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THE PROBLEMAZATION IN THE FREIRE'S PERSPECTIVE AND IN PROBLEM-BASED LEARNING: APPROACHES AND DISTINCTIONS¹

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ABSTRACT: In contrast to traditional teaching approaches, various problematizing perspectives have gained prominence in Education, such as the Freirean approach and Problem-Based Learning (PBL). This study is guided by the following question: What are the convergences and divergences in the conception of problematization within the Freirean perspective and PBL? To address this question, we characterized the notion of problematization in each framework through a qualitative analysis of Freire's foundational bibliographic works and, in the case of PBL, Brazilian theses and dissertations that mobilize this methodology. A key limitation of the study is that the analysis of PBL relied predominantly on secondary sources, since the original works do not fully explicate the conceptual terms required for the investigation, thereby restricting direct access to the primary formulation of the approach. Based on this characterization, we identified both convergences and divergences between the two perspectives. Among

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the convergences, we highlight the centrality of the problem-situation, the importance of dialogue, and the interdisciplinary potential present in both. With regard to the divergences, the findings indicate: (i) the non-hierarchical relationship between educator and learner in the Freirean perspective, in contrast to the student-centered protagonism characteristic of PBL; and (ii) the Freirean emphasis on the concrete and community-based reality of learners, whereas PBL tends to be circumscribed to experiential situations mediated within small groups.

Keywords: Problematization, Freire's perspective, *Problem-Based Learning*.

A PROBLEMATIZAÇÃO NA PERSPECTIVA FREIREANA E NA *PROBLEM-BASED LEARNING* (PBL): APROXIMAÇÕES E DISTANCIAMENTOS

RESUMO: Na contramão do ensino tradicional, diversas perspectivas problematizadoras têm se destacado na Educação, entre elas a freireana e a *Problem-Based Learning* (PBL). Este estudo se orienta pela seguinte questão: quais são as aproximações e os distanciamentos na concepção de problematização para Freire e para a PBL? Para respondê-la, caracterizou-se a noção de problematização em cada referencial por meio de uma pesquisa qualitativa que analisou bibliografias básicas de Paulo Freire e, no caso da PBL, teses e dissertações brasileiras mobilizadoras dessa abordagem. Como limite do estudo, destaca-se que a análise da PBL se baseou majoritariamente em leituras de segunda mão, uma vez que as obras originais não explicitam integralmente os termos conceituais necessários à investigação, o que restringe o acesso direto à formulação primária da abordagem. A partir dessa caracterização, foram identificados aproximações e distanciamentos entre as duas perspectivas. Entre as aproximações, ressaltam-se a centralidade da situação-problema, a importância do diálogo e o potencial interdisciplinar. Quanto aos distanciamentos, evidenciam-se: (i) a não hierarquização da relação educador-educando na abordagem freireana, em contraste com o protagonismo estudantil típico da PBL, e (ii) a ancoragem freireana na realidade concreta e comunitária dos educandos, enquanto a PBL tende a circunscrever-se às experiências vivenciais mediadas em pequenos grupos.

Palavras-chave: Problematização, Paulo Freire, *Problem-Based Learning*.

LA PROBLEMATIZACIÓN DE LAS PERSPECTIVAS FREIREANA Y *PROBLEM-BASED LEARNING*: APROXIMACIONES Y DISTINCIONES

RESUMEN: A diferencia de los enfoques tradicionales de enseñanza, en los últimos años han cobrado fuerza diversas perspectivas que toman la problematización como eje central del proceso educativo. Entre ellas se destacan la propuesta freireana y el *Problem-Based Learning* (PBL). Este estudio se orienta por la siguiente pregunta: ¿cuáles son las convergencias y divergencias en la concepción de problematización entre la perspectiva freireana y el PBL? Para responderla, se realizó un análisis cualitativo de la noción de problematización en ambos marcos teóricos, tomando como referencia las obras fundamentales de Paulo Freire y, en el caso del PBL, tesis y disertaciones brasileñas que desarrollan esta metodología. Conviene señalar una limitación relevante del estudio: el análisis del PBL se apoyó principalmente en fuentes secundarias, debido a que los textos originales no presentan con suficiente claridad los conceptos necesarios para la indagación, lo que restringe el acceso directo a la formulación inicial de la propuesta. A partir de este mapeo, se identificaron puntos de cercanía y de distanciamiento entre ambas perspectivas. Entre las convergencias se destacan la centralidad de una situación-problema, la relevancia del diálogo y el potencial interdisciplinario. En cuanto a las divergencias, se observó: (i) que la relación entre educador y educando, en la perspectiva freireana, no se estructura de modo jerárquico, a diferencia del énfasis en

el protagonismo estudiantil característico del PBL; y (ii) que la propuesta freireana se ancla en la realidad concreta y comunitaria de los sujetos, mientras que el PBL tiende a mantenerse dentro del ámbito de experiencias vivenciales trabajadas en pequeños grupos.

Palabras clave: Problematicación, Paulo Freire, *Problem-Based Learning*.

PRESENTATION AND THEORETICAL ASPECTS

In today's socio-temporal landscape, advocating for behaviorist educational practice in Science Education, specifically in Physics Teaching, is ineffective. These practices prioritize the exclusive transmission of knowledge, a concept that Freire (1987) described as "Banking Education." He defines this type of education as "[...] an act of depositing, in which the students are the depositories and the educator is the depositor" (FREIRE, 1987, p. 33). The shortcomings of pedagogical practices based on rote memorization and mere preparation are evident in both academic and school environments, as (KRASILCHIK, 1987; RODRIGUES, 2017). In contrast to traditional teaching methods, there is a growing advocacy for an approach in which scientific knowledge is collaboratively constructed through dialogue and the problematization of the students' contexts. Within this framework lie various theoretical and/or methodological educational perspectives that prioritize problematizing pedagogical practices, such as the Problem-Based Learning (PBL) methodology and the tenets of the Brazilian educator Paulo Freire.

As a methodological strategy or dynamic in the form we recognize today, PBL was initially implemented in the late 1960s at McMaster University in Canada, and shortly thereafter at Maastricht University in the Netherlands (CAMP, 1996). According to Servant (2016), one of the pioneering professors and researchers in this field was Howard S. Barrows, who asserts that "learning through problems is a condition of human existence. In our attempts to resolve the various problems encountered in daily life, learning occurs" (BARROWS, TAMBLYN, 1980, p. 1). Furthermore, PBL emerged within the context of professional training, specifically in medical schools, rather than in basic education. However, there have been recent, albeit sporadic, implementations across a wide range of educational levels, particularly in secondary and higher education (SILVA; VIDMAR; PASTORIO, 2023a). In Brazil, the institutions that pioneered the implementation of PBL were the Marília Medicine School, the Medical Program at the State University of Londrina, and the Ceará School of Public Health (SILVA; DELIZOICOV, 2008).

This methodology is premised on the centrality and autonomy of the learner within the teaching-learning process, and its primary characteristics include the integration of disciplinary content, always structured in a problem-designed program for group discussion and resolution (SILVA; DELIZOICOV, 2008). This problem should be grounded in a real-world situation relevant to the learner's social and professional life. Among the objectives of this methodological approach are:

- (a) develop clinical reasoning and the student's problem-solving ability, (b) enhance the acquisition, retention, and application of knowledge, (c) bridge the gap between basic and clinical science content, (d) foster self-directed learning on the part of the student, (e) stimulate their interest in the subject or content addressed, and (f) encourage more effective

strategies for learning this content (BORDAGE, 1994; SCHMIDT, 1993, *cited in* SILVA & DELIZOICOV, 2008).

