

Physics Teacher Education Programs in the Federal District: A Documentary and Comparative Analysis of Pedagogical Course Projects and Their Implications for Teacher Identity^{+,*}

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Abstract

This article presents a documentary analysis of the Pedagogical Course Projects (PPCs) of Physics teacher education programs in Brazil's Federal District, encompassing on-campus and distance-learning modalities, as well as institutional curricular revisions. The study is grounded in the conception of the teacher as a historical, social, and relational subject (Nóvoa, 1992, 1995; Tardif, 2014; Dubar, 2005), linking teacher education, professional identity, and educational policies in dialogue with the National Curriculum Guidelines (2015). Methodologically, this is a qualitative documentary study conducted through content analysis (Bardin, 2016). Comparative tables were developed to highlight convergences, divergences, and trends across the PPCs, considering workload, graduate profile, curricular structure, formative practices, and methodological approaches. The results indicate that, although the programs share a common foundation, they differ in the emphasis placed on pedagogical practice, the integration of knowledge,

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and the professional profile outlined. It is also noted that part of the analyzed documents predates Resolution CNE/CP No. 2/2019, which characterizes the study as a time-bound and partial analysis, thus not allowing for generalizations. The study concludes that analyzing PPCs is a relevant tool for understanding Physics teacher education projects in the Federal District and their implications for the construction of teachers' professional identity.

Keywords: *Initial Teacher Education; Physics Degree Programs; Pedagogical Course Projects; Professional Teaching Identity; National Curriculum Guidelines.*

I. Introduction

Teacher education in Brazil has been the subject of recurring academic and political debates. These debates stem primarily from longstanding challenges related to the social and professional recognition of teachers, the integration of theory and practice, and the consolidation of a critical and reflective professional identity. In this context, teaching cannot be conceived as a merely technical or instrumental activity, but rather as a situated social practice shaped by processes of socialization, multiple forms of knowledge, and institutional interactions. Within this framework, the present study adopts the conception of the teacher as a historical, social, and relational subject, in line with the contributions of Nóvoa (1992, 1995), Tardif (2014), and Dubar (2005), who understand teaching as an identity-building process permeated by institutional, political, and cultural factors. Adopting this perspective implies recognizing that Pedagogical Course Projects (PPCs) not only organize curricular pathways but also convey conceptions of teaching and teacher professionalism.

Within this formative context, Higher Education Institutions (HEIs) play a central role, as they are responsible for preparing future teachers to meet contemporary educational challenges. This preparation requires a solid, comprehensive, and innovative educational foundation that integrates scientific knowledge, pedagogical principles, and meaningful practical experiences. Research indicates that well-structured programs contribute to the development of reflective and critical skills, strengthening the professional identity of Physics teachers (Nardi; Cortela, 2015; Pinto; Ribeiro, 2018). In this sense, the quality of initial teacher education is understood to be intrinsically linked to the articulation among disciplinary, pedagogical, and experiential forms of knowledge, in accordance with the National Curriculum Guidelines (DCNs).

From this perspective, it is relevant to revisit the historical development of Physics education in Brazil, which dates back to the nineteenth century and became institutionalized in 1837 with the founding of Colégio Pedro II in Rio de Janeiro (Rosa; Rosa, 2005). The first undergraduate Physics program was established in 1934 at the University of São Paulo (USP),

consolidating the specialized preparation of teachers in this field. Since then, Physics teacher education programs have undergone successive curricular reforms, in line with changes in educational policies and social demands (Moreira, 2000, 2018; Nardi, 2005).

Within this historical context, Araujo and Vianna (2010) examine the legislation governing Physics teacher education programs in Brazil, highlighting the transition from face-to-face training models to arrangements that incorporate distance education, as well as the normative tensions that accompany this process. Complementing this analysis, Araujo and Vianna (2012), based on interviews with teacher educators working in distance education Physics programs, discuss the impacts of public educational policies on course organization, revealing institutional and conceptual challenges associated with the implementation of these guidelines.

Within this historical and normative process, key milestones include the Law of Guidelines and Bases of National Education (LDB; Law No. 9,394/1996), Resolution CNE/CES No. 9/2002², Resolution CNE/CP No. 2/2015³, and, more recently, Resolution CNE/CP No. 2/2019⁴, which redefined the parameters for initial teacher education in Brazil.

In the specific context of Brazil's Federal District (DF), this national movement was reflected in the creation and diversification of Physics teacher education programs, albeit on a more limited scale. The University of Brasília (UnB), founded in 1962, launched its Physics teacher education program in the 1970s, becoming a pioneer in the region (University of Brasília, 2017a, 2017b). Subsequently, the Catholic University of Brasília (UCB) implemented a Science program with a concentration in Physics in 1984, which was later converted into a full Physics teacher education degree in 1997 (Catholic University of Brasília, 2010). More recently, in 2015, the Federal Institute of Brasília (IFB) inaugurated its Physics teacher education program (Federal Institute of Brasília, 2016). This expansion diversified the range of programs offered, including both on-campus and distance education modalities, while also seeking to broaden access to teacher education in the sciences. However, as explained in the methodological section, the analyzed documents have temporal limitations that require interpretive caution, particularly regarding their alignment with the most recent normative guidelines.

Despite these institutional advances, the availability of Physics teacher education programs in the Federal District remains limited, currently concentrated mainly at UnB and

² Resolution CNE/CES No. 9, of March 11, 2002, establishes the Curricular Guidelines for Bachelor's and Licentiate Degree courses in Physics (Brazil, 2002).

³ Resolution CNE/CP No. 2, of July 1, 2015, defines the National Curriculum Guidelines for initial higher education (undergraduate courses, teacher training courses for graduates, and second undergraduate courses) and for continuing education (Brazil, 2015).

⁴ Resolution CNE/CP No. 2, of December 20, 2019, defines the National Curriculum Guidelines for Initial Teacher Training for Basic Education and establishes the National Common Base for Initial Teacher Training for Basic Education (BNC-Formação) (Brazil, 2019).

IFB. This configuration tends to restrict the number of qualified teachers and, consequently, the capacity to meet the demands of the local basic education system. Furthermore, although there is relevant research on Physics teacher education in Brazil, a gap remains in studies specifically focused on the Federal District, both in terms of its historical development and the critical analysis of Pedagogical Course Projects (PPCs).

