
Decoloniality and teacher professional development: (im)pertinent issues to scientific education

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Abstract

In this essay, we aim to establish a theoretical bridge between decolonial theoretical assumptions and teacher professional development. In this scope, we raise discussions about hegemonic discourses and practices – uncritically adopted – that naturalize the colonial and Eurocentric legacy which subordinated other ways of being and existing in the world. We discuss the professional development of epistemic individuals, builders of knowledge from reflection on their own practice, as opposed to the mere reproduction of curricular and institutional prescriptions, still heavily influenced by the logic of coloniality. We also point to possible paths to foster professional development based on critical reflection about the social inequalities and injustices that permeate the educational context, as well as the adoption of fairer integrative, and emancipatory pedagogical discourses and practices in science education.

Keywords: Teacher professional development. Decoloniality. Coloniality. Science Education.

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Decolonialidade e desenvolvimento profissional docente: questões (im)pertinentes à educação científica

Resumo

Neste ensaio, buscamos estabelecer uma ponte teórica entre pressupostos teóricos decoloniais e desenvolvimento profissional docente. Nesse âmbito, levantamos discussões sobre discursos e práticas hegemônicas – empreendidos de forma acrítica – que naturalizam o legado colonial e eurocêntrico que subalternizou outras formas de ser e de existir no mundo. Discutimos o desenvolvimento profissional de sujeitos epistêmicos, construtores de conhecimento a partir da reflexão sobre a própria prática, em oposição à mera reprodução de prescrições curriculares e institucionais, ainda muito influenciada pela lógica da colonialidade. Apontamos ainda possíveis caminhos para fomentar um desenvolvimento profissional pautado na reflexão crítica sobre as desigualdades e injustiças sociais que permeiam o contexto educacional, assim como para a adoção de discursos e práticas pedagógicas mais justas, integradoras e emancipatórias no ensino de ciências.

Palavras-chaves: Desenvolvimento profissional docente. Decolonialidade. Colonialidade. Educação Científica.

Decolonialidad y desarrollo profesional docente: cuestiones (im) pertinentes a la educación científica

Resumen

En este ensayo, buscamos establecer un puente teórico entre supuestos teóricos decoloniales y el desarrollo profesional docente. En este marco, planteamos discusiones acerca de discursos y prácticas hegemónicas –emprendidos de manera acrítica – que naturalizan el legado colonial y eurocéntrico que subordinó otras formas de ser y existir en el mundo. Discutimos el desarrollo profesional de sujetos epistémicos, constructores de conocimiento a partir de la reflexión sobre su propia práctica, en contraposición a la mera reproducción de prescripciones curriculares e institucionales aún muy influenciada por la lógica de la colonialidad. Asimismo, apuntamos posibles caminos para fomentar un desarrollo profesional basado en la reflexión crítica sobre las desigualdades e injusticias sociales que permean el contexto educativo, así como para la adopción de discursos y prácticas pedagógicas más justas, integradoras y emancipadoras en la educación de las ciencias.

Palabras clave: Desarrollo profesional docente. Decolonialidad. Colonialidad. Educación científica.

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Introduction

Educational processes are, or should be, important instruments for social transformation, with a view to building a fairer and more equal society. However, over time, the history of education has been marked by relations of power and inequality, which is reflected in the way knowledge is produced, disseminated and used. To understand these relationships, it is important to consider the decolonial perspective, which questions and challenges hegemonic narratives and proposes new ways of thinking and acting in various social contexts, including education (Oliveira, 2016; Maldonado-Torres, 2020).

Scientific knowledge is a type of knowledge that has become hegemonic in the world, with its legitimacy and validity strongly based, over time, on a logic of technical-instrumental rationality. Thus, the civilizing project of contemporary society, in all its spheres, was and is influenced by technical-scientific rationality, both in terms of the production of knowledge and the production of technological artefacts. The purpose of this civilizing project – unfortunately for many and fortunately for a few – is intrinsically focused on

the accumulation of wealth and the valorization of capital, so that science has been used to strengthen the capitalist logic (Campos, 2013).

In this sense, it is worth pointing out that the relevance of the development promoted by scientific and technological knowledge is indisputable, and, among its many contributions, those that have made it possible to advance humanity's quality of life stand out. However, it is also essential to discuss how this idea of development has impacted the historical and socio-cultural contexts of many populations, in terms of their ways of being, thinking and living in a plural universe.