The theoretical premises of the educator Paulo Freire have increasingly guided the development of curricula and critical pedagogical practices within the field of Science Education, specifically, Physics Teaching. Prominent in this domain are concepts related to Thematic Investigation (AUGUSTO et al., 2023; SOUSA et al., 2014); the “Three Pedagogical Moments”, whether employed as a classroom dynamic (FERREIRA, PANIZ, MUENCHEN, 2016) or as a framework for curriculum structuring (ARAÚJO, 2015; MUENCHEN, 2010); the development of instructional materials (PACHECO, MAGOGA, MUENCHEN, 2022); initial teacher education (FREITAS, QUEIRÓS, 2020; MUENCHEN et al., 2019; PANIZ, 2017); furthermore, the continuing education of educators (CENTA, MUENCHEN, 2016; FONSECA et al., 2018).

Thus, the categories of problematization and dialogue assume a central position, serving both as educational practices and as structuring elements of curricula. According to Muenchen and Delizoicov (2013), *problematization* has guided various initiatives, ranging from curricular practices, such as those conducted by Paulo Freire in the municipality of São Paulo (FREIRE, 1995), to the issuance of official documents, exemplified by the National Curricular Parameters for Elementary Education (BRASIL, 1998) and Secondary Education (BRASIL, 2002). Such documents call upon educators to engage in problematizing practices, thereby reinforcing the centrality of this principle within Science Education (MUENCHEN; DELIZOICOV, 2013).

According to Freire (1996), it is the educator's responsibility to strive to promote the transition from naive curiosity to critical curiosity, a process in which problematization plays a structuring role. In this direction, Delizoicov (2001, pp. 132-133) emphasizes that these problems

[...] must have the potential to instill in the student the need to acquire knowledge that they do not yet possess and that has not yet been presented by the teacher. The formulated problem must hold significance for the student, thereby making them aware that its solution requires knowledge that is, for them, entirely new.

Muenchen (2010) clarifies the differences between problematizing and asking questions. Problematization, according to the author, necessarily entails dialogue; it stems from the existence of a real problem to be confronted and is oriented toward transformation. It constitutes a movement that generates intellectual restlessness, fosters a critical reading of the world, and drives the transition from “naïve curiosity” to “critical curiosity,” being operationalized through open-ended problems situated within the concrete reality of the learners. In contrast, the mere act of asking questions does not generate curiosity; it typically takes the form of a monologue in which the teacher anticipates or answers their own questions, neither fostering restlessness nor dialogue, and tends to be restricted to closed-ended problems involving exact answers and situations disconnected from the students' context (MUENCHEN, 2010).

Without claiming to exhaust these discussions, and based on the premises outlined previously, this study is guided by the following research problem: What are the convergences and divergences regarding the conceptions of problematization within the Freirean perspective and the Problem-Based Learning methodology? To address this question, this investigation sought to characterize the term “problematization” within the Freirean framework and in research utilizing PBL, aiming to identify the convergences and divergences between these two frameworks.

METHODOLOGICAL ASPECTS

This research is qualitative in nature and is characterized as both exploratory and explanatory, in terms of its general purposes. Qualitative research is concerned more with the meanings, values, and beliefs associated with a particular phenomenon than with the actual quantification of data. Gil (2022, p. 41) highlights that the purpose of exploratory research is “[...] to provide greater familiarity with the problem, with a view to making it more explicit or to formulating hypotheses. Its design tends to be quite flexible, as it seeks to consider the most varied aspects related to the fact or phenomenon under study”².

For the selection of the corpus analysis, we opted to investigate the core bibliographies of the theoretical frameworks under study. From a Freirean perspective, we selected six works by the educator Paulo Freire. This selection was based on the works referenced in the book *Dicionário de Paulo Freire* (STRECK; REDIN; ZITKOSKI, 2019) in its description of the concept of problematization. Table 1 presents the codes and corresponding titles of the selected works.

Table 1 – Works by Paulo Freire Analyzed

Code	Book
L1	<i>Extensão ou comunicação?</i> (1969)
L2	<i>Por uma Pedagogia da Pergunta</i> (1985)
L3	<i>Ação Cultural para a Liberdade</i> (1981)
L4	<i>Educação e Mudança</i> (1979)
L5	<i>Conscientização</i> (1979)
L6	<i>Pedagogia do Oprimido</i> (1987)

Source: The authors

From a PBL perspective, the following core texts were analyzed: Barrows and Tamblyn (1980) and Barrows (1988; 1996), due to their historical significance in disseminating the methodology; and Hung, Jonassen, and Liu (2008) and Hung (2006), for their contributions regarding frameworks for structuring problems. However, upon analyzing the entirety of the highlighted works, no excerpts or references were found that would directly assist in answering the proposed research problem. We believe that this is primarily attributable to issues related to translation from English into Portuguese.

The selection of the analysis corpus from the PBL perspective was carried out using the Digital Bank of Dissertations and Theses (BDTD)³, employing the search terms “Problematization” and “PBL” combined with the Boolean operator AND. Initially, we identified 18 works. Upon a full reading

² This research was produced within the context of the course “Trends in Physics Teaching” (FSC873), offered during the first semester of 2023 in the Graduate Program in Mathematics Education and Physics Teaching (PPGEMEF) at the Federal University of Santa Maria (UFSM).

³ Available at <https://bdt.d.ibict.br/vufind/>. Access on: July 9th, 2023.

of these texts, we observed that only four addressed the research problem. To ensure greater reliability in the study and rigor in the selection of research works, we applied the following criteria for constituting the analysis corpus: (i) does the work establish an explicit link between the term Problematization and the Problem-Based Learning approach? and (ii) does the work draw upon foundational references within this perspective, such as Barrows, to substantiate its discussions regarding *problematização*? Consequently, the analysis corpus was constituted by the works presented in Table⁴.

Table 2 — Analysis Corpus from the Perspective of PBL

Code	Title	Author	Year of Defense
T1	<i>A problematização do lixo eletrônico no ensino de química para o primeiro ano do ensino médio</i>	Débora Quaresma Almeida	2019
T2	<i>Narrativas OC2-RD2 e PBL: uma proposta para o ensino da programação de computadores</i>	Eduardo Savino Gomes	2021
T3	<i>Problem-Based Learning e educação a distância: uma proposta para a educação estatística no ensino superior</i>	Josney Freitas Silva	2019
T4	<i>Aprendizagem Baseada em Problemas: um roteiro para o Ensino de Termodinâmica na Educação Básica</i>	Bruno Arena Barros	2020

Source: The authors

Data analysis was guided by Discursive Textual Analysis (DTA) (MORAES; GALIAZZI, 2016), through the processes of unitarization, categorization, and communication. In DTA, the categorization process may be conducted based on a priori or emergent categories. A priori categories are defined before the unitarization stage, that is, before the extraction of the excerpts that constitute the analysis corpus. Emergent categories result from the actual reading and interpretation of the excerpts; they are constructed inductively rather than being previously established. The 10 works comprising the corpus of this study were analyzed based on four a priori categories: i) Problematization of what?, ii) Problematization for what?, iii) Problematization in search of what?, and iv) What is the role of the Educator? These categories were selected because they provide a broad overview of the conception of problematization within each of the theoretical frameworks, aiding in the characterization of problematization from both Freirean and PBL perspectives. We note that the excerpts from the texts constituting the sample, referred to as “units of meaning” in DTA, will be identified using the following alphanumeric system: L1_U1, L1_U2, L2_U1,..., L_n_U_n or T1_U1, T1_U2, T2_U1,..., T_n_U_n.