In this research field, recent studies have sought to map and analyze the scholarly literature on the curricula of Physics teacher education programs in Brazil, highlighting important advances in understanding training structures, pedagogical conceptions, and the guidelines that shape initial teacher education. Conceição, Sitko, and Vizzotto (2022) emphasize that, although there has been significant growth in research addressing curricular analysis and Pedagogical Course Projects (PPCs), gaps remain regarding comparative approaches, specific regional perspectives, and more systematic connections to teachers' professional identity. These gaps reinforce the relevance of investigations that take PPCs as a key empirical source, analyzing them in a situated and relational manner, as proposed in the present study by focusing on Physics teacher education programs in the Federal District.

At the national level, recent analyses of the availability and organization of Physics teacher education programs reveal a scenario marked by regional asymmetries, institutional fragilities, and challenges related to student retention and the consolidation of these programs. Based on an analysis of microdata from the Higher Education Census, Vizzotto (2021) highlights inequalities in the distribution of Physics teacher education programs across Brazil, as well as significant dropout rates and course discontinuation, factors that directly affect initial teacher education and the construction of teachers' professional identity. This national panorama reinforces the relevance of situated research capable of understanding how educational policies, institutional choices, and local contexts interact in shaping Pedagogical Course Projects (PPCs) and the formative trajectories of future teachers.

In light of this set of elements, the following research problem emerges: *What convergences, divergences, and trends can be identified in the Pedagogical Course Projects (PPCs) of undergraduate Physics programs in the Federal District, considering both in-person and distance learning modalities, and how do these differences impact teacher training and identity?*

To address this question, the overall objective of this article is to conduct a comparative analysis of the Pedagogical Course Projects (PPCs) of Physics teacher education programs offered by Higher Education Institutions in the Federal District, with emphasis on conceptions of teacher education and professional identity. Five specific objectives derive from this aim: (i) to identify and compare the total workload and its distribution (required courses, practical activities, supervised teaching internships, and complementary activities); (ii) to examine the graduate profiles defined in each program and their alignment with the National Curriculum Guidelines (DCNs); (iii) to analyze the curricular structure in terms of training components, the integration between theory and practice, and the inclusion of pedagogical

courses; (iv) to examine the methodological conceptions of teaching, learning, and assessment presented in the documents; and (v) to discuss, in light of the theoretical contributions of António Nóvoa, Maurice Tardif, and Claude Dubar, the extent to which the PPCs foster-or limit-the construction of a critical and reflective teacher identity.

From this analytical perspective, examining Pedagogical Course Projects (PPCs) is a key strategy for understanding how different institutions structure and guide Physics teacher education in response to the legal and pedagogical demands imposed by recent curricular reforms. By systematizing and comparing these documents, it becomes possible not only to identify curricular convergences and divergences, but also to reflect on the limits and potential of each proposal in fostering a critical, reflective, and socially committed teacher identity. In this way, the present study contributes to the academic debate on initial teacher education by providing analytical insights into Physics teacher education programs in the Federal District.

II. Theoretical Basis

Teacher education is a complex process that goes beyond the mere transmission of content and involves personal, professional, and institutional dimensions. In this sense, Nóvoa (1992) argues that teacher education should be understood as a space for the construction of professional identity, bringing together experience, critical reflection, and ethical commitment. The author further emphasizes that teaching is a situated social practice, in which professionalism is built at the intersection of personal trajectories and institutional contexts (Nóvoa, 1995). Imbernón (2011), in turn, criticizes technicist approaches to teacher education, arguing that they should promote autonomy, reflective capacity, and critical engagement with school realities.

Building on this debate, Tardif (2014) systematizes teachers' knowledge into four major categories-professional training knowledge, disciplinary knowledge, curricular knowledge, and experiential knowledge-emphasizing that these forms of knowledge are acquired in diverse settings and constantly interact in everyday practice. This multiplicity of knowledge, however, is fully realized only through the process of professional socialization, which Dubar (2005) conceives as the progressive internalization of values and practices specific to the profession. Perrenoud (2001) adds that teacher development requires competencies that go beyond content mastery, also demanding skills related to adaptation, classroom management, and critical reflection on practice, in line with Schön's (1992) notion of "reflection-in-action".

From this articulation between knowledge and socialization emerges the debate on teachers' professional identity. Dubar (2005) defines identity as the result of ongoing negotiations between personal and collective dimensions, continuously reconfigured throughout one's professional trajectory. Similarly, Nóvoa (1992) understands teacher identity as a provisional synthesis, constructed through life history, pedagogical knowledge, and institutional experience. Thus, identity cannot be understood as a static entity, but rather as a

dynamic and evolving process marked by tensions among personal expectations, institutional demands, and educational policies.

The discussion of identity is also connected to the debate on professionalization and teacher professionalism. Freidson (2001; 2019) argues that professionalization is associated with the monopoly of specialized knowledge, autonomy in the exercise of professional functions, and social recognition. However, teaching has historically faced difficulties in consolidating itself as a fully recognized profession due to the heterogeneity of training pathways, working conditions, and recurring social devaluation. In this context, professionalism has increasingly been associated with ethical engagement and commitment to teaching quality, even though it is often disconnected from the structural conditions necessary for the full exercise of the profession.

When it comes specifically to Physics teacher education, these discussions take on even more distinctive contours. Nardi (2005) emphasizes that Physics teacher education programs should integrate a solid foundation in disciplinary content with innovative pedagogical practices capable of bringing students closer to scientific thinking. For Moreira (2000; 2018), overcoming the fragmentation between content and didactics remains a central challenge, making the articulation between theory and practice indispensable throughout the entire training process. In this sense, Angotti (2006) draws attention to the historical challenges involved in preparing Physics educators, highlighting the persistent separation between scientific and pedagogical training, as well as the difficulty of consolidating a teacher identity that integrates conceptual mastery, educational commitment, and critical reflection on practice. Rosa and Rosa (2005), in turn, recall that Physics teaching in Brazil became established as a school subject in the nineteenth century and has undergone successive reforms that shaped teacher education programs and reflected changes in educational policies and social demands.

In this context, the National Curriculum Guidelines play a central role, particularly through Resolution CNE/CP No. 2/2015 and Resolution CNE/CP No. 2/2019, which redefined key principles and parameters for initial teacher education in Brazil. These regulations reinforce the need to articulate theory and practice, to value practice as a curricular component, and to strengthen the links between initial teacher education and school realities. At the same time, studies such as Souza (2009) propose quality indicators that may serve as analytical benchmarks for examining the structure and coherence of Pedagogical Course Projects (PPCs).