In the case of the native people of Latin America, the abrupt superimposition of European culture on their cultures drastically influenced their ways of being and existing. In Brazil, in particular, the invasion of Europeans throughout history brought not only ideals of civilization and development, but also the denial of the humanity of the inhabitants of the supposedly "discovered" lands, expropriation, exploitation of natural resources and the decimation of many native populations.

In this perspective, Eurocentric narratives have been the subject of much debate and questioning about their hegemony, as well as the need to think about other ways of being and existing in the world. In this sense, it is important to highlight the contributions of Latin American scholars – known as decolonial intellectuals – among whom the following stand out: Walter D. Mignolo, Ramón Grosfoguel, Nelson Maldonado-Torres, Catherine Walsh. In general, the essence of these theorists' questions refers to the geopolitics of knowledge based on European thinking, whose theories, knowledge and paradigms have unfolded as universal truths, which have made invisible and silenced individuals who produce "other" knowledge and histories around the world (Oliveira, 2016).

Still, according to these theorists, coloniality is "[...] constitutive of modernity, and modernity cannot be understood without taking into account the links with colonial heritage and the ethnic differences that modern/colonial power has produced" (Oliveira, 2016, p. 37). In this perspective, Mignolo (2017, p. 2) argues that modernity is a narrative, "[...] whose point of origin was Europe, a narrative that constructs Western civilization by celebrating its conquests while, at the same time, hiding its darker side, the coloniality". Thus, modernity and coloniality coexisted within a complex logic of dehumanization

and violence, land invasion and the exacerbated trafficking of Africans to be enslaved in America and the Caribbean between the 16th and 18th centuries.

In Brazil, decolonial theories have influenced countless studies, especially in the field of education, which is still strongly marked by many power relations and inequalities. Such research's advances discussions that understand education as an instrument for the development and emancipation of individuals who, today, still suffer the impacts of coloniality.

Mota Neto (2016) argues that the term decoloniality is associated with understanding how modernity/coloniality operates against undervalued social groups (mainly indigenous and black) in the regions colonized and neo colonized by the Euro-North American metropolises. Furthermore, still according to the author, in addition to understanding, it is necessary to radically question undervaluation, seeking to overcome the different forms of oppression to which human beings have been subjected (and which are still reflected today), whether in existence itself, in social and economic relations, or in thought and in education.

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With regard to science teaching, the focus of this article, there is an urgent need to problematize the extent to which teaching in this area has naturalized or uncritically conceived hegemonic practices and discourses, leaving aside fundamental principles of education, such as promoting citizenship and respect for diversity. In view of this, we seek to discuss aspects of teacher professional development from a counter-hegemonic perspective, henceforth referred to as decolonial.

In this study, Teacher Professional Development is understood as a continuous process of formation and learning that aims to broaden teachers' skills and abilities so that they can perform their role in a more effectively and critically way. It is a process that begins even before entering a bachelor of education degree and extends throughout professional life, taking place in multiple spaces and moments of life, involving personal, institutional and socio-cultural aspects and family (Marcelo, 2009; Fiorentini; Crecci, 2013).

With regard to the decolonial approach to teacher formation, we propose reflections on the inequalities and power relations that permeate the educational context, both in terms of teacher work and in the search for new ways of learning and teaching that take into account the cultural and epistemological diversities that exist on the "school floor". In this way, we seek

to explore relationships between the Teacher Professional Development and decolonial assumptions, raising discussions that advance the understanding of how teaching based on a decolonial perspective can influence the formation and practice of teachers of the Science discipline, as well as contributing to the construction of a fairer and more equal education.

Colonialism, coloniality, decoloniality and education

Modern colonialism, according to Maldonado-Torres (2020), should be understood as the historical formation of colonial territories, operated by Western empires in most parts of the world, based on the narrative of discovery and conquest of these territories by Europeans. On the other hand, coloniality

[...] represents, despite the end of colonialism, a pattern of power that emerged as a result of modern colonialism, but rather than being limited to a formal power relationship between peoples or nations, it refers to the way in which work, knowledge, authority and intersubjective relations are articulated with each other through the global capitalist market and the idea of race (Maldonado-Torres, 2007 apud Walsh; Oliveira; Candau, 2018, p. 4).