⁴ It should be emphasized that the aim is not to conduct a literature review on this theme within the context of Science education. Rather, the sole objective is to consolidate the theoretical foundation for discussing problematization from a PBL perspective.

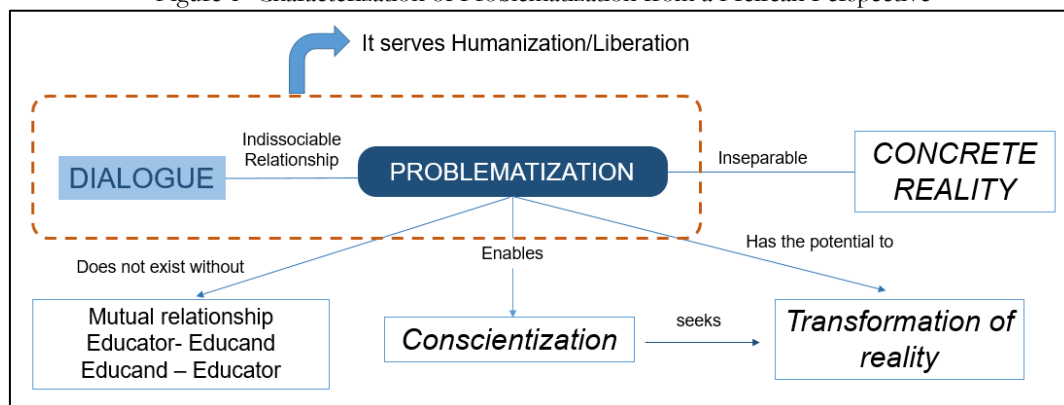
THE CONCEPT OF *PROBLEMATIZATION* FROM A FREIREAN PERSPECTIVE

Characterizing the concept of *problematization* from a Freirean perspective is far from a simple task. Throughout Paulo Freire's works, one observes that this term lacks a univocal meaning, at times presented as a method of knowing, at others as an attitude inherent to one's very being. Mühl (2019) highlights that, for Freire, the term *problematization* carries at least two pertinent meanings: the epistemological and the ontological, or anthropological.

In an epistemological sense, he [Freire] grounds a way of conceiving knowledge, and, in particular, of engaging with the objects of knowledge. This mode of engaging with and conceiving these objects implies that they do not possess an end inherent in themselves, and that the knowledge we derive from them constitutes merely one dimension of the mediation established between knowing subjects. [...] [In an ontological sense,] the attitude of problematizing is an imperative stemming from the anthropological condition of the human being. Thus, problematizing entails questioning; and questioning is not merely an act of knowing, but an act that actualizes human existence (MÜHL, 2019, pp. 383–384).

However, it must be emphasized that *problematization*, in both senses, is the cause of liberation and the formation of critical consciousness in individuals, and stands in opposition to the practice of Banking Education. Thus, this study aims to provide a more general characterization of the term *problematization*, based on an analysis of the works of Paulo Freire, as listed in the previous section. The discussions presented in the following paragraphs are guided by a priori categories and culminate in the schematic map (Figure 1).

Figure 1- Characterization of Problematization from a Freirean Perspective



Source: The authors

For Freire, *problematization* and *dialogue* share an indissociable relationship. In other words, there is no *dialogue* without *problematization*, nor *problematization* without *dialogue*. This is because the purpose of dialogue is to stimulate the problematization of the learner's knowledge, in its indisputable relationship with concrete reality. This can be observed in the following excerpt:

The aim of dialogue, in any instance (whether centered on scientific and technical knowledge or on “experiential” knowledge), is the problematization of knowledge, in its indisputable relationship with the concrete reality in which it is generated and upon which it acts, to better understand, explain, and transform it (L1_U3).

When we ask ourselves, “*Problematization of what?*”, Freire emphasizes, in this excerpt and in various others throughout his work, that *problematization* is done only when its object is the concrete reality

of the learners. Thus, problematization maintains an inseparable relationship with the world in which the learners are embedded, for it is precisely within the dialogical encounter between learners and the world that the *problematization* of concrete reality is fostered. This process aims to trigger a critical awakening by the subjects who constitute and act within that reality, as is further evidenced in the following excerpts:

This problematization, which takes place within the field of communication, **centering on real, concrete, and existential situations, or on intellectual contents that also refer back to the concrete**, demands, by the interlocutors engaged in this process, an understanding of the signs that signify meanings (L1_U10, *emphasis added*).

Fundamentally, in its very process, problematization is the reflection that an individual exercises upon a given content, whether that content is the product of an act or the act, to act more effectively, in concert with others, within reality. **There can be no problematization without this latter element**. (Hence, any discussion regarding the “beyond” must, as its point of departure, be grounded in a discussion of the “here”, which, for human beings, is invariably also a “now”) (L1_U12, *emphasis added*).

Thus, the educational conception we advocate, and which we are here summarily presenting as problematic content for the potential readers of this study, **is around the problematization of the "human-world" nexus. It does not center on the problematization of the human being isolated from the world, nor on that of the world isolated from the human being; rather, it focuses on the indichotomizable relationships established between the two** (L1_U13, *emphasis added*).

At this point, it is appropriate to challenge the unfounded criticisms that educational practices within the Freirean perspective lack scientific grounding. There can be no *problematization* without a cognitive act, because both are in an inseparable relationship. Otherwise, problematization becomes mere alienation. In this sense, Freire argues that *problematization* is not, nor can it ever be

[...] an intellectualist form of entertainment, alienated and alienating; an escape from action; a means of disguising the denial of reality. **Inseparable from the act of knowing, problematization is, much like that act itself, inseparable from concrete situations**. This is the reason why, proceeding from these latter situations, the analysis of which leads subjects to re-examine themselves in their confrontation with them, and to re-engage in that confrontation, problematization entails a critical return to action. It originates in action and returns to it (L1_U11, *emphasis added*).

Based on these premises and presuppositions, what, then, constitutes the *problematization* of concrete reality? What constitutes the problematization of the indichotomizable relations established between learners and the world? Such problematizations, proposed by Freire in *Extensão ou Comunicação?* (L1)—assist us in systematizing what it means to problematize the concrete reality of learners. The author highlights that:

[...] The problematization, in truth, does not concern the term “relation”. The term “relation” denotes that which is intrinsic to man in his stance toward the world, namely, being in it and with it, as a being of labor and action through which he transforms the world. [...] This is not to suggest that it would be illegitimate to discuss the concept of relation, situated within the strictly human sphere, by contrasting it with that of contact, situated within the animal sphere, for instance; nor is it to suggest that it would be impossible to discuss it from a linguistic, philosophical, sociological, or anthropological standpoint, among others. What matters fundamentally to education, however, viewed as an authentic epistemological situation, is the problematization of the world of labor, of works, products, ideas, convictions, aspirations, myths, art, and science, in short, the world of culture and history, which, as the outcome of man-world relations, in turn conditions human beings themselves: its very creators. To posit this human world as a problem for human beings means proposing that they *marvel at*, critically, and through a totalizing operation, both their actions and the actions of others upon the world (L1_U14).