Thus, the literature converges on the understanding that teacher education should be analyzed as a complex, relational, and situated process in which professional identity is continuously constructed. Authors such as Nóvoa (1992; 1995), Tardif (2014), and Dubar (2005) emphasize the articulation among knowledge, practices, and social contexts as a central element in the constitution of teaching. Despite theoretical advances and contributions from the field of Physics education, gaps remain regarding the analysis of local contexts and the ways in which Pedagogical Course Projects (PPCs) shape both possibilities and limitations for the construction of a critical, reflective, and socially committed professional identity. This

reinforces the relevance of the present investigation, which proposes a comparative analysis of Physics teacher education programs in the Federal District.

III. Historical overview of Physics undergraduate programs in the Federal District

Physics teacher education is a central element in the consolidation of scientific and technological education in Brazil, not only in terms of public educational policies, but above all as a space for the construction of teachers' professional identity, since it articulates disciplinary, pedagogical, and experiential knowledge within specific institutional contexts (Nóvoa, 1992; Tardif, 2014; Dubar, 2005).

In the context of the Federal District, Physics teacher education programs play a central role in preparing professionals capable of working in basic education and other educational settings, thereby contributing to the democratization of scientific knowledge. Currently, the University of Brasília (UnB) and the Federal Institute of Education, Science and Technology of Brasília (IFB) stand out in this scenario as public institutions that maintain active Physics teacher education programs. It is also worth noting the historical contribution of the Catholic University of Brasília (UCB), which, although it no longer offers the program, played an important role in teacher education throughout its institutional trajectory.

This section presents a historical and analytical synthesis of the Physics teacher education programs offered by these higher education institutions, considering their origins, pedagogical projects, curricula, objectives, and educational resources. The analysis is based on data obtained from institutional websites and, primarily, on a systematic reading of the Pedagogical Course Projects (PPCs). It is important to note, however, that the analyzed documents reflect the normative framework in force at the time they were produced. This aspect should be taken into account in the historical interpretation of the programs, as discussed in the Methodology section.

III.1 Physics courses at the University of Brasília (UnB)

Founded in 1962, the University of Brasília has established itself as one of the leading higher education institutions in Brazil, recognized for its academic excellence, scientific output, and commitment to social transformation (University of Brasília, 2023; 2024). Since its creation, UnB has assumed responsibility for educating teachers and researchers in various fields of knowledge, including Physics, whose undergraduate program was established in accordance with the scientific and educational demands of the time.

The Physics teacher education program at UnB began in 1993, in response to the growing demand for teachers in basic education (University of Brasília, 2017a). Currently, the Institute of Physics (IF/UnB) offers three undergraduate programs: a Bachelor's degree in Physics (daytime), an on-campus Physics teacher education program (evening), and a distance learning Physics teacher education program.

The Pedagogical Project for the on-campus program (University of Brasília, 2017a) was approved in 2017 and aims to prepare teachers with strong pedagogical training, mastery of the conceptual, historical, and epistemological aspects of Physics, and teaching competencies that enable them to work in both basic education and non-formal educational settings. The curriculum is organized into two main components: (i) a common core, covering General Physics, Mathematics, and Classical and Modern Physics; and (ii) a sequential module focused on the preparation of Physics educators, with emphasis on pedagogical practice and supervised internships. In addition, the program includes complementary activities, seminars, forums, and interdisciplinary initiatives that strengthen teachers' professional identity and promote articulation with the educational context of the Federal District.

Regarding the distance learning program, its creation was driven by UnB's participation in the Open University of Brazil System (UAB) in 2007 and is regulated by a specific Pedagogical Course Project (PPC) (University of Brasília, 2017b). Its main objective is to broaden access to Physics teacher education, meeting the social demand for qualified professionals. Like the on-campus version, the distance learning program is organized into a common core and a pedagogical training module, integrating teaching, research, and outreach activities. The use of virtual learning environments, undergraduate research programs, and outreach projects ensures the integration of knowledge and formative practices.

Despite recognition of their quality, UnB's Physics teacher education programs face persistent challenges, such as student dropout, the need to update the curriculum in light of technological and pedagogical changes, and the consolidation of interdisciplinary practices. Furthermore, the analyzed Pedagogical Course Projects were developed prior to CNE/CP Resolution No. 2/2019, which calls for reflection on their alignment with current regulations, particularly regarding supervised internships, practice as a curricular component, and the graduate profile.

III.2 Physics course at the Federal Institute of Brasília (IFB)

The Federal Institute of Education, Science and Technology of Brasília (IFB), created in 2008 by Law No. 11,892, is part of the Federal Network of Professional, Scientific, and Technological Education. Since its inception, the institution's mission has been to promote free, high-quality public education, integrating teaching, research, and outreach activities at different educational levels (Federal Institute of Brasília, 2016; 2017; 2024).

The Physics teacher education program was authorized by Resolution No. 034-2013/CS-IFB and began its activities in 2015. Its central objective is to prepare teachers capable of understanding physical phenomena in their different dimensions, including mechanics, optics, thermodynamics, and electromagnetism, while integrating conceptual and methodological content with pedagogical practice.

According to its Pedagogical Course Project (PPC) (Federal Institute of Brasília, 2016), the curriculum is organized into three axes: (i) a Common Physics Core (NCF),

comprising courses in General Physics, Mathematics, and scientific fundamentals; (ii) a Physics Educator Module (MFE), encompassing components related to education, supervised internships, and complementary activities; and (iii) an elective module, which allows for the diversification of training pathways. In addition to required courses, the program includes undergraduate research activities, outreach initiatives, and educational practices in both formal and non-formal settings.

IFB stands out for its emphasis on integrative practices, offering teaching laboratories, applied research projects, and outreach opportunities that bring undergraduate students closer to the educational context of the region. Despite challenges such as consolidating its institutional identity and reducing dropout rates, IFB's Physics teacher education program has significantly contributed to expanding the supply of teachers in the Federal District, reaffirming the institution's commitment to high-quality teacher education. Nevertheless, its PPC (2016) requires updating in light of the changes introduced by CNE/CP Resolution No. 2/2019, which may affect the adequacy of its curricular components in meeting current regulatory requirements.

III.3 Physics course at the Catholic University of Brasília (UCB)

The Catholic University of Brasília (UCB), founded in 1974 and granted university status in 1994, is maintained by the Brazilian Union of Catholic Education (UBEC). Throughout its trajectory, the institution has stood out for offering undergraduate and graduate programs in various fields of knowledge, grounded in community-based and Christian principles (Catholic University of Brasília, 2010; 2022; 2024).