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Thus, coloniality consists of a global logic of dehumanization (slavery, violence, domination, extermination, expropriation etc.) operated by the colonizers in ancient times, but which is still evident today through racial and gender prejudice and socially constructed forms of power, being and knowledge (Maldonado-Torres, 2020). In this way, thinking from a decolonial perspective means going against all this inhuman logic that is still present in various social spheres, as well as going against its material, epistemic and symbolic effects.

However, thinking and acting from a decolonial perspective is still a challenge for many educators. Maldonado-Torres (2020), in the text entitled *Analysis of coloniality and decoloniality*, argues about the anxiety generated around the debate on colonialism, decolonization and other related concepts. For the author, this anxiety is justified by the fact that these concepts question the legitimacy of narratives about the way in which Western empires and modern nation-States have naturalized the abrupt and violent superimposition

of their culture on colonized peoples. The colonizer narratives allude to heroic acts, the discovery of ownerless territories, colonization as a synonym for civilization and enslavement justified as a means for the “subhuman” to become disciplined.

In this logic, Boaventura Santos (2018) states that colonial domination is still alive and its operation is still as violent as in the past, but under different configurations. In the past, colonialism consisted of a mode of domination based on the denial of human essence and the ontological degradation of beings for purely ethno-racial reasons. Thus, individuals who were victims of this violent domination had their dignity annulled, were conceived by the colonizer as part of the “discovered” lands, ownerless lands, objectified, being exploited to the extreme, subjected to slave labor and many, indigenous and Africans, exterminated.

On the other hand, in the contemporary context, this colonial domination still exists and manifests itself in the

[...] populations and bodies victimized by racism, xenophobia, expulsion from their lands to make way for mining and agro-industrial megaprojects and real estate speculation, police violence and paramilitary militias, human and organ trafficking, slave labor euphemistically designated as “work analogous to slave labor” to satisfy the well-thought-out hypocrisy of international relations, the conversion of their communities from crystal-clear rivers and idyllic forests into toxic hells of environmental degradation (Santos, 2018, n. p.).

We can also notice that, although issues such as “democracy” and “human rights” are always on the agenda, there is a large contingent of people who suffer the negative influences of this modern colonialism. Maldonado-Torres (2020) states that coloniality and its universal logic of dehumanization, despite the supposed independence of colonial territories, is still embodied in many situations of domination, exploitation, expropriation and prejudice against subordinated peoples and their descendants. Even nature is not exempt from the influences of coloniality. Natural resources and territories inhabited by ancestral peoples live under constant threats of expropriation and invasion, resulting from economic interests and disregard for human life and the environment.

In the field of education, Ferreira, Santana and Verástegui (2022, p. 51) question the strong influence of coloniality in educational processes, both in basic education (through curricula) and in higher education, which often favors theoretical references “[...] mostly written by white European men and those from Anglo-Saxon America, who have historical, ethnic, linguistic and cultural ties with the United Kingdom”. Still in this direction, Oliveira (2016, p. 37) states that the educational context is still marked by coloniality and this materializes in learning manuals, “[...] in the criteria for writing academic papers, in culture, in common sense, in the self-image of peoples, in the aspirations of individuals [...]”, among other aspects of modern life.

From this perspective, Carvalho (2020, p. 85) argues that the implementation of Brazilian universities was surrounded by racist and xenophobic myths deriving from “[...] imperialism, colonialism and Atlantic slavery of previous centuries [...]”, thus installing our white academic elite as a continuation or tropical depot of the European academic elite”. Thus, the effects of colonization went beyond territorial invasion and also involved “mental colonization”, turning Brazilian academia into an entirely white space, which identifies with the ideas of its European peers.

In other words, the implementation of Brazilian universities was not focused on the constitution of a democratic and emancipatory space. Instead, over time, the university has become an exclusivist and elitist institution. Despite more recent public policies that have made it possible for indigenous, black and other segments of the Brazilian population to enter higher education, there is still a lot of progress to be made so that these historically disadvantaged populations can actually occupy different socially valued spaces, including the university.

Similarly, Walsh (2008) states that schools and universities bear deep marks of coloniality, which contribute to the legitimization of hegemonic knowledge, central to a project of *coloniality of knowledge*, which makes another knowledge invisible. Processes of the *coloniality* of being also operate in this context, undermining the social function of teachers, weakening their professional identities, and reducing them to technical and pedagogical competence to “transmit” knowledge developed by individuals outside the professional spaces.