Regarding the question “*Problematization, for what?*”, another Freirean category emerges: *Conscientization*. For Freire, *problematization* leads to the critical consciousness of the learners, as observed in the following excerpts:

For this reason, emphasis is placed on the continuous problematization of the learners' existential situations as they are presented in the codified images. The further the problematization progresses, the deeper the subjects penetrate the essence of the problematized object, and the more capable they become of “unveiling” this essence. **To the extent that they “unveil” it, their nascent consciousness deepens, thus leading to the conscientization of the situation by the poor classes. Their critical self-insertion into reality, or rather, their conscientization, causes their apathy to transform into a utopian state of denunciation and announcement: a viable project** (L5_U1, *emphasis added*).

Dialogue and problematization do not lull anyone to sleep; they awaken consciousness. Within this dialogicity, within this problematization, **the educator-as-learner and the learner-as-educator both develop a critical stance, resulting in the perception that this body of knowledge exists in a state of interaction.** It is a knowledge that reflects the world and human beings, situated within the world and in relation to it, explaining the world, yet, above all, compelled to justify through the world's transformation. Dialogical problematization transcends the old *magister dixit*, that refuge behind which those who deem themselves the “owners,” “administrators,” or “bearers” of knowledge attempt to hide (L1_U6, *emphasis added*).

We are convinced that any effort toward popular education, whether or not it is linked to vocational training, and whether situated in the agricultural or the urban-industrial sphere, must, for the reasons analyzed thus far, pursue one fundamental objective: **through the problematization of the “human-world” relationship, or of human beings in their interactions with both the world and other people, to enable individuals to deepen their critical awareness of the reality in which they are immersed and with which they engage** (L1_U1, *emphasis added*).

Thus, *problematization* cannot occur within the teaching-learning process and result in alienation; for, unlike Banking Education, Liberating, or Problematizing Education leads to conscientization. Based on the preceding excerpts and discussions, it is evident that the concept of *problematization*, from a Freirean perspective, is oriented toward humanization, or Liberation, achieved through the attainment of critical consciousness. However, a central question remains: does *conscientization* alone liberate? In other words: *problematization* in pursuit of what?

From this perspective, problematization aims at the transformation of the reality experienced by the subjects involved. As previously mentioned, this reality is not merely a basic, everyday issue; rather, it constitutes a real, existential, and concrete set of problems that structure the living conditions of the learners. For instance, in a low-income peripheral community, the issue to be discussed should not be “How do electric showers work?” or “How do refrigerators work?” Instead, it should be: “Why do many people in the neighborhood lack access to refrigerators, electric showers, and, at times, even electricity itself?” Thus, it is not enough simply to ask questions; it is necessary to engage in problematization.

With this in mind, we highlight the studies of Muenchen (2010), who emphasizes that every problematization is a question, but not every question is a problematization. This distinction is fundamental to understanding the formative potential of the act of problematizing, as can be observed in the excerpts that follow:

This shift in perception, which occurs through the problematization of a concrete reality, amidst the clash of its contradictions, **entails a new form of engagement between man and his reality.** It entails contemplating that reality in its totality: viewing it from “within,” and, from that “interior” vantage point, disaggregating it into its constituent parts to contemplate it once

more, acquiring a more critical and profound insight into one's own situation within a reality that does not merely condition one. It entails an "appropriation" of the context; an insertion into it; a refusal to remain merely "adhered" to it; a refusal to exist almost "beneath" time, but rather within time. It entails recognizing oneself as a human being, a **human being who must act, think, grow, and transform, rather than fatalistically adapting to a dehumanizing reality** (L4_U1, *emphasis added*).

The process of adult literacy must, on the one hand, necessarily involve the popular masses in a concerted effort of mobilization and organization, an effort in which they, acting as subjects alongside the educators, take ownership of the very process itself. On the other hand, it must engage them in the continuous problematization of their reality, **or of their practice** within that reality (L3_U8, *emphasis added*).

To conclude the discussions regarding the concept of *problematization* from a Freirean perspective, we ask: What is the role of the Educator according to Freire? First and foremost, we must emphasize that, within this framework, the educator is always a problematizing educator. Their role begins even before classroom implementation, for *problematization* must be present, specifically, during the investigation of reality, wherein the Generative Theme is sought:

Thus, in the **process of searching for significant themes, a concern for problematizing the themes themselves**, for their connections with others, and for their historical-cultural context, **must already be present** (L6_U2, *emphasis added*).

Once the theme has been established, the organization of the course program, or teaching plan, must not lose sight of its problematizing character. After all, the role of the educator, proceeding from an investigation of reality, is no longer to lecture, but rather to problematize, as indicated by the following excerpts:

It is only through the investigation of this minimal vocabulary universe that the educator can organize a program which, in this way, originates with the learners and returns to them, not as a dissertation, but as a problematization (L3_U1).

Over dialogue, they prefer lengthy, erudite dissertations replete with citations. Over problematizing dialogue, they prefer what is termed "reading control" (a method of controlling not the reading itself, but rather the learner), a practice that yields no truly intellectual or creative discipline, but merely the learner's submission to a text whose reading is deemed in need of "control." At times, they label this "assessment," or assert that it is necessary to "compel" young people to study and to acquire knowledge. In truth, they are unwilling to embrace the risks inherent in dialogical adventure, the risks of problematization, and instead take refuge in their discursive, rhetorical lectures, which function as little more than "lullabies." Narcissistically reveling in the echo of their own "words," they lull the learner's critical capacity to sleep (L1_U5).

In *Pedagogia do Oprimido* (L6), Freire critiques the "transmission of content" and advocates for a dialogical education. Consequently, the construction of knowledge is always carried out within a problematizing framework, through which we can view the role of the educator from an epistemological perspective.

Even when a scientist, while investigating in search of something, encounters that which they were not seeking (and this invariably occurs), their discovery originated from a process of problematization [...] **What we advocate is precisely this: if scientific knowledge, and the formulation of rigorous thought—cannot dispense with its problematizing matrix, then the apprehension of this scientific knowledge, and the rigor of this philosophical thought—likewise cannot dispense with the problematization that must be undertaken regarding the very body of knowledge the learner is expected to internalize** (L1_U4, *emphasis added*).

The education incumbent upon those who are truly committed to liberation cannot be founded upon a conception of human beings as "empty" vessels whom the world is to "fill" with content;

it cannot be based on a specialized, mechanistically compartmentalized consciousness, but rather on human beings as “conscious bodies” and on consciousness as a consciousness directed toward the world. It cannot be an education of depositing content, but rather one of problematizing human beings in their relationships with the world. In contrast to “banking” education, problematizing education, by responding to the very essence of consciousness, which is its intentionality, rejects mere communiqués and restores existence to the act of communication itself. It aligns with the intrinsic nature of consciousness, which is always to be a “consciousness of something”, not only when directed toward objects but also when it turns back upon itself, in what Jaspers terms a “cleavage.” A cleavage in which consciousness becomes a consciousness of consciousness. In this sense, liberating, problematizing education can no longer be an act of depositing, narrating, transferring, or transmitting “knowledge” and values to learners, who are treated as mere passive recipients, in the manner of “banking” education, but must instead be a truly cognitive act (L6_U1).

