional declarations and operational competencies.

TABLE 3 Heat map: relationship between the category “Graduate Competencies” and the three universities.

Graduate competencies	University 1	University 2	University 3
Attitudinal competencies			
Procedural competencies			
Transversal competencies			
Value-based competencies			
Graduate profile			
Interdisciplinary work			

The depth of the color indicates the intensity of discourse based on the results.

University 3 also demonstrates balanced coverage, but with particular emphasis on “Procedural Competencies” and the “Graduate Profile.” This may reflect a focus on the practical development of the teaching role, with a strong presence of courses and experiences aimed at the applicability of pedagogical knowledge. However, it shows lower intensity in value-based competencies, raising questions about the role of ethical training in its curricular proposal. Beyond these differences, the analysis shows that the “Graduate Profile” functions as a structural component of the curriculum across all three institutions, though with varying levels of development and depth. In some universities, it is conceptualized as a transversal guide that informs all competencies, while in others it appears as a programmatic statement with limited operational translation.

Ultimately, this relational map not only enables the comparison of formative intensities but also reconstructs the pedagogical and institutional emphases promoted by each university. Thus, three configurations emerge: one that privileges ethical and transversal competency development (university 2), another centered on practical knowledge and professional profiling (university 3), and a third that opts for a more balanced but less intensive focus on technical or social aspects (university 1). These configurations, in their differences, reflect not only curricular priorities but also distinct conceptions of the teaching role and the social function of physical education, specific to each institution.

The heat map presented in Table 4 provides a synthetic and relational visualization of the distribution of different training categories in the PETE programs of the studied universities. Through a chromatic scale—ranging from white (absence or minimal presence) to deep blue tones (high density and repetition) it graphically represents the degree of emphasis each institution places on various curricular, pedagogical, and epistemological components.

A global overview reveals that the three universities exhibit differentiated training profiles, while also sharing certain significant omissions. For instance, university 1 displays a predominant bluish shading in categories such as “Human Motor Approach” and “Ethical and Social Education,” indicating a strong presence of these dimensions in its institutional documentation. This chromatic intensity suggests that training is based on a biocultural conception of the body and guiding ethical values, reflecting a concern with

TABLE 4 Heat map: relationship between categories and initial teacher education.

Categories	University 1	University 2	University 3
Activities in natural environments			
Lectures			
Attitudinal competencies			
Procedural competencies			
Transversal competencies			
Value-based competencies			
Constructivism			
Cultural and social diversity			
Human motor approach			
Focus on health and well-being			
Remedial assessment			
Lecture-based instruction			
Ethical and social education			
Educational inclusion			
Technological innovation			
Critical pedagogy			
Graduate profile			
Portfolio			
Procedural			
Rubrics			
Summative			
Workshops			
Interdisciplinary work			

The depth of the color indicates the intensity of discourse based on the results.

preparing teachers who understand motor activity from a humanistic and situated perspective. However, a relative paleness or whiteness can also be seen in key categories such as “Constructivism,” “Technological Innovation” and “Portfolio” revealing methodological and theoretical gaps that may limit the program’s pedagogical diversity and contemporary relevance.

University 2, in turn, shows high intensity in categories such as “Ethical and Social Education,” “Value-Based Competencies” and “Rubrics.” This density indicates a clear intention to integrate ethical,

value-oriented, and evaluative dimensions into the teacher education profile. The consistent use of rubrics suggests efforts to make teachers' judgments more transparent and to promote more objective assessments. However, this pattern is contrasted by white or barely shaded areas in categories such as "Constructivism," "Workshops," "Activities in Natural Environments," and even "Critical Pedagogy." The absence of color in these areas is not merely technical but epistemological, revealing a weak incorporation of contemporary theoretical frameworks that could enhance pedagogical reflection from a transformative perspective, as well as a lack of experiential or alternative methodological tools that connect theory and practice in a situated manner.

In contrast, university 3 stands out for a high presence of blue in categories such as "Activities in Natural Environments," "Technological Innovation," "Workshops" and "Interdisciplinary Work." These choices indicate a curricular orientation toward exploration, the use of new technologies, and the practical articulation of knowledge. The intense blue markings in these areas suggest an experimental didactic approach with a strong applied component, which may reflect an intention to train teachers with versatile pedagogical tools adapted to non-conventional contexts. However, the white or very low density in categories such as "Value-Based Competencies," "Ethical and Social Education," and "Constructivism" raises concerns about the lack of strong philosophical and ethical foundations guiding teaching practices. In this case, the map suggests a risk of producing highly technically competent professionals who may lack critical reflection on the educational, political, and social meaning of their pedagogical work.