Giraldo and Fernandes (2020) also argue that many teachers may be politically unaware of the social functions of their profession, a condition that contributes to a lack of perception of the context in which the educational process takes place – with deep traces of coloniality and the imposition of hegemonic epistemologies – which end up excluding other knowledge, including that inherent to their profession, denying them autonomy over their practices and formation processes.

It is also worth pointing out that Brazilian society and other Latin American societies, made up of different peoples – with unique cultures and ways of living and thinking – still have their education based on a logic that disregards their origins and praises the culture of others, seeking to copy or reproduce educational logics from countries considered developed. Educational processes bend to the demands of those with economic power, as if this were the decisive factor in the advancement of education and the resolution of social problems (Campos, 2013; Maldonado-Torres, 2020).

In this context, whether in the field of basic education or higher education, it is necessary to understand that institutional/educational spaces cannot become propagators of the logic of coloniality. And, given this scenario, the decolonial perspective in education must not only have the character of a “denunciation” against colonial hegemony, but also act in a propositional way (Oliveira, 2016). Thus:

Decolonizing would then mean, in the field of education, a praxis based on a propositional educational insurgency, therefore not just a denunciatory one – hence the term “DEcolonizing” and not “DO NOT colonizing” –, in which the term insurgent represents the creation and construction of new social, political, and cultural conditions and thinking. In other words, the construction of a pedagogical notion and vision that goes far beyond the processes of teaching and transmitting knowledge, a pedagogy conceived as cultural politics, involving not only formal educational spaces, but also the organizations of social movements. DEcolonizing in education means building pedagogies other than the hegemonic one. Do not colonizing is only denouncing colonial ties and not constituting other ways of thinking and producing knowledge (Oliveira, 2016, p. 39).

Similarly, Bernardino-Costa, Maldonado-Torres and Grosfoguel (2020, p. 16) point out that “[...] there is an urgent need for dialogue and affirmation of perspectives on knowledge and peoples that have been undervalued within colonial modernity”.

In addition, living in a multi-epistemic world requires questioning hegemonic (Eurocentric) epistemologies, as well as educational practices that aim to suffocate, ridicule, or make invisible the otherness, for whatever reason. Breaking with discourses and narratives that aim to disregard or shame those who have always been subordinated, so that they remain in a condition of dependence, is a proposal that must echo and materialize in effective actions in educational processes (Walsh; Oliveira; Candau, 2018).

Thus, it is more necessary than ever to include actions in the educational context that highlight the countless contributions of different peoples (quilombolas, indigenous, natives, extractivists, among others) to the cultural and economic development of the Brazilian nation. It is essential to combat narratives that uncritically approach the process of slavery and colonization in Brazil as mere historical curiosities (Carvalho, 2020). It is an obligation of any educator to repair the harmful impacts of coloniality on populations affected by social inequalities and power relations that are evident in traces of authoritarianism, racism and misogyny, among others.

In this sense, Chassot (2018) criticizes how science education, specifically high school Chemistry curricular component, is useful for maintaining domination, by prioritizing an approach to content that moves away from a more critical reading of reality.

We can say, in the name of the need to offer everyone an adequate scientific education, that there is a universality to the content that is taught in any country. This universality does not only occur because the conquerors imposed their science or their school on the colonized, in addition to their religion and culture, but also (and especially) because emerging countries seek, in a fantastic imitation, the science of rich countries to the detriment of local knowledge, even to supposedly validate the rise of socially discredited minorities, thinking that if they “learn” the (exotic and esoteric) science of the dominators, they will no longer be dominated (Chassot, 2018, p. 57).

Chassot's arguments are consistent with the understanding that science and its teaching cannot remain unrelated to the socio-cultural reality of students, whose educational process should not consist of the mere transmission of scientific knowledge prescribed in curricula, often disconnected from the needs and motivations of those students. Therefore, it is understood that science teaching in basic education should be configured as an opportunity for the development of the person, in the sense of promoting the mobilization of knowledge, a critical attitude towards social issues that denote inequalities and injustices, preparing them to free themselves from the bonds of domination, making them susceptible to being agents of transformation for a fairer and more egalitarian society.