We must also understand that the role of the educator extends beyond problematizing concrete reality; it equally encompasses the scientific knowledge that mediates the world of the learners, underscoring the relevance of Science for understanding and acting within reality. In this regard, Freire highlights that:

The educator's task, then, is to problematize for the learners the content that mediates them, not to lecture upon it, to bestow it, to extend it, or to hand it over as if it were something already made, elaborated, finished, or complete. In this act of problematizing the learners, the educator is simultaneously problematized. Problematization is so profoundly dialectical that it would be impossible for anyone to establish it without becoming personally committed to its process. **Indeed, no one can problematize something for someone else while simultaneously remaining a mere spectator of that problematization.** Even when methodologically speaking, the educator chooses to remain silent while presenting the problem-situation, allowing the learners to grasp, analyze, and comprehend it, he remains problematized nonetheless. **This is because, within the process of problematization, every step taken by any one of the subjects toward delving deeper into the problematic situation opens up new avenues for the other subjects to comprehend the object of analysis** (L1_U8, *emphasis added*).

However, it is only possible to problematize the concrete reality of learners in a dialogical manner if the educator humbly understands that, in teaching, he learns. Consequently, knowledge must never be merely transmitted, but rather constructed dialogically within non-hierarchical educator-learner/learner-educator relationships. In this regard, Freire’s works emphasize that:

[...] knowledge does not extend from the one who deems himself knowledgeable to those who deem themselves ignorant; knowledge is constituted in human-world relations, relations of transformation, and is perfected through the critical problematization of these relations (L1_U2, *emphasis added*).

The educator, problematized only in the act of problematizing, “re-admires” the problematic object through the “admiration” of the learners. **This is the reason why the educator continues to learn; and the more humble he is in the “re-admiration” he undertakes through the “admiration” of the learners, the more he will learn** (L1_U9, *emphasis added*).

We have stated that education, as a gnoseological situation, signifies the problematization of the content upon which educator and learner co-intend, as knowing subjects (L1_U15).

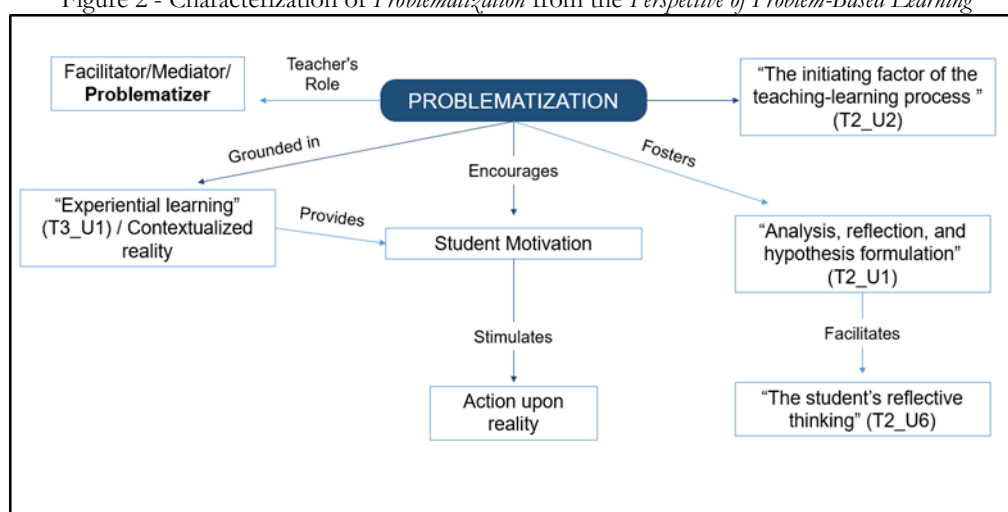
Based on the discussions conducted, we can observe that the schematic map in Figure 1, presented at the beginning of this section, systematizes the conceptions of problematization from a Freirean perspective. Similar discussions will be undertaken in the next section from the standpoint of the PBL perspective.

THE CONCEPT OF PROBLEMATIZATION FROM THE PERSPECTIVE OF PROBLEM-BASED LEARNING (PBL)

In this section, the concept of problematization is characterized from the perspective of PBL, based on an analysis of the studies listed in Table 2. The discussions developed in the following paragraphs are guided by units of meaning extracted from the analytical corpus, which were subsequently organized into four a priori categories: *Problematization* of what?, *Problematization* for what?, *Problematization* in pursuit of what?, and What is the role of the educator?

During the categorization process, a fifth category also emerged, titled “*Problematization as the initiating factor of the teaching-learning process*”, which constitutes an emergent category consistent with the premises of DTA. The articulation among these categories resulted in the creation of a schematic map (Figure 2), which synthesizes the conception of problematization within the context of PBL.

Figure 2 - Characterization of *Problematization* from the *Perspective of Problem-Based Learning*



Source: The authors

A first point to be highlighted from the analysis of studies involving *Problematization* and PBL is the emergent category of *Problematization as the initiating factor in the teaching-learning process*. Various studies argue that problematization within PBL plays a crucial role in initiating and fostering the teaching-learning process, as illustrated by the following excerpts:

[...] the PBL (*Problem-Based Learning*) methodology was adopted as an interesting alternative for developing a teaching and learning process that fosters reflective thinking in the student. This methodology was chosen because it proceeds from the problematization of content to its presentation (T2_U6, *emphasis added*).

[...] **problematization as its trigger** and the formulation of hypotheses as one of its phases (T2_U5, *emphasis added*).

This methodology [PBL] aligns with the proposals of Freire and Polya, **positing problematization as the initiating factor in the teaching and learning process**. However, the PBL methodology begins with studying a problem, offering no specific guidelines for how that problem should be presented; this approach allows the student to truly engage with the context and experience the process of analysis, reflection, and hypothesis formulation (T2_U2, *emphasis added*).

These assertions align with Barrows (1996), who highlights problematization as a central element in the organization and stimulation of learning. Regarding the category “Problematization of

what?”, various excerpts demonstrate that problematization is grounded in lived experiences, that is, in a concrete and contextualized reality, as observed below:

[...] we understand that, through this **process of contextualized problematization, applied at the very core of learning**, solid knowledge is constructed, **grounded in lived experiences** that lead students to take ownership of their learning. This fact will reflect positively on their academic and professional development, as it demands responsibility by the students and contributes significantly to their learning (T3_U2, *emphasis added*).

Problematization, or simply contextualization, is assigned to the next stage of the technique: the Elaboration of the Motivation Plan (T3_U1, *emphasis added*).

This “contextual” or “lived experiences” focus within PBL can be understood since this approach was developed within the context of professional training, particularly within medical schools. As for the category “Problematization: For What?”, we observe, as shown in Figure 2, that problematization plays a central role in motivating learners, facilitating a reflective and autonomous learning process, as illustrated by the following excerpts:

[...] thus, this work proceeds from the premise that PBL (Problem-Based Learning) constitutes one of the possible responses for **creating a teaching and learning context that enables students to practice analysis, reflection, and hypothesis formulation** (T2_U1, *emphasis added*).

The targets shift, whether because reality has changed, because interests have changed, or both; merely imparting knowledge in a gradual, solid, and static manner, **detached from the problematization that generated it, does not allow students to develop the skills that will render them more autonomous and capable of choosing and attaining their own targets** (T2_U4, *emphasis added*).

Based on these data, we identify that problematization in PBL aims to foster a more critical and autonomous perspective in learners. However, the question remains: what does problematization seek to achieve? In other words, why do we want learners to adopt a critical and autonomous perspective? Both Figure 2 and the excerpts presented below demonstrate that, in PBL, problematization seeks to mobilize learners to act upon the reality in which they are embedded, guiding them to intervene in a critical, reflective, and transformative manner.