In the field of Physics, UCB began its activities in 1984 within a Science program and, in 1997, established a full Physics teacher education program designed to meet the demand for teachers in basic education. The program underwent successive curricular reforms, incorporating laboratory activities and active learning methodologies, until its last documented update in 2016. However, the institution no longer offers the Physics teacher education program, and there is no publicly available record of the last graduating cohort.

Despite its discontinuation, UCB's Physics program played an important role in training teachers in the Federal District, serving as a relevant alternative to public provision and contributing to the entry of qualified professionals into the labor market. However, the analyzed Pedagogical Course Project (PPC) corresponds only to an excerpt from 2010, which represents a partial document and does not fully reflect the curricular proposal in force at the time. This limitation weakens the comparative analysis and should be explicitly acknowledged as a relevant methodological constraint in order to avoid overgeneralization and unwarranted inferences.

IV. Research Methodology

This study is characterized as qualitative documentary research, focused on the comparative analysis of the Pedagogical Course Projects (PPCs) of Physics teacher education programs offered in the Federal District. This choice is justified by the relevance of PPCs as normative and institutional documents that express formative conceptions, graduate profiles, and curricular structures, thereby enabling an understanding of how each institution guides initial teacher education. The empirical scope encompassed documents in force or in circulation between 2010 and 2024, a period during which important national guidelines for teacher education were consolidated. It should be noted, however, that a significant portion of the examined PPCs predates CNE/CP Resolution No. 2/2019, which frames the analysis as a time-bound documentary snapshot. This partial scope requires interpretive caution and precludes generalizations to Physics teacher education programs nationwide.

According to Gil (2006), documentary research is similar to bibliographic research, differing in the nature of the sources consulted, which have not undergone prior systematic analytical treatment. In this sense, the PPCs were considered primary sources, open to reinterpretation in light of the objectives of this study. Lüdke and André (1986) emphasize that documentary analysis provides access to qualitative data in a way that complements other techniques, revealing institutional and pedagogical aspects that may not be evident in statistical surveys. Furthermore, Bardin's (2016) approach to content analysis, understood here in its qualitative dimension, guided the categorization and interpretation of the data, prioritizing a critical examination of the orientations expressed in the documents.

The research corpus consisted of the following documents: (i) the Pedagogical Course Project of the Physics teacher education program at the University of Brasília (UnB), in both on-campus and distance learning modalities; (ii) the Pedagogical Course Project of the Physics teacher education program at the Federal Institute of Brasília (IFB), on-campus modality; and (iii) an excerpt from the Pedagogical Course Project of the Physics teacher education program at the Catholic University of Brasília (UCB), on-campus modality, a program currently being phased out. It should be noted that, in the case of UCB, it was not possible to obtain the complete version of the document, and the file provided by the institution was therefore used. Although this limitation requires interpretive caution, it did not compromise the comparative analysis proposed in this study. However, it is acknowledged that the use of a partial excerpt weakens the analysis of certain curricular dimensions, and this limitation should be explicitly considered when interpreting the results.

The documents were collected through searches on the institutions' official websites and, when necessary, through direct contact with academic and administrative departments. After obtaining the material, a comprehensive reading of each PPC was carried out in order to identify, systematize, and compare the main elements related to teacher education.

To organize the data, the information was categorized into six analytical axes, defined based on national teacher education guidelines and specialized literature: (a) general structure

of the PPCs; (b) institutional profile; (c) course and graduate profile; (d) workload, duration, and number of places offered; (e) curriculum, with emphasis on the integration between disciplinary and pedagogical content; and (f) emphasis on research and scientific production. In addition, the quality indicators proposed by Souza (2009) were incorporated, encompassing criteria related to curricular coherence, theory and practice integration, and the valorization of pedagogical training. This approach allowed for a critical analysis that complements the official parameters of the Ministry of Education (MEC).

It is important to emphasize that the analyzed Pedagogical Course Projects were developed or reformulated between 2010 and 2017, therefore prior to the approval of CNE/CP Resolution No. 2/2019 and its subsequent normative developments. This temporal delimitation constitutes a methodological limitation of the study, requiring interpretive caution regarding the scope of the findings and preventing generalizations to Physics teacher education programs implemented after 2019.

The findings should therefore be understood as representative of a specific historical moment in curriculum formulation, in which Physics teacher education programs in the Federal District were structured under the Law of Guidelines and Bases of National Education (Law No. 9,394/1996), the Curriculum Guidelines for Bachelor's and Licentiate Degrees in Physics (CNE/CES Resolution No. 9/2002), and CNE/CP Resolution No. 2/2015. From this perspective, the analysis highlights both institutional advances and curricular weaknesses characteristic of the period, situating the examined PPCs within the broader national process of reformulating initial teacher education.

Within this framework, the comparative analysis sought to identify convergences and divergences among Physics teacher education programs in the Federal District, examining the extent to which the Pedagogical Course Projects align with the National Curriculum Guidelines for initial teacher education in basic education, particularly CNE/CP Resolutions No. 2/2015 and No. 2/2019. In this analytical process, teacher identity was conceived not as an isolated category, but as a transversal and relational dimension, examined through the descriptions of graduate profiles, formative objectives, and the integration between theory and practice presented in the analyzed documents.

Finally, this study acknowledges limitations related to the absence of empirical field data, such as interviews with program coordinators or faculty members, as well as the unavailability of the complete PPC from UCB. Nevertheless, the choice of a comparative documentary analysis allowed the construction of a consistent analytical framework regarding the programs examined, offering relevant insights for reflecting on Physics teacher education in the Federal District and its articulation with national educational policies.

V. Results and discussion

The document analysis conducted in this study enabled the organization and comparison of the Pedagogical Course Projects (PPCs) of Physics teacher education programs

offered in the Federal District, encompassing different institutional and curricular dimensions. The results were systematized in comparative tables built from the categories defined in the methodology, making it possible to identify convergences, divergences, and gaps among the training proposals, as well as their degree of alignment with the National Curriculum Guidelines (DCNs) for initial teacher education (CNE/CP Resolutions nº. 2/2015 and nº. 2/2019).

The analyses presented here are grounded in the conception of teacher education as an identity-building, relational, and historically situated process, in dialogue with Nóvoa (1992; 1995), Tardif (2014), and Dubar (2005). From this perspective, teaching is understood not merely as a technical activity, but as a social practice mediated by multiple forms of knowledge, disciplinary, pedagogical, and experiential, as well as by institutional and historical processes that shape professional identity. Accordingly, curricula are understood not only as regulatory documents, but also as projects that convey specific conceptions of teachers and of the teaching profession.