So, what should we expect from teachers? Will it be up to these professionals to submit themselves to a work based on technical rationality, aimed at implementing rigid curricula, or to participate actively and critically in building a model of education more in line with decolonial assumptions? What is the role of science education in the context of the operation of coloniality? The intention of this article is not to answer these questions, but rather to encourage relevant reflections to think about teacher formation and performance in a context of social inequalities and the operation of coloniality. Therefore, based on the references discussed throughout these sections, we have listed some aspects that refer to coloniality and are commonly evidenced in the educational context (chart 1).

Chart 1 – Indications of coloniality in the educational scenario

Práticas que não combatem e/ou naturalizam preconceitos e/ou discriminação baseada em raça, origem, gênero, orientação sexual, deficiência, classe social, dentre outros aspectos da diversidade humana.
Currículos e práticas que valorizam excessivamente as narrativas hegemônicas (eurocêntricas), ignorando e/ou minimizando a contribuição de grupos historicamente subalternizados, desde a invasão das Américas.
Discursos que enaltecem a meritocracia acadêmica, porém não levam em consideração as desigualdades socioeconômicas que priva muitos/as estudantes de ter acesso e se manter nos estudos, seja no contexto do Ensino Básico, seja no Ensino Superior.
Currículos que orientam as práticas pedagógicas para desenvolver habilidades e competências segundo as aspirações do mercado capitalista, em detrimento de uma formação humana crítica e para o exercício da cidadania plena.
Discursos que implicitamente e/ou explicitamente corresponsabilizam a atuação docente pelo sucesso ou fracasso dos/as estudantes no processo de ensino e aprendizagem, baseados em avaliações de padrões internacionais, sem levar em consideração a precariedade dos recursos materiais das escolas públicas e outros fatores que interferem no desempenho dos/as estudantes.
Subalternização da atividade docente à execução de prescrições curriculares verticalizadas, que não levam em consideração os saberes inerentes à profissão e os diferentes contextos educacionais.
Educação Básica e Superior elitista, que favorecem os detentores do poder econômico, majoritariamente brancos, que passam pelas melhores escolas e se tornam maioria nas universidades, principalmente, em cursos que desde o período colonial conferem prestígio às elites (engenharias, medicina, direito).

Source: the authors (2023).

It is also important to point out that many aspects denote the operation of coloniality in the context of teaching work and make it difficult to propose any initiative based on decolonial assumptions. These are aspects related to the working conditions of teachers, especially in basic education, which directly influence the quality of teaching offered to the students who attend these schools. Some of these aspects are listed below, based on references (Imbernón, 2011; Libâneo, 2011; Campos, 2013; Tardif, 2014) which, although they do not literally mention the term “coloniality”, allow us to establish important relationships. These include:

- Remuneration disproportionate to the work, suggesting devaluation and exploitation of teaching work.
- Excessive workload due to low pay, resulting in double and/or even triple working hours, which can lead to a drop in the quality of life of the professional and affect the quality of teaching.
- Reduced or lack of autonomy. Teaching activity is controlled by external agents, so that teachers' creativity and pedagogical skills are limited by excessive regulations/bureaucracy.
- Few or no resources. In the midst of the many demands and bureaucratic issues, there are teachers who don't even have adequate materials, technology and support for the countless challenges they face on a daily basis.
- Lack of professional recognition. Despite being socially strategic, the teaching profession does not receive the deserved and/or adequate recognition, which can lead to demotivation, abandonment of the profession and/or lack of dedication to the job.

12 These discussions and notes are crucial to understanding the process of teacher professional development in a dimension that is opposed to what is known as "formation" or "capacity building", usually offered through courses and/or workshops. This reductionist perception of the teacher formation process is, as a rule, idealized and/or produced by actors who are unaware of the reality of the classroom and who are unaware of many of the daily challenges faced by the teaching community.

In this sense, in the next topic we present reflections on the professional development of science teachers from a decolonial perspective and in a way that is more aligned with the real needs of teachers and students, considering the diversity of knowledge and cultures that exist in the educational environment.

Decoloniality and the professional development of Science discipline teachers: possible relationships

DFaced with a panorama that is still so permeated by social inequalities, it is important to reflect on how teacher formation processes have been concerned with overcoming practices that contribute to propagating the

logic of coloniality. It is therefore worth reflecting on the following question: How can we think about/implement processes aimed at Teacher Professional Development with a view to promoting an emancipatory education that does not reproduce social exclusion amid a diversity of individuals, knowledge, and cultures?