When considering the weakest categories across all cases, the lack of chromatic presence in "Critical Pedagogy," "Constructivism" and "Portfolio" becomes evident. This reveals a general trend of omitting contemporary pedagogical approaches that promote reflective, dialogical, and learner-centered teaching. These white areas function as markers of absence, signaling that the critical and transformative dimensions of teacher education have yet to be structurally consolidated in the reviewed programs. The absence of these categories represents a missed opportunity to challenge the reproductive logic of traditional curricula and to propose alternative meanings of what it means to teach and learn physical education today.

It is also noteworthy that, despite the inclusive and ambitious institutional discourse declared by all three universities in their graduate profiles, categories such as "Interdisciplinary Work" and "Educational Inclusion" show pale or moderate color intensity in most cases. This phenomenon suggests a disconnection between the projected educational horizon and its operational materialization in curricular frameworks and teaching strategies. The chromatic intensity does not fully support the discourse of integration or commitments to educational justice, evidencing a structural tension between what is declared and what is implemented. Within this framework, the heat map not only allows us to "see" what is present but also to "read" what is missing, compelling us to ask: Which categories are systematically marginalized? What conceptions of knowledge, the body, and teaching are being reproduced through these omissions? Ultimately, the visual and epistemic analysis of the heat map invites a critical rethinking of the foundations of PETE, emphasizing the need to integrate solid theoretical frameworks, diversified pedagogical tools, and an ethical perspective committed to educational transformation.

## 4 Discussion

The findings of this study provide insight into key aspects of PETE as conceptualized and operationalized across the three participating Chilean universities. The results reveal the existence of three distinct curricular logics, each reflecting specific pedagogical assumptions, epistemological stances, and institutional identities. When compared with the international literature, these configurations offer a valuable lens for understanding the prevailing trends and tensions in PETE as an essential consideration, given that the curriculum ultimately shapes the professional conceptions and practices of future graduates (Montás-García and Sánchez-Moreno, 2022).

First, the prevalence of traditional models based on disciplinary content, particularly in university 1, aligns with what Kirk (2009) described as a "techné" orientation in physical education, focused more on the reproduction of technical skills than on the development of critical and reflective professionals. Similar concerns have been raised in the Chilean context (Moreno-Doña et al., 2014). This content-centered model generates tensions, which have been noted for over a decade in places such as the United Kingdom and parts of Europe, where physical education programs often prioritize sport-specific instruction at the expense of pedagogical innovation (Casey and Goodyear, 2015). Such a technical structuring runs the risk of reinforcing outdated paradigms that fail to address the inclusive, ethical, and interdisciplinary demands of 21st-century education (Espoz-Lazo et al., 2024).

In contrast, university 2 presents a curriculum that strongly emphasizes sociocultural and ethical dimensions of teacher education, highlighting categories such as social inclusion, cultural diversity, and value-based competencies. This reflects a global shift toward justice-oriented education in PETE, wherein teacher training is expected to prepare future educators to confront systemic inequalities and promote critical pedagogy (Odebiyi, 2018). Similar trends have been observed in contexts such as Canada and Australia, where inclusion and cultural sensitivity are increasingly integrated into PETE programs (Pill et al., 2022).

University 3 stands out for its deliberate integration of educational innovation strategies and technologies into its curricular structure. The high intensity of categories such as "Technological Innovation," "Workshops" and "Activities in Natural Environments" aligns with global debates on the need to modernize PETE programs through the use of digital tools and active learning approaches (Kuzminsky, 2023; Poblete-Valderrama et al., 2022). In this sense, university 3 appears to embody the profile of an adaptive institution responding to the emerging challenges of educational change and digital transformation, as advocated globally for institutions of higher education (AlKasasbeh and Amawi, 2024; Perea-Rodríguez and Abello-Avila, 2021).