Table 1: General Structure of PPCs.

Institution	Modality	PPC Year	Course Status	Document available
University of Brasília (UnB)	On-campus	2017	Active	Full
University of Brasília (UnB)	Distance Learning	2017	Active	Full
Federal Institute of Brasília (IFB)	On-campus	2016	Active	Full
Catholic University of Brasília (UCB)	On-campus	2010	Discontinued (being phased out)	Partial (PPC excerpt)

Source: prepared by the authors.

As shown in Table 1, all the Pedagogical Course Projects analyzed were developed prior to the approval of CNE/CP Resolution No. 2/2019. Although the PPCs of UnB (2017) and IFB (2016) differ slightly in terms of when they were produced, both belong to the same regulatory cycle. The main exception is UCB's PPC, developed in 2010, whose temporal gap is substantially greater than that of the other documents analyzed.

Institutional differences influence course design, as shown in Table 2. While UnB and IFB have a public mission focused on integrating science, citizenship, and innovation, UCB emphasizes a humanistic and Christian-oriented perspective, with a stronger emphasis on ethical values. Although this distinction is valid, it should be problematized in terms of teacher identity: to what extent do these institutional missions shape the conceptions of teacher education projected in the PPCs?

Table 2: Institutional Profile.

Institution	Type	Scope	Institutional mission (summary)
UnB	Federal public institution	Teaching, research, and outreach	Civic education and the production of critical scientific knowledge.
IFB	Federal public institution	Professional and technological education	Comprehensive education, combining science, technology and citizenship.
UCB	Private philanthropic	Faith-based higher education	Human and ethical development from a Christian perspective.

Source: prepared by the authors.

Table 3: Course and Graduate Profile.

Institution	Course Profile	Graduate Profile
UnB (On-campus and Distance Learning)	Comprehensive training, combining disciplinary physics content, pedagogical principles, and research in science education.	A critical and reflective teacher, capable of working in Basic Education and engaging with research in science education.
IFB	Integrated training combining Physics and pedagogical practices, with emphasis on the technological dimension.	A teacher with conceptual and pedagogical expertise, committed to inclusive practices and educational innovation.
UCB	Training focused on specific Physics content and conventional pedagogical subjects.	A qualified teacher for Basic Education, with a more technical and less critical profile.

Source: prepared by the authors.

Table 3 indicates greater adherence of UnB and IFB to the DCNs (2015/2019), as they emphasize critical, reflective, and integrative teacher education. The profile projected by UCB, in turn, appears less aligned, favoring a more content-centered and technical approach. This difference illustrates Dubar's (2005) argument that professional identity results from negotiations between institutional contexts and individual trajectories, since less integrated curricula tend to project more restrictive teaching identities.

The comparison in Table 4 reveals convergence between UnB and IFB, which meet the requirements of CNE/CP Resolutions No. 2/2015 and No. 2/2019, particularly regarding the distribution of hours dedicated to Practice as a Curricular Component and supervised internships. UCB's program, however, shows weaknesses due to both the smaller number of hours allocated to practice and the lack of curricular updating.

Table 4: Curriculum Structure and Total Workload.

Institution	Total workload	Supervised Internship	Practice as a Curricular Component	Complementary Activities	Observations
UnB (On-campus)	3,200 h	400 h	400 h	200 h	Emphasis on the integration of theory and practice.
UnB (Distance Learning)	3,200 h	400 h	400 h	200 h	Equivalent structure to the on-campus modality.
IFB	3,240 h	400 h	400 h	200 h	Emphasis on pedagogical practices and outreach.
UCB	2,800 h	300 h	200 h	100 h	Lower workload allocated to practice and lack of updating in accordance with the DCNs/2015.

Source: prepared by the authors.

Beyond the number of hours allocated to internships and practice, differences also emerge in how the PPCs organize these components. In UnB's programs (on-campus and distance learning), internships are distributed throughout the program, gradually integrating with courses in didactics and Physics teaching methodology. IFB emphasizes an approach that links internships, outreach projects, and pedagogical practices, reinforcing its institutional identity oriented toward technological and inclusive teacher education. UCB, by contrast, adopts a more concentrated model with fewer hours and limited integration between internships and pedagogical practices. This weakens the relationship between theory and practice and compromises the progressive development of teachers' professional identity.

The comparative analysis presented in Table 5 highlights significant differences in how courses distribute subjects across training components. In UnB's on-campus program (2017), there are approximately 16 pedagogical courses focused on teacher education and teaching practice, 6 courses in calculus and mathematics, 24 Physics courses, 6 courses related to research and scientific methodology, and 3 courses related to inclusion and diversity, totaling about 55 curricular components. Similarly, UnB's distance learning program (2017) shows a comparable configuration, with 15 pedagogical courses, 6 in calculus and mathematics, 23 in Physics, 6 in research and methodology, and 3 in inclusion and diversity, totaling about 53 components.

Table 5: Distribution of subjects by areas of study in undergraduate Physics teacher education programs in the Federal District.

Institution	Education and Teacher Training	Calculus and Mathematics	Physics content courses	Research and Methodology	Inclusion and Diversity	Approximate total number of courses
UnB on-campus (2017)	16	6	24	6	3	55
UnB distance Learning (2017)	15	6	23	6	3	53
IFB on-campus (2016)	18	7	25	7	4	61
UCB on-campus (2010, discontinued)	12	8	22	4	2	48

Source: prepared by the authors, based on the analyzed PPCs (UnB on-campus and distance learning, 2017; IFB, 2016; UCB, 2010).

IFB's program (2016) has the largest number of curricular components across the different training areas, comprising 18 pedagogical courses, 7 in calculus and mathematics, 25 in Physics, 7 in research and methodology, and 4 focused on inclusion and diversity, totaling about 61 components. This configuration suggests greater quantitative fragmentation of the curriculum, without necessarily implying greater formative diversity or stronger qualitative integration across training areas. In contrast, UCB's program (2010), which is currently being phased out, presents a more limited set: 12 pedagogical courses, 8 in calculus and mathematics, 22 in Physics, 4 in research and methodology, and only 2 in inclusion and diversity, totaling about 48 components. This structure reflects a leaner and more concentrated curriculum, which also shows limitations in the integration across training components.