[...] the teaching-learning process begins with **confronting a problem situation, which generates in students the need to acquire new knowledge, only then enabling them to act upon reality** (T4_U1, *emphasis added*).

In this context of debate regarding the need to revise educational strategies, problem-posing education, among which PBL stands out, emerges as one of the primary approaches to replace, or complement, traditional education, **empowering students to engage critically with reality by fostering creativity and reflection** (T1_U1, *emphasis added*).

From this perspective, the initial aim of problematization was to encourage learners to act professionally within their own realities. For Barrows (1996), for instance, one of the six characteristics of an educational practice grounded in PBL is precisely that problematization serves as a vehicle for developing clinical problem-solving skills. However, as evidenced by the preceding excerpts, PBL has evolved to extend beyond the professional sphere, penetrating and indeed becoming integrated into the school environment. Thus, it is evident that problematization plays a pivotal role in PBL, since it seeks to foster the learners' critical engagement with reality, a point highlighted in excerpt T1_U1.

With regard to the category “What is the role of the educator?”, the studies generally demonstrated alignment with Barrows (1996), as observed in the following excerpt.

According to Barrows (1996, cited in BOER; CATEN, 2014), the main characteristics of PBL center on student-focused learning, learning stimulated by problem-solving, and **a shift in the teacher's role, whereby the teacher becomes a facilitator of learning** (T3_U2, *emphasis added*).

Although not present in the analysis corpus, a recent study from Silva, Vidmar, and Pastorio (2023a) developed physics instructional activities utilizing the methodological dynamics of PBL, in which educators acted by guiding and assisting groups during problem-solving. The authors detail the structural design of this implementation and highlight the necessity of employing scaffolding tools for the development of PBL activities (SILVA, VIDMAR, and PASTORIO, 2023b). The term scaffolding refers to the assistance offered to students in executing tasks that they would be unable to perform independently (CHOO, 2012; PHUMEECHANYA and WANNAPIROON, 2014). These tools include, among others, the educator's mediating role, small-group collaboration, worksheets, and the use of technology (CHOO, 2012). Thus, the educator's role in PBL resembles that of scaffolding in construction: a temporary support that sustains and guides the process of knowledge construction through problem-posing.

From this perspective, there are indications of a resemblance between the role of the educator in PBL and that of the problematizing educator, such that Barrows (1988) characterizes the educator as a metacognitive guide. Therefore, their role is to question the students, posing the very problems that the students should be posing to themselves (BARROWS, 1988; 1996).

CONVERGENCES AND DIVERGENCES IN THE CONCEPTION OF PROBLEMATIZATION FROM THE FREIREAN PERSPECTIVE AND IN PROBLEM-BASED LEARNING (PBL)

Based on the discussions in the preceding sections and the insights from Figures 1 and 2, we can identify certain similarities and differences regarding the concept of problematization from the perspectives of Freire and Problem-Based Learning (PBL). Notably, the study by Cavanagh, Vanstone, and Ritz (2019), titled “Problems of Problem-Based Learning: Towards Transformative Critical Pedagogy in Medical Education,” highlights three key differences between Freirean pedagogy and PBL in the context of medical education: the nature of problems, the understanding of knowledge, and the role of patients. The authors argue that while both approaches engage with problems, Freirean pedagogy focuses on broader social and political issues, whereas PBL primarily addresses specific clinical challenges.

However, the present study revealed that there are both convergences and divergences regarding the conception of *problematization* in the two perspectives. These elements were systematized in Table 3 below and organized into six categories that emerged during the analysis: principle, moment of dialogue, role of the teacher, moment of occurrence, objective, and content.

Table 3 – Points of Convergence and Divergence in the Conception of Problematization in the PBL and Freirean Perspectives

Categories	Convergences	Divergences	
		PBL	Freirean Perspective

Principle	Problem Situations	Lived Experiences	Concrete reality
Moments of Dialogue	Occurrence of dialogue/discussion	In small groups	All members of the school community
Teacher's role	Problematizing	The Student as Protagonist	Non-hierarchical educator-learner relationship (without protagonists)
Time of occurrence	Start of the teaching-learning process	In general, just to start the process	Necessarily, throughout the entire process
Objective	Seek alternatives to resolve the problem situation.	Development of Individual Skills	Transforming concrete reality (collective/social objective)
Contents	Interdisciplinary Potential	-	-

Source: The authors

Regarding the category of “principle,” both perspectives begin by problematizing a problem situation. However, as previously discussed, in the Freirean perspective, this entails problematizing the concrete reality of the learners as well as the scientific knowledge that mediates it. In contrast, within PBL, problematization focuses on the students’ lived experiences, being a starting point for mobilizing the knowledge necessary to resolve the proposed problems.

In both approaches, problematization necessitates the occurrence of “moments of dialogue.” As previously mentioned, problematization and dialogue are inseparable concepts. The distinction lies in the fact that, in PBL, dialogue and discussions tend to occur predominantly within small groups or among the entire class. Conversely, for Freire, dialogue is indispensable right from the initial phase of investigating the "generating theme" within the community—involving not merely small groups or the classroom, but the entire school and local community.

In the category of “the teacher's role,” it is important to highlight that one of the points discussed in this work is that, from the perspective of PBL, the teacher's role extends beyond the functions of facilitator, mediator, or guide: above all, the educator assumes a problematizing role. This aspect constitutes a point of convergence between the concept of problematization in Freire’s work and in PBL. However, much like other active learning methodologies, PBL positions the student as the central protagonist of the teaching-learning process, even though the teacher continues to play a fundamental role. For Freire, educators and learners establish a non-hierarchical relationship, as illustrated in Table 3 and Figure 1, and, even though they occupy distinct roles within the classroom, there are no protagonists: both are mediated by the concrete reality in which they are embedded.

In the timing of the problematization, we observe that both perspectives initiate the teaching-learning process based on a problem situation. However, generally speaking, PBL uses it merely as a “trigger” for the educational process, whereas the Freirean approach necessarily engages in problematization throughout the entire process, from the selection of scientific knowledge to the evaluation of the teaching-learning process itself.

In the objective of the problematization, both approaches share the principle of stimulating the search for solutions to the problem situation that gives rise to the educational process. Nevertheless, PBL focuses primarily on the development of individual skills, a reflection of its origins in professional training, whereas, from the Freirean perspective, the purpose of problematization is to transform the concrete reality of the learners, thereby assuming a collective and social objective.

Finally, regarding the category of “content,” both PBL and the Freirean perspective advocate for the planning and development of interdisciplinary didactic-pedagogical projects. Since both are structured around problematizations that emerge from what is meaningful to each student, it becomes evident that scientific knowledge drawn from a single discipline can hardly “adequately address” the complexity of a given context and/or complex problem. In this sense, we underscore the importance of interdisciplinary work in school education, thereby overcoming the fragmentation that remains predominant in curricula (MUENCHEN, 2006).

FINAL CONSIDERATIONS

This study identified points of convergence and divergence between the conceptions of *problematization* within the Freirean perspective and in *Problem-Based Learning* (PBL). Thus, we characterized *problematization* in both approaches, based on works of Paulo Freire and, in the case of PBL, Brazilian theses and dissertations that employ this methodology. The inability to consult the core literature of PBL was a limitation of this study, as the analysis relied predominantly on secondary sources. The original works on PBL do not sufficiently show the conceptual terms necessary for this investigation; this restricted direct access to the primary formulation of the approach and constrained the depth of the analyses conducted.