The term Teacher Professional Development has been used in educational literature to distinguish it from the traditional and discontinuous logic of teacher formation. This logic denotes an action of “shaping” or “forming someone”, with the aim of producing individuals capable of meeting the aspirations of intuitions and society (Ponte, 1998).

However, we cannot ignore the fact that teaching is a social activity that takes place in institutional and socio-cultural spaces, and should therefore be designed to meet the needs of plural individuals. So, it has a political dimension, since, in theory, it is the teaching staff’s job to implement the public educational policies that rule teaching in the country. In addition, in the course of their work, teachers encounter countless daily situations that reveal profound social and economic inequalities, which, in some way, require and/or influence political positions, with possibilities for social transformation.

In this context, Oliveira-Formosinho (2009) argues that Teacher Professional Development consists of a continuous process that involves formal or informal moments, centered on the teacher, or a group of teachers in interaction, which are aimed at advancing teaching practices, the purpose of which is to promote educational changes that are favorable to the student body, families, and communities. In this direction, Ponte (1998) suggests various actions that are potentially coherent with the idea of Teacher Professional Development. So, based on this author’s ideas, we present in chart 2 a parallel between the traditional logic of teacher formation and actions that are consistent with the concept of Teacher Professional Development.

Chart 2 – Parallel between the traditional logic of formation and Teacher Professional Development, based on Ponte (1998)

Traditional teacher formation logic	Teacher Professional Development
Strongly associated with participation in courses, workshops, seminars etc.	It takes many forms: exchanging experiences among peers, reading and reflection activities, among others.
Assimilation of knowledge and information transmitted by a “trainer” or specialist.	It is up to the teacher to make fundamental decisions about what they consider relevant to their professional development.
Fragmentation by subject or discipline.	The focus is on the teacher as a whole, considering cognitive, affective and relational aspects.
Focuses on aspects that are supposedly necessary for “adequate” formation, filling formation gaps.	Attention and focus on the teacher’s potential.
Formation is based on theory and is, sometimes, exclusively theoretical.	The articulation between theory and practice is valued.

Source: the authors (2023).

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As Ponte (1998) points out, the logic of traditional teacher formation – still predominant in the educational scenario – and the actions consistent with the Teacher Professional Development are marked by various contradictions. It is clear that the former is often disconnected from the reality of the classroom, while the Teacher Professional Development assumptions take into account the complexity of teaching work, which requires teaching professionals to constantly reflect on their own practice, search for improvement, focus on potential and articulate the theoretical knowledge inherent to the job and the daily practice experienced within the institution where they work.

In this way, many aspects need to be taken into account with regard to Teacher Professional Development – which do not fit into a list of attributions about what one should “know” and “know how to do” – and which start from an understanding of the complexity of this professional activity, which requires reflection and a continuous search for improvement, given the dynamics of the classroom and the social demands that surround the educational environment on a daily basis, with diverse people, knowledge and cultures. Thus, teaching

must also be understood from a political perspective, which has changed the understanding of the role of the educator and, consequently, the formation processes for teaching.

In Brazil, since the 1980s, new configurations have emerged regarding the professionalization of teaching, with the understanding that teachers are people who act “[...] within the power structure of society, in which identity is conceived as a social and cultural construction” (Cunha, 2013, p. 614). This concept is in line with Paulo Freire’s ideas, when he argues that the teacher is “[...] a being in a situation, a being of work and transformation [...]” (Freire, 1992, p. 28). Thus, it is necessary to consider that Teacher Professional Development is a process strongly influenced by different aspects, including: life stories; public policies and curricular guidelines for formation and performance; the teaching activity itself and the spaces in which it takes place (Marcelo, 2009; Fiorentini; Crecci, 2013).

In this study, we argue that an important aspect to be considered in the Teacher Professional Development – in view of the countless social challenges that are imposed on teaching practice (racism, violence, poverty, environmental degradation, among others) – is the creation of opportunities for teachers to participate in discussions that have decoloniality as their agenda, but in an approach that considers the experiences and challenges of these professionals.

