

THE ROLE OF THE PEDAGOGICAL COORDINATOR IN PROMOTING SCHOOL INTERDISCIPLINARITY

A ATUAÇÃO DO COORDENADOR PEDAGÓGICO NA PROMOÇÃO DA INTERDISCIPLINARIDADE ESCOLAR

EL PAPEL DEL COORDINADOR PEDAGÓGICO EN LA PROMOCIÓN DE LA INTERDISCIPLINARIEDAD ESCOLAR

Clérison José da Silva ANDRADE¹

Eduardo José Fernandes NUNES²

Paulo César Marques de Andrade SANTOS³

ABSTRACT: This article aims to discuss the pedagogical coordinator's contribution in promoting interdisciplinarity in the didactic-pedagogical process in the school environment, seeking to understand how this process occurs and evidence that there are elements in the literature that signal a rupture of the disciplinary work and its replacement by an interdisciplinary practice in the teaching and learning relationship. The literature review and document analysis that guided the study indicate the important presence of the pedagogical coordination in the conduction of actions that have collaborated with the substitution of traditional models of teaching plan for models that contemplate interdisciplinarity, used by teachers in the classroom. Thus, it is considered that the work of pedagogical coordinators, in partnership with teachers, is an important strategy to overcome the fragmentation of teaching.

KEYWORDS: Coordinator. School. Pedagogical project. Collective work. Classroom.

RESUMO: Este artigo tem como objetivo discutir a contribuição do coordenador pedagógico na promoção da interdisciplinaridade no fazer didático-pedagógico no ambiente escolar, buscando compreender como este processo ocorre e evidências de que há elementos na literatura que sinalizam para uma ruptura do trabalho disciplinar e a substituição pela prática interdisciplinar na relação de ensino e aprendizagem. A revisão bibliográfica e análise documental que nortearam o estudo indicam a importante presença da coordenação pedagógica na condução de ações quem têm colaborado com a substituição dos modelos tradicionais de plano de ensino por modelos que contemplam a interdisciplinaridade, utilizados pelos professores em sala de aula. Considera-se, assim, que a atuação dos

¹ University of Pernambuco (UPE), Petrolina – PE – Brazil. Master's student in the Graduate Program in Teacher Training and Interdisciplinary Practices (PPGFPI). ORCID: <https://orcid.org/0000-0003-4194-2435>. E-mail: cleriston.andrade@upe.br

² Bahia State University (UNEB), Salvador – BA – Brazil. Adjunct Professor, Department of Education. Permanent Professor of the Graduate Program in Education and Contemporaneity (PPGEDUC). Doutorado em Análise Geográfica Regional (UB–Espanha). ORCID: <https://orcid.org/0000-0002-9358-8039>. E-mail: eduardojosf2@gmail.com

³ University of Pernambuco (UPE), Petrolina – PE – Brazil. Adjunct Professor of the Department of Pedagogy. Permanent Professor of the Graduate Program in Teacher Training and Interdisciplinary Practices (PPGFPI). Post-doctoral student in the Graduate Program in Education and Contemporaneity (UNEB). ORCID: <https://orcid.org/0000-0001-5803-2388>. E-mail: paulo.marques@upe.br

coordenadores pedagógicos, em parceria com os docentes, é uma importante estratégia de superação da fragmentação do ensino.

PALAVRAS-CHAVE: *Coordenador. Escola. Projeto pedagógico. Trabalho coletivo. Sala de aula.*

RESUMEN: *Este artículo tiene como objetivo discutir la contribución del coordinador pedagógico en la promoción de la interdisciplinariedad en la práctica didáctico-pedagógica en el ámbito escolar, buscando comprender cómo se produce este proceso y evidenciar que existen elementos en la literatura que señalan una ruptura del trabajo disciplinario y la sustitución por la práctica interdisciplinaria en la relación de enseñanza y aprendizaje. La revisión bibliográfica y el análisis documental que lideró el estudio indican la importante presencia de la coordinación pedagógica en la conducción de las acciones que han colaborado con la sustitución de los modelos tradicionales de plan de enseñanza por modelos que contemplan la interdisciplinariedad, utilizados por los docentes en el aula. Por lo tanto, se considera que el desempeño de los coordinadores pedagógicos, en asociación con los docentes, es una estrategia importante para superar la fragmentación de la enseñanza.*

PALABRASCLAVE: *Coordinador. Escuela. Proyecto pedagógico. Trabajo colectivo. Aula de clase.*

Introduction

Interdisciplinarity at school has been the subject of much debate among educators in Brazil and worldwide, with the production of a considerable number of research studies, articles, dissertations, theses and books with this focus (FAZENDA, 2008; GATTÁS; FUREGATO, 2007; MORIN, 2001; LENOIR, 1998). These works mostly evidence the demand for overcoming old educational paradigms that are expressed both in the curricular models fragmented into disciplines and in the teacher training process, whose emphasis is still concentrated on a Cartesian view of reality. In this scenario, the school environment could be illustrated as an archipelago composed of several islands that do not communicate with each other and seem separated by distances that are difficult to be covered.

Despite the existence of some successful experiences, the daily routine of the teaching units is still strongly marked by the implementation of a compartmentalized logic among and within the different areas of knowledge. Trained as specialists and often deprived of access to continuing education that contemplates interdisciplinary visions, teachers generally focus their efforts on the work of their disciplines, promoting little or no interface with other curricular components taught by other teachers in the same educational institution.

In general, the adoption of strategies such as project-based pedagogy is only occasional, with the realization of watertight projects in which the only connection between disciplines is almost always the chosen theme. The tasks are distributed, teachers dedicate some time in their classes to the proposed subject, but there is little interaction among teachers and few correlations between the knowledge of the several areas. In some experiences verified in school units, the culmination of festive events in schools, such as science fairs, promotes the meeting between the different areas that was little noticed during the development of the project.

In this scenario, the figure of the pedagogical coordinator may represent an important ally in the search for the separation of the model of isolated and incommunicable curricular components, acting as a promoter of the dialogue between the teachers of the several areas and, through the moments of in-service training, collaborating so that teachers broaden their horizons beyond the subjects they work on, becoming open to the dialogue with other school subjects. It is important to emphasize, however, that this action also faces obstacles imposed on teachers: little time for planning, multiple work contracts due to low pay and lack of continuing education, among others.

The scenario outlined above is not fortuitous. This current education model is the result of society projects and worldviews that have been consolidated throughout history, especially in the West (TONET, 2013). The challenge that is presented requires the revision of concepts, but, above all, the constitution of dialogue as the main foundation of everyday school life. The objective of this article, therefore, is to discuss the pedagogical coordinator's