Based on the results obtained, this investigation proved to be of paramount importance for a better elucidation of the concept of problematization, both from the perspective of Paulo Freire and within the framework of PBL, facilitated through the creation of schematic maps (Figures 1 and 2). For Freire, *problematization* must stem from the concrete reality of the learners, to foster their critical consciousness and seek to transform that reality. However, it is not sufficient to focus solely on the learners' reality; it is also necessary to problematize the scientific knowledge that mediates it (FREIRE, 2006). With these considerations, the educator assumes the role of problematizer in the classroom, engaging in a mutual relationship with the learner; for, in truth, “no one problematizes something to someone while simultaneously remaining a mere spectator of the problematization” (FREIRE, 2006, pp. 81–82).

In the context of PBL, problematization is, in essence, a “trigger” or “initiator” for the teaching-learning process and is linked to the learners' lived experiences (BARROWS; TAMBLYN, 1980; HUNG; JONASSEN; LIU, 2008). Thus, it aims to foster critical analysis and reflection among learners, enabling them to subsequently take action within their respective contexts (BARROWS, 1988).

Following discussions regarding the concept of *problematization*, we developed Table 3, which systematizes the points of convergence and divergence between the Freirean and PBL perspectives. Among the points of convergence, we highlight the following: both take a problem situation as their starting point; both rely on the occurrence of dialogue; both position problematization at the very

beginning of the teaching-learning process; both assign the educator the role of “problematizer”; and both demonstrate interdisciplinary potential, given the complexity of the situations they mobilize.

Regarding the points of divergence, while for Freire the relationship between educator and learner is non-hierarchical, in PBL, although the educator plays a fundamental role, the primary agency is attributed to the learner. Furthermore, from a Freirean perspective, problematization is anchored in the concrete reality of the learners, whereas in PBL, it is grounded in lived experiences. Finally, we observe that problematization in PBL primarily aims at the development of individual skills, whereas in Freire, it seeks the transformation of concrete reality.

We highlight that the primary differences between the approaches discussed stem from the differing hierarchical relationships among the subjects involved. From the Freirean perspective, hierarchical equality between educator and learner presupposes mutual respect for one another's knowledge, that is, the knowledge and lived experiences of both are indispensable for resolving the problem-situation. In contrast, within PBL, it is the learners who must solve the problem, while the educator acts as a metacognitive guide; specifically, it is expected that, eventually, this role of the educator will become dispensable (BARROWS, 1988).

We must emphasize that the conception of *problematization* in both perspectives exhibits points of convergence and divergence, such as those presented in this study. The two approaches have different objectives and emerged within different contexts: the Freirean perspective emerged within the context of Popular Education, whereas PBL emerged within the context of professional training in medical schools. Thus, within the scope of this investigation, the objective was not to evaluate which approach is superior or inferior, but rather to discuss the convergences and divergences surrounding the concept of problematization, as well as to contribute to studies in this field. Finally, we reiterate our advocacy for a problematizing and dialogical education, and for the publication of an increasing number of studies moving in this direction.

REFERENCES

ARAÚJO, Laís B. *Os três momentos pedagógicos como estruturantes de currículos*. 2015. Dissertação (Mestrado em Educação em Ciências). Santa Maria: Universidade Federal de Santa Maria, 2015.

AUGUSTO, Stephanie. O.; SANTOS, Jefferson S.; MACIEL, Nicolas. S.; GEHLEN, Simoni T. Temas Geradores em tempos de pandemia e suas contribuições para o ensino de Ciências/Física. *Caderno Brasileiro de Ensino de Física*, v. 40, n. 1, p. 154-187, 2023. Disponível em: <https://periodicos.ufsc.br/index.php/fisica/article/view/89686>. Acesso em: 23 abr. 2024.

BARROWS, Howard. S. Problem-Based Learning in Medicine and Beyond: A Brief Overview. *New directions for teaching and learning*, v. 1996, n. 68, p. 3-12, 1996. Disponível em: <https://doi.org/10.1002/tl.37219966804>. Acesso em: 1 jun. 2023.

BARROWS, Howard. S. The tutorial process. *Springfield*: Southern Illinois School of Medicine, 1988.

BARROWS, Howard. S.; TAMBLYN, Robyn. M. *Problem-Based Learning: An Approach to Medical Education*. New York: Springer Publishing Company, ed.1, 1980.

BRASIL. Ministério da Educação. *PCN+ Orientações Educacionais Complementares aos Parâmetros curriculares Nacionais – Ciências da Natureza, Matemática e suas Tecnologias*. Brasília, 2002.

BRASIL. *Parâmetros Curriculares Nacionais: Ciências Naturais/Secretaria de Educação Fundamental*. Brasília, 1998.

CAMP, Gwendie. Problem-based learning: A paradigm shift or a passing fad? *Medical Education Online*, v. 1, n. 2, 1996. Disponível em: <http://med-ed-online.net/index.php/meo/article/view/4282>. Acesso em: 23 abr. 2024.

CAVANAGH, Alice; VANSTONE, Meridith; RITZ, Stacey. Problems of problem-based Learning: Towards transformative critical pedagogy in medical Education. *Perspectives on Medical Education*, v. 8, p. 38-42, 2019. Disponível em: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6382617/>. Acesso em: 23 abr. 2024.

CENTA, Fernanda G.; MUENCHEN, Cristiane. O Despertar para uma Cultura de Participação no Trabalho com um Tema Gerador. *Alexandria: revista de educação em Ciência e Tecnologia*, v. 9, n. 1, p. 263-291, 2016. Disponível em: <https://periodicos.ufsc.br/index.php/alexandria/article/view/1982-5153.2016v9n1p263>. Acesso em: 23 abr. 2024.

CHOO, S. S. Y. Scaffolding in Problem-based Learning. In: O'GRADY, G. et al. (org.). *One-Day, One-Problem*. Singapore: Springer Singapore, 2012. p. 167–184. Disponível em: http://link.springer.com/10.1007/978-981-4021-75-3_8. Acesso em: 6 abr. 2024.

DELIZOICOV, Demétrio. Problemas e Problematisações. In: PIETROCOLA, M. (org.). *Ensino de Física conteúdo, metodologia e epistemologia numa concepção integradora*. Florianópolis: Ed. da UFSC, 2001.

FERREIRA, Marinês. V; PANIZ, Catiane M.; MUENCHEN, Cristiane. Os Três Momentos Pedagógicos em consonância com a Abordagem Temática ou Conceitual: uma reflexão a partir das pesquisas com olhar para o Ensino de Ciências da Natureza. *Ciência & Natura*, Santa Maria, v. 38, n. 1, p. 513-525, 2016. Disponível em: <https://periodicos.ufsm.br/cienciaenatura/article/view/18951>. Acesso em: 23 abr. 2024.

FONSECA, Kamilla; MILLI, Júlio C. L.; BOMFIM, Manuela G.; ALMEIDA, Eliane D. S.; NERES, Cleilde A.; GEHLEN, Simoni T. A feira livre como tema gerador: possibilidades de abordar física no Ensino Fundamental. *Física na Escola*, v. 16, n. 2, p. 62-67, 2018. Disponível em: <http://www.ww1.fisica.org.br/fne/phocadownload/Vol16-Num2/a11.pdf>. Acesso em: 23 abr. 2024.

FREIRE, Paulo. *Educação na cidade*. São Paulo: Cortez, 1995.