Table 6 indicates that UnB's programs (on-campus and distance learning) and IFB show a better balance between pedagogical, disciplinary, and research-oriented components, although they adopt different models of curricular organization. This configuration more clearly addresses contemporary demands in teacher education. In addition to traditional areas such as Mathematics, Classical Physics, and Modern Physics, these PPCs allocate significant hours to Practice as a Curricular Component and to Supervised Internships. Practice is distributed throughout the program and is linked, to varying degrees, to both pedagogical courses and Physics courses, giving teacher education a transversal character. This arrangement reinforces the articulation among disciplinary, curricular, experiential, and professional knowledge, in line with Tardif's (2014) argument that the construction of teacher identity requires a balanced integration of multiple forms of knowledge.

Table 6: Quantitative distribution of workload by training areas in undergraduate Physics teacher education programs.

Training Area	UnB On-campus (Evening)	UnB Distance Learning (UAB)	IFB On-campus	UCB On-Campus	Observations
Education/Didactics/Pedagogical Training	660 h	600 h	570 h	600 h	Didactics, Educational Psychology, Organization of Brazilian Education, Educational Policies.
Mathematics/Calculus	540 h	480 h	450 h	540 h	Calculus I–III, Linear Algebra, Analytic Geometry, Statistics.
Classical Physics	720 h	640 h	690 h	600 h	Mechanics, Electromagnetism, Thermodynamics, Optics.
Modern/Contemporary Physics	420 h	360 h	300 h	300 h	Quantum Mechanics, Relativity, Nuclear Physics.
Academic Research/TCF	120 h	120 h	120 h	120 h	Research Methodology, Final Course Project.
Inclusive Education/Social Dimension	120 h	120 h	120 h	120 h	Brazilian Sign Language (LIBRAS), Diversity, Inclusive Education, Environmental Education.
Practice as a Curricular Component	420 h	460 h	400 h	200 h*	UnB (University of Brasília) On-campus: 420 hours; UnB Distance Learning: 460 hours; IFB (Federal Institute of Brasília): 400 hours; UCB (Catholic University of Brasília): only partially specified in the PPC (*approx.).
Supervised Internship	420 h	450 h	400 h	400 h	Teaching Internship in Physics in Basic Education.

Complementary Activities	210 h	240 h	200 h	200 h	Variable workload as per institutional regulations.
Total Workload	3,300 h	3,240 h	3,247.5 h	≈2,805 h (adjusted to 3,200h after 2015)	All meet the legal minimum (Resolution CNE/CP No. 2/2015).

Source: Pedagogical Course Projects (PPCs) of the undergraduate Physics teacher education programs (UnB on-campus and distance learning/UAB, IFB, and UCB).

At the institutional level, relevant differences can be observed in how practice is incorporated into curricula. At IFB, Practice as a Curricular Component is predominantly linked to pedagogical training courses, although there are occasional connections to disciplinary Physics courses. At UnB, practice tends to assume a more transversal and progressive character throughout the curriculum. In contrast, UCB's program, especially in its 2010 version, reflects a conception of practice concentrated in specific pedagogical components with less transversal integration, which is characteristic of curricular models that predate the most recent guidelines.

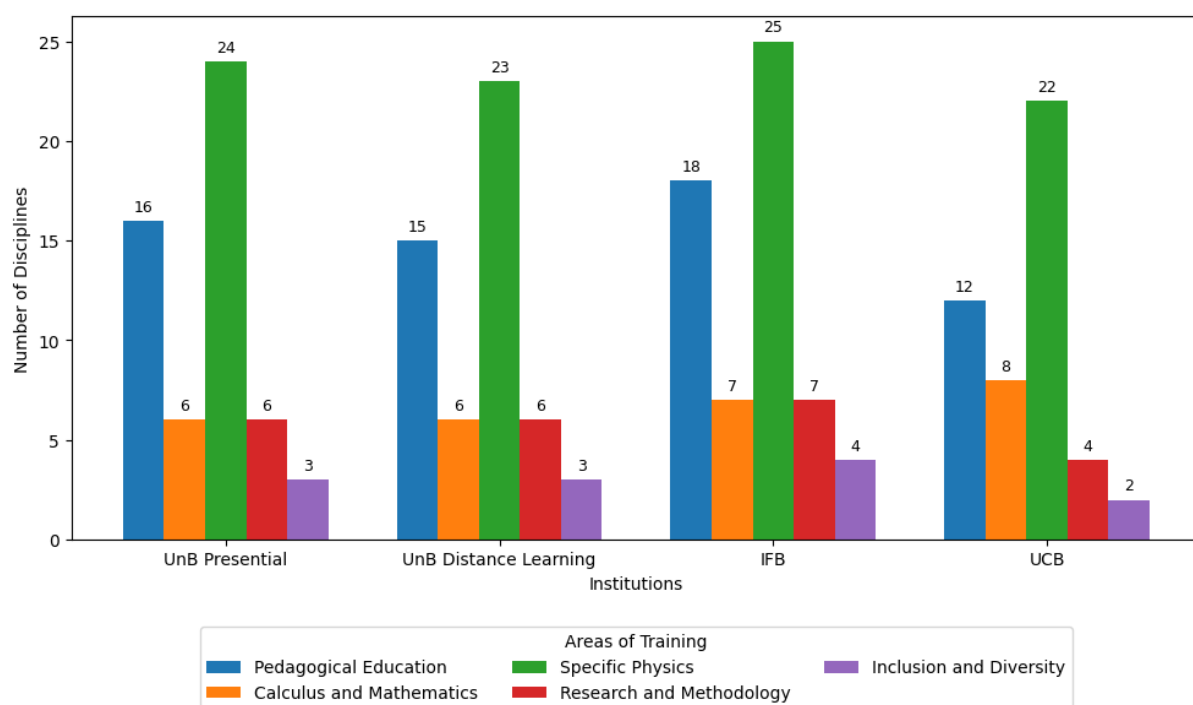
It is worth noting that the PPCs analyzed were developed in distinct normative contexts, which partly explains their structural differences. While UCB's PPC was conceived under the 2002 National Curriculum Guidelines, which prioritized disciplinary content, the PPCs of UnB and IFB already incorporated the guidance of CNE/CP Resolution No. 2/2015. This resolution established a minimum of 400 hours of practice and 400 hours of supervised internships, and it emphasized critical, reflective, and inquiry-oriented teacher education. Subsequently, CNE/CP Resolution No. 2/2019 further detailed these principles by defining professional competencies and proposing closer integration between teacher education programs and the National Common Curricular Base (BNCC), although its implementation has been marked by debate and tension in the educational field. Overall, UnB's and IFB's PPCs show greater adherence to the most recent guidelines, whereas UCB's PPC reflects a model associated with earlier legal frameworks, whose alignment with the 2015 and 2019 regulations would require curricular updating.