From this perspective, educational practices would be based on critical reflections on Eurocentric and colonial conceptions, which are naturalized in the educational field, seeking to question and propose new emancipatory practices and discourses, contrary to any type of oppression. In this direction, Imbernón (2011, p. 29) argues that teacher professionalization will only make sense if it is related to the emancipation of people. The author also states that one of the central purposes “[...] of education is to help make people freer, less dependent on economic, political and social power”.

Similarly, Libâneo (2011) argues that the quality of education is a strategy for overcoming social inequalities, but it is necessary to go beyond criticizing the current educational model. It is necessary to understand that there are gaps between the ideals of citizenship advocated in official documents and the results of the quality of education linked to indicators, derived from data obtained in an extremely unequal context and marked by ideals of

competitiveness, productivity and efficiency. In addition, the economic model that outlines the ideals of equity based on the accumulation and/or distribution of wealth and rights, in itself, already sounds exclusionary. For the author, the challenge is to promote an education that benefits everyone and not just a privileged few.

Based on the above considerations, Libâneo (2011) proposes some objectives for what he considers to be quality basic education, which are in line with decolonial assumptions, although the author makes no reference to this term. According to him, it is the teacher's role to:

Persist in the effort to help students seek a critical perspective on the content, to get used to apprehending the realities focused on in school content in a critical-reflective way (Libâneo, 2011, p. 37).

Attend to cultural diversity and respect differences in the school and classroom context (Libâneo, 2011, p. 42).

Investing in scientific and technical and cultural updating as ingredients of the continuing education process (Libâneo, 2011, p. 43).

Developing ethical behavior and knowing how to guide students in values and attitudes towards life, the environment, human relations and themselves (Libâneo, 2011, p. 45).

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Based on these relationships, we defend the idea that the articulation between the assumptions of decoloniality and Teacher Professional Development can contribute to the development of more integrative educational practices, including: actions that emphasize the recognition and appreciation of diverse cultures; critical reflections on colonial and Eurocentric practices; and diverse actions that take diversity and equity into account in the educational context.

Teachers Science discipline cannot be oblivious to the socio-cultural and/or economic specificities that relate to students' life stories and to their own. With that, we aim a teaching that prioritizes "[...] an educational approach that is contextualized, socially referenced and committed in curricular terms" (Jacinski, Linsingen, Corrêa, 2019, p. 196). It is also necessary to consider the numerous challenges faced in the classroom that go beyond issues related to the teaching and learning of content or the skills and abilities prescribed in the curricula, making it necessary to (re)establish a connection

between science and society in science teaching, making explicit its social, cultural, political and economic nature (Linsingen, 2007).

In view of these points, we have tried to summarize the main points of convergence between decolonial assumptions and Teacher Professional Development in chart 3, focusing on connections related to ideals of emancipation, social justice, and equity.

Chart 3 – Converging points between decolonial assumptions and teacher professional development assumptions. Based on Maldonado-Torres (2020), Carvalho (2020), Oliveira (2016), Walsh, Oliveira, Candau (2018); Imbernón (2011), Libâneo (2011) and Campos (2013)

Decolonial perspective	Professional teacher development
Historical and social recognition of groups who have been impacted and those who still suffer the influences of coloniality in the current context.	Recognition of the importance of the local context and reality, with a view to a teaching approach that considers the socio-cultural, historical, and economic aspects of the students.
Critically conceiving of the hegemony of Western knowledge, revolting against the various forms of oppression in the social and school context from Eurocentric thinking.	Proposing and implementing teaching approaches based on local knowledge and practices.
Critical reflection on teaching practice in the context of the challenges of teaching during cultural diversity and epistemic plurality.	Emphasis on critical reflection on teaching practice and its relevance in the social context.
Education as a relevant strategy for promoting emancipation, social justice, citizenship, and the integration of diversity.	Designing and developing strategies that meet the educational needs of marginalized groups, with a view to integrating diversity into the classroom.
Promoting student autonomy/affirmation.	Making students autonomous, in the sense of taking an active part in the learning process.

Source: the authors (2023).

All the aspects highlighted in chart 3 point to the importance of science education establishing dialogues that challenge the idea of the neutrality of science, through teaching strategies that highlight its implications for society. These strategies should also encourage students to become critical and

aware of their role in the social, political and environmental fields, as well as making them capable of questioning dominant narratives (Linsingen, 2007). This questioning of dominant narratives is a possibility to challenge and/or rebel against the structures of power and domination that permeate the reality of students and teachers (Giraldo; Fernandes, 2020).