FREIRE, Paulo. *Extensão ou comunicação?* São Paulo: Paz e Terra, 2006.

FREIRE, Paulo. *Pedagogia do Oprimido*. 17. ed. Rio de Janeiro: Paz e Terra, 1987.

FREIRE, Paulo. *Pedagogia da Autonomia: saberes necessários à prática educativa*. Rio de Janeiro: Paz e Terra, 1996.

FREITAS, Wélida P. S.; QUEIRÓS, Wellington P. A politização docente para o enfrentamento de uma situação-limite por meio de intervenções didáticas pautadas na perspectiva Giroux-CTS. *Investigações em*

Ensino de Ciências, v. 25, n. 2, p. 293-312, 2020. Disponível em: <https://ienci.if.ufrgs.br/index.php/ienci/article/view/1602>. Acesso em: 23 abr. 2024.

GIL, Antônio Carlos. *Como elaborar projetos de pesquisa*. 7. ed. Barueri (SP): Atlas, 2022.

HUNG, Woei. The 3C3R Model: A Conceptual Framework for Designing Problems in PBL. *Interdisciplinary Journal of Problem-Based Learning*, v. 1, n. 1, 2006. Disponível em: <https://docs.lib.purdue.edu/ijpbl/vol1/iss1/6/>. Acesso em: 23 abr. 2024.

HUNG, Woei; JONASSEN, D. H.; LIU, R. Problem-Based Learning. In: SPECTOR et al. *Handbook of Research on Educational Communications and Technology*. Abingdon: Routledge, 2008. p. 485-506.

KRASILCHIK, Myriam. *O professor e o currículo das Ciências*. São Paulo: EPU: Editora da Universidade de São Paulo, 1987.

MORAES Roque; GALIAZZI, Maria do Carmo. *Análise Textual Discursiva*. Ijuí: Unijuí, 2016.

MUENCHEN, Cristiane. *Configurações curriculares mediante o enfoque CTS: desafios a serem enfrentados na EJA*. Dissertação (Mestrado em Educação). Santa Maria: Universidade Federal de Santa Maria, 2006.

MUENCHEN, Cristiane; DELIZOICOV, Demétrio. Concepções sobre problematização na Educação em Ciências. *Enseñanza de las Ciencias*, v. 1, p.2447-2451, 2013.

MUENCHEN, Cristiane. *A disseminação dos três momentos pedagógicos: um estudo sobre práticas docentes na região de Santa Maria/RS*. Tese (Doutorado em Educação Científica e Tecnológica) – Florianópolis: Universidade Federal de Santa Catarina, 2010.

MUENCHEN, Cristiane; MAGOGA, Thiago F.; SCHNEIDER, Tatiani M.; ARAÚJO, Laís B. Os Três Momentos Pedagógicos na formação inicial de professores: o trabalho com Temas Geradores. In: G. Watanabe (org.). *Educação Científica Freireana na escola*. 1.ed. Editora: Livraria da Física, 2019.

MÜHL, Eldon Henrique. Problematização. In: STRECK, Danilo R.; REDIN, Euclides.; ZITKOSKI, Jaime J. *Dicionário Paulo Freire*. 4. ed. Autêntica Editora: Belo Horizonte/MG, 2019.

PACHECO, Lucas C.; MAGOGA, Thiago F.; MUENCHEN, Cristiane. O processo de construção do material didático “(Há) Física na cidade?”. *Caderno Brasileiro de Ensino de Física*, v. 39, n. 1, p. 83-108, 2022. Disponível em: <https://periodicos.ufsc.br/index.php/fisica/article/view/80898>. Acesso em: 23 abr. 2024.

PANIZ, Catiane Mazocco. *O PIBID como política articuladora na construção de currículos críticos: o trabalho desenvolvido no Instituto Federal Farroupilha – campus São Vicente do Sul*. Tese (Doutorado em Educação em Ciências). Santa Maria: Universidade Federal de Santa Maria, 2017.

PHUMEECHANYA, Noppadon; WANNAPIROON, Panita. Design of Problem-based with Scaffolding Learning Activities in Ubiquitous Learning Environment to Develop Problem-solving Skills. *Procedia - Social and Behavioral Sciences*, v. 116, p. 4803–4808, 2014. Disponível em: <https://www.sciencedirect.com/science/article/pii/S1877042814010453?via%3Dihub>. Acesso em: 23 abr. 2024.

RODRIGUES, Igor. *Paulo Freire e o Ensino de Física- o caráter freireano de relatos de experiência do SNEF*. Dissertação (Mestrado em Educação). Rio de Janeiro: Universidade Federal do Estado do Rio de Janeiro, 2017.

SERVANT, Ginie. *Revolutions and Re-iterations: An Intellectual History of Problem-based Learning*. 2016. Tese (Doutorado) - Erasmus Universiteit Rotterdam, Netherlands, 2016.

SILVA, Bruno P. da; VIDMAR, Muryel P.; PASTORIO, Dioni. P. Problem-Based Learning no Ensino de Física: descrição e análise de uma implementação no ensino superior. *in: anais do simpósio nacional de metodologias ativas na educação profissional e tecnológica - SINMAEPT*, 2023a. *Anais [...]*. [S. l.: s. n.], 2023. p. 1. Disponível em: <https://www.even3.com.br//anais/iisinmaept/610730-problem-based-learning-no-ensino-de-fisica--descricao-e-analise-de-uma-implementacao-no-ensino-superior>. Acesso em: 6 abr. 2024.

SILVA, Bruno P. da; VIDMAR, Muryel P.; PASTORIO, Dioni. P. Problem-Based Learning para o desenvolvimento da Flexibilidade Cognitiva: um design estrutural através de ferramentas Scaffolding. *Simpósio Sul-Americano de Pesquisa em Ensino de Ciências*, 2023b. Disponível em: <https://portaleventos.uffs.edu.br/index.php/SSAPEC/article/view/19229>. Acesso em: 6 abr. 2024.

SILVA, Wellington B.; DELIZOICOV, Demétrio. Problemas e problematizações: implicações para o ensino dos profissionais da saúde. *Ensino, Saúde e Ambiente*, v.1, p. 14-28, 2008. Disponível em: <https://periodicos.uff.br/ensinosaudeambiente/article/view/21028>. Acesso em: 23 abr. 2024.

SOUSA, Polliane. S.; SOLINO, Ana Paula.; FIGUEIREDO, P. S.; GEHLEN, Simoni T. Tema Gerador no Ensino de Ciências/Física: Construção de uma Proposta com Professores do Ensino Fundamental. *In: XV Encontro de Pesquisa em Ensino de Física*, Maresias/SP, 2014.

STRECK, Danilo R.; REDIN, Euclides; ZITKOSKI, Jaime J. *Dicionário Paulo Freire*. 4. ed. Autêntica Editora: Belo Horizonte/MG, 2019.

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DECLARATION ON DATA AVAILABILITY

The content underlying the research text is contained in the manuscript.

AUTHORSHIP STATEMENT

Author 1 – Study conceptualization, data collection, data analysis, and manuscript writing.

Author 2 – Active participation in data analysis and manuscript writing.

Author 3 – Active participation in data analysis, guidance on the PBL perspective, and final manuscript review.

Author 4 – Active participation in data analysis, guidance on the PBL perspective, and final manuscript review.
Author 5 – Study conceptualization, guidance on the Freirean perspective, and final manuscript review.

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest regarding the present article.