V.1 Comparative analysis of PPCs

A comparative analysis of the Pedagogical Course Projects (PPCs) of Physics teacher education programs in the Federal District reveals significant differences in curricular organization, institutional profile, and conceptions of teaching that guide teacher education. While the University of Brasília (UnB, both on-campus and distance learning modalities) and the Federal Institute of Brasília (IFB) present proposals that are more balanced across disciplinary, pedagogical, and research-oriented components, the Catholic University of Brasília (UCB), conceived under the 2002 National Curriculum Guidelines, maintains a strong

emphasis on disciplinary knowledge and devotes less attention to pedagogical practices. This imbalance compromises the integration between theory and practice and is further aggravated by the discontinuation of the program.

This discrepancy can be interpreted in light of Tardif's (2014) framework, which systematizes teachers' knowledge into four dimensions: disciplinary, curricular, experiential, and professional. In the programs offered by UnB and IFB, this articulation appears more consolidated, supporting critical and comprehensive teacher education. In the UCB program, however, the predominance of disciplinary content results in a more technical and fragmented formative profile, which is less conducive to the development of reflective teachers.



Graph 1: Proportional distribution of areas of study in Bachelor's Degree courses in Physics. Source: prepared by the authors based on the PPCs.

Graph 1 illustrates the proportional distribution of different training areas across the analyzed programs, highlighting the predominance of disciplinary content at UCB in contrast to the greater balance between theory, practice, and research observed at UnB and IFB. This pattern confirms the trends already identified in Tables 5 and 6, reinforcing the distance between competing teacher education models.

At the institutional level, UnB and IFB embrace the principle of the inseparability of teaching, research, and outreach, in line with the conception of teaching as a collective and socially situated practice advocated by Nóvoa (1995). UCB, in turn, adopts a more restricted model, with limited integration with research activities, which constrains pedagogical innovation and weakens the professional identity of its graduates. This difference is also reflected in levels of engagement in research and scientific production, as discussed below.

Table 7: Emphasis on Research, Scientific Production and Quality.

Institution	Integration of research into the course	Scientific output (students/faculty)	MEC Indicators
UnB	Strong connection between teaching and research; established groups in physics education.	Publications in journals and events in the field.	Score 5 (ENADE/INEP)
IFB	Participation in scientific initiation and extension projects.	Regional productions in science education and dissemination.	Score 4 (ENADE/INEP)
UCB	Limited integration of research into the program; absence of established research groups.	One-off, non-systematic production.	Course being phased out (no current evaluation).

Source: prepared by the authors.

Table 7 indicates that UnB shows strong integration between teaching, research, and outreach, supported by consolidated research groups and significant scientific production, as reflected in its quality indicators (ENADE/INEP score of 5). IFB, although more recent, already incorporates undergraduate research and outreach as structuring dimensions of its program, with relevant regional scientific output. In contrast, UCB shows limited research engagement and an absence of consolidated research groups, a situation further aggravated by the discontinuation of the program. This dimension is central to teacher identity because, as Nóvoa (1992) argues, teachers should be conceived as producers of knowledge rather than merely transmitters.

Regarding the professional identity projected, UnB and IFB outline critical, reflective, and socially committed profiles, aligning with the conception of professionalization as a process of social legitimation (Dubar, 2005). In the case of UCB, the analyzed PPC, corresponding to a partial documentary extract from 2010, indicates the predominance of a curricular organization centered on disciplinary Physics content, with less emphasis on pedagogical and research dimensions. This configuration suggests a historical tendency in the institution's formative proposal during that period, closer to a technical and content-centered model, which may have limited the construction of a relational and critical teacher identity. It should be noted, however, that this interpretation is conditioned by the partial and outdated nature of the available document.

Table 8 summarizes the main findings, confirming that while UnB and IFB present a more balanced curriculum, place greater value on research, and strengthen the critical profile of graduates, UCB exhibits structural, curricular, and institutional weaknesses, with negative repercussions for teacher identity.

Table 8: Synthesis of PPC findings through the theoretical lens of Nóvoa, Tardif, and Dubar.

Dimension analyzed	Findings in the PPCs (UnB, IFB and UCB)	Theoretical dialogue (Nóvoa, Tardif, Dubar)
Curriculum structure and workload	UnB and IFB offer a better balance between specific and pedagogical content, with supervised internships and practice as a curricular component; UCB prioritizes disciplinary knowledge, with a reduced workload allocated to pedagogical practice.	Tardif (2014): the predominance of disciplinary knowledge weakens professionalization; integration strengthens the articulation between different teaching knowledge.
Institutional and course profile	UnB and IFB emphasize the inseparability of teaching, research, and outreach; UCB has a more restricted profile, with less emphasis on research.	Nóvoa (1995): teaching as a collective and socially situated practice; broader institutional profiles reinforce teacher identity.
Research and scientific production	UnB and IFB value undergraduate research (scientific initiation) and extension programs; UCB shows weaknesses in this dimension.	Nóvoa (1992): teachers as intellectuals and producers of knowledge; valuing research expands professional autonomy.
Professional identity of the graduate	UnB and IFB project critical, reflective, and socially committed teachers; UCB presents a more technical and content-oriented profile.	Dubar (2005): identity as a relational construction; critical profiles strengthen the social legitimacy of teaching. technical profiles weaken it.
Quality indicators (MEC)	UnB and IFB have satisfactory ratings; UCB is in the process of phasing out the program.	Dubar (2005): Institutional fragility compromises social recognition and teacher identity.
Common challenges	The need for greater integration between disciplinary and pedagogical areas, stronger engagement with real school contexts, and the strengthening of collective formative practices.	Nóvoa (1992): teacher training as a collective and collaborative practice, still lacking in the courses analyzed.

Source: prepared by the authors.

Finally, the quality indicators of the Ministry of Education (MEC) corroborate this contrast. UnB and IFB show satisfactory performance indicators, demonstrating coherence between their pedagogical projects and institutional outcomes, whereas UCB is currently in the process of being phased out and lacks a recent valid evaluation. In light of Dubar's (2005) framework, this scenario signals institutional and identity-related fragility. Despite these differences, shared challenges can be identified among the three institutions, such as strengthening the integration between disciplinary and pedagogical areas, expanding students' engagement with real school contexts, and consolidating spaces for collective formative practices. These issues, discussed by Nóvoa (1992), indicate that teacher education still requires stronger collaborative and institutionalized articulation, which is a fundamental condition for the consolidation of a robust and socially recognized professional identity.

V.2 Interpretative Synthesis

A comparative analysis of the Pedagogical Course Projects (PPCs) of Physics teacher education programs in the Federal District reveals a scenario marked by advances, limitations, and challenges that directly affect the construction of teachers' professional identity.

Regarding advances, the University of Brasília (UnB) and the Federal Institute of Brasília (IFB) stand out, as their PPCs show a stronger balance between disciplinary and pedagogical components, ensuring the integration of theory and practice and meeting the requirements of the National Curriculum Guidelines (2015 and 2019). These institutions also distinguish themselves by valuing undergraduate research and outreach activities, which bring students closer to knowledge production and contribute to the construction of a critical, reflective, and socially committed professional identity, in line with the perspectives of Nóvoa (1992; 1995) and Dubar (2005).

Regarding limitations, the Catholic University of Brasília (UCB) presents significant weaknesses, both due to the predominance of disciplinary knowledge at the expense of pedagogical and experiential knowledge and due to the lack of curricular updating and limited articulation with research activities. These characteristics result in a more content-centered and technical training model, which is less conducive to educating critical and reflective teachers, thus supporting Tardif's (2014) argument about the fragility of training proposals centered exclusively on content. Furthermore, the discontinuation of the program weakens its institutional legitimacy and compromises the professional identity projected for its graduates.

Finally, with respect to challenges, it is evident that even the institutions with the greatest adherence to the National Curriculum Guidelines, namely UnB and IFB, still face obstacles related to consolidating collaborative practices, effectively integrating pedagogical components with disciplinary Physics content, and expanding formative experiences in authentic school contexts. As emphasized by Nóvoa (1992), teacher education should be conceived as a collective and socially situated practice, which requires institutional policies capable of overcoming curricular fragmentation and fostering continuous professional development.

In summary, the data indicate that the analyzed PPCs not only structure curricula but also project distinct conceptions of teaching and of the teaching profession, at times strengthening and at times weakening teachers' professional identity. This finding reinforces the need to understand Physics teacher education as a complex, relational, and historically situated process, whose direction depends on the articulation between educational policies, institutional choices, and concrete pedagogical practices.

VI. Final Considerations

The research conducted throughout this study enabled a critical and comparative examination of the Pedagogical Course Projects (PPCs) of Physics teacher education programs

offered by Higher Education Institutions in the Federal District, with the aim of understanding the extent to which these documents express and foster the construction of teachers' professional identity. Based on Bardin's (2016) content analysis, articulated with the theoretical frameworks of Nóvoa (1992; 1995), Tardif (2014), and Dubar (2005), the study identified that the initial education of Physics teachers is marked by significant advances, but also by persistent weaknesses that affect teacher professionalization and its social legitimacy.

The results indicate that the programs offered by the University of Brasília (UnB) and the Federal Institute of Brasília (IFB) show greater adherence to the National Curriculum Guidelines of 2015 and 2019 by promoting the integration of theory and practice, valuing research and outreach activities, and projecting a critical, reflective, and socially committed teaching profile. These elements reinforce professional identity by articulating the different forms of knowledge required for teaching, according to the typology proposed by Tardif (2014), and by consolidating teaching as a collective and historically situated practice, in line with Nóvoa's perspective. In contrast, the program offered by the Catholic University of Brasília (UCB) reveals structural and curricular limitations, including the low workload allocated to pedagogical practices, limited emphasis on research, and fragile institutional indicators. In light of Dubar's (2005) framework, such gaps may be interpreted as expressions of institutional identity fragility, with repercussions for graduates' professional identity and their social insertion as teachers.

It is important to emphasize, as discussed in the methodological section, that the results presented stem from a specific documentary and temporal scope. This limitation requires interpretive caution and precludes generalizations to Physics teacher education programs nationwide. Rather than diminishing the relevance of the investigation, this delimitation reinforces its contribution to understanding a particular historical moment of curricular formulation and reformulation.

Despite the advances identified, the study demonstrates that shared challenges remain across the three institutions analyzed. These include the need to deepen integration between disciplinary Physics content and pedagogical components, to expand students' engagement in authentic school contexts in order to strengthen the relationship between academic training and professional practice, and to create institutional spaces for collaboration that consolidate teaching as a collective and reflective practice, as advocated by Nóvoa (1992). These elements reinforce the understanding that teacher identity is not constituted in a linear or homogeneous manner, but rather emerges from historical, social, and institutional processes in constant negotiation.

From the perspective of teacher education policies, the findings allow for several recommendations. First, the systematic implementation and periodic updating of PPCs in accordance with the National Curriculum Guidelines (DCNs) are essential to ensuring the integration of theory, practice, and research as structuring axes of initial teacher education. Second, institutional policies that promote the inseparability of teaching, research, and outreach

must be strengthened, creating conditions for future Physics teachers to recognize themselves as autonomous subjects and producers of knowledge. Third, the promotion of collaborative and collective formative practices is recommended, as these can overcome fragmented and content-centered models that weaken professional identity.

In the field of academic research, this study opens possibilities for further investigation. Longitudinal studies that follow graduates' professional trajectories are particularly relevant, as they may clarify how curricular and institutional elements shape professional identity in teaching practice. Comparative studies across different Brazilian states and regions are also recommended, as they can reveal regional specificities and tensions in Physics teacher education. Finally, research that combines documentary analysis of PPCs with teacher narratives and classroom experiences may further enrich the understanding of professional identity as a dynamic and relational process.

In summary, this study contributes to the debate on Physics teacher education by demonstrating that the construction of teachers' professional identity in the Federal District is ongoing and contested, shaped by both advances and limitations. While UnB and IFB are moving toward more integrated training proposals aligned with contemporary professional demands, UCB reflects a more restricted, content-centered, and weakly articulated model. Nevertheless, across all institutions, the challenge of consolidating teaching as a socially recognized profession, grounded in specialized knowledge and supported by collaborative and reflective formative practices, persists. Addressing this challenge requires coordinated engagement among universities, regulatory bodies, and the teaching profession itself in order to strengthen both professional identity and the social legitimacy of Physics teaching in contemporary Brazil.

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