Considering all the ideas and reflections discussed so far, we present below a series of aspects that we believe are consistent with a Teacher Professional Development committed to adopting decolonial practices in science teaching. These are:

- Encourage practices and discussions about the importance of diversity and representativeness at school, as well as the contributions of different cultures and knowledge to the advancement of science and technology.
- Critically conceptualize Eurocentrism, since science and technology education has historically been dominated by Eurocentric ideas, silencing other cultures and scientific traditions. In this way, the decolonial perspective “opens the door” for other cultural and scientific traditions to have space and otherness in the school context.
- To value the scientific and technological knowledge of other cultures that have been central to the constitution of the Brazilian nation, from the moment Europeans invaded its lands: indigenous culture and, later, African culture, whose peoples were violently captured from their lands for forced labor in the American colonies, as well as other traditions that have historically been neglected and excluded in science and technology education.
- Promote science teaching that critically discusses the social, political and ethical implications of scientific discoveries and innovations, so that students, teachers and the community become aware of the various problems of the society in which they live, and have the opportunity to think and/or act to ensure a fairer and more equal society through scientific and technological knowledge.
- Discuss how science education can help solve chronic problems that affect marginalized populations (black, indigenous, women, among others): food insecurity; scarcity of drinking water; little or no access to health services; lack of decent housing; lack of basic sanitation; unemployment; invasion of indigenous peoples’ lands; among others.

- Recognize that, in addition to social issues, environmental issues are extremely important, and that it is the responsibility of scientific and technological education to establish strategies aimed at raising awareness, as well as proposing effective actions for the conservation of the environment, which is essential to health, quality of life and sustainability.
- To highlight the power relations that exist in the implementation of public educational policies that are verticalized and do not serve the interests of economically disadvantaged students, as well as undermining the knowledge of teachers.
- To value the work of teachers, considering that teaching has an epistemological character and involves the constant re-signification of practices, so that it is not merely a matter of reproducing the knowledge and techniques prescribed in curricula and official documents that guide educational practice.

We believe that a Teacher Professional Development based on decoloniality requires the role teachers of Science discipline to go beyond the mere execution of curricular and institutional prescriptions. In this way, this professional comes to be understood as an agent of transformation and (re)builder of knowledge, both that inherent to the profession and that central to the articulation between scientific knowledge and socio-cultural, political, economic and/or environmental issues. These aspects are fundamental when the aim is to promote an emancipatory, critical and quality education for students.

Final considerations

In this essay, we seek to establish a theoretical bridge between the assumptions of decoloniality and Teacher Professional Development, exploring points that converge and are susceptible to the adoption of discourses and actions that point towards a scientific education and teacher performance that considers the cultural and epistemic plurality of voices and perspectives that exist on the “school floor”.

The theoretical references adopted in this study foster discussions about the legacy of coloniality/modernity, which is still impregnated in educational institutions, pointing to an educational and formation process that is contrary to any form of oppression. Discussions are raised that are susceptible to a

pedagogical practice that contemplates other ways of thinking, of being and being in the world, through a critical and counter-hegemonic stance. Counter-hegemony, in this context, refers to opposing every practice and discourse that aims to override/impose, disregard, make invisible the otherness, in relation to their ways of thinking and being in the plural universe that is the school (Walsh; Oliveira; Candau, 2018).

In the context of teacher formation, we emphasize the need for teachers of Science discipline to consider the political, economic and socio-cultural dimensions, as well as to establish meaningful dialogues that consider the otherness of historically excluded groups in order to build fairer and more emancipatory educational practices.

We would also point out that the teaching community has its own epistemology, which is not consistent with the idea that these professionals are mere executors of prescribed curricula and institutional guidelines, but that they are the main actors in the process of thinking about/implementing formation processes inherent to the profession, related to their real professional development needs.

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Based on the above considerations, we conclude that the decolonial perspective can be configured as a relevant theoretical input, whose contributions can foster the professional development of teachers of Science discipline. These contributions include valuing the teaching profession; critical reflection on science education practices; recognizing and valuing different forms of knowledge; understanding the historical, socio-cultural, political, economic and environmental implications of scientific innovations, among others.

It is hoped that this study will encourage other research aimed at discussing decoloniality in teacher professional development, as well as the development of practices based on decolonial assumptions in the field of science teaching.

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