Despite these divergent emphases, the three programs also share some structural weaknesses. In particular, the limited presence of critical pedagogy and constructivist approaches suggests an absence of systematic models of reflective teaching, central elements in contemporary discourses on transformative teacher education (Zeichner, 2010). This may be viewed as a shortcoming, especially considering that such approaches are expected in the Chilean higher education context. In fact, the Chilean Ministry of Education (MINEDUC) promotes specific monitoring instruments (such as the National Diagnostic Evaluation) to assess the extent to which future graduates appropriate pedagogical reflection and other aspects related



to critical educational approaches (Rodríguez-Alveal and Vásquez, 2022). Although tools commonly associated with reflective practice such as rubrics or portfolios are detected (López-Pastor, 2009), they are rarely integrated into a coherent pedagogical framework that promotes co-assessment, self-regulation, or dialogic learning. This reflects a broader issue: the gap between declared intentions and operational practices within curricular design, a challenge already identified in Latin American studies on PETE (Gallardo-Fuentes et al., 2023).

Additionally, the limited presence of “Interdisciplinary Work” and “Educational Inclusion” suggests that these dimensions have not yet been consolidated as cross-cutting principles within the curricular architecture. This omission is concerning, especially in light of international frameworks such as those promoted by UNESCO (McLennan and Thompson, 2015), which call explicitly for Initial Teacher Education programs to foster diversity and interdisciplinarity. Furthermore, in today’s educational landscape marked by multicultural realities and educational inequality, Pre-service Teacher Education must prepare professionals not merely as knowledge transmitters, but as agents of social change (Cochran-Smith et al., 2016).

One important implication of these findings lies in the potential of visual and cartographic analytical tools, such as heat maps. These tools allow researchers and institutions to identify patterns and omissions in curricular discourse (Lehn, 2024). They enable the detection of conceptual overloads and formative voids, thus fostering a more informed approach to curricular redesign (Clark et al., 2021; Fatima et al., 2024). In line with what Gulson and Sellar (2019) describe as “data infrastructures for decision-making in educational contexts,” the methodological contribution of this study lies not only in what it reveals but also in how it enables institutions to self-assess and improve. The study’s findings can be applied to the development of practical improvement plans for the analyzed university programs.

Finally, it is essential to consider the broader context in which this study is situated namely, a regional Latin American reality in which Initial Teacher Education faces challenges such as underfunding, institutional fragmentation, and, in some cases, a disconnection between universities and schools, as well as limited policy coherence (Gallardo-Fuentes et al., 2023). Furthermore, the implementation of the formative curricula in degree programs such as those in this study relies on operational conditions, where the quality of facilities, academic resources, and institutional support determine the effectiveness of teaching and learning processes (Medina-Manrique et al., 2022). These conditions make institutional efforts to integrate ethical, social, and innovative dimensions even more significant. However, as this study demonstrates, such efforts must be accompanied by systemic curricular reforms that go beyond isolated innovations and ensure alignment between institutional discourse, learning outcomes, and pedagogical practices (Korpics and Bajnok, 2024; Udych et al., 2023).

## 5 Conclusion

The study identified three distinct curricular logics in Chilean PETE programs: technical-biomedical, sociocultural-ethical, and innovation-oriented. Each represents a specific institutional response

to global debates on teacher education, thereby addressing the first research question. In response to the second research question, the technical orientation prioritizes disciplinary content, the sociocultural approach promotes inclusion and justice-oriented education, and the innovation-oriented model emphasizes technological and experiential strategies. However, when compared with international literature, all three reveal persistent weaknesses in the systematic integration of reflective and critical pedagogies.

These findings also help answer the third research question, as they suggest the need for differentiated recommendations. Programs with a technical emphasis should incorporate stronger elements of formative assessment, inclusion, and interdisciplinarity to move beyond content reproduction. Innovation-driven curricula require the strengthening of ethical and critical foundations to ensure pedagogical depth. Finally, sociocultural-oriented programs must consolidate practical mechanisms for reflective teaching and interdisciplinary collaboration. Collectively, these operational guidelines address the identified weaknesses and offer pathways for curricular redesign, contributing to the improvement of PETE in similar Latin American contexts.

## Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: Contact the corresponding author Francisco Gallardo-Fuentes, email: fgallardo@ulagos.cl.

## Author contributions

FG-F: Writing – original draft, Writing – review & editing. BC-T: Writing – review & editing, Writing – original draft. JR-V: Writing – original draft, Writing – review & editing. NC-S: Writing – review & editing, Writing – original draft. SP-T: Writing – review & editing, Writing – original draft. JG-F: Writing – review & editing, Writing – original draft. LA-M: Writing – review & editing, Writing – original draft.

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Training? The Impact of Teaching Profession Standards on Disciplinary Knowledge through Reciprocal Assessment.”

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

The author(s) declare that Generative AI was used in the creation of this manuscript. Generative AI was used for supervised assistance in proofreading and improving English grammar and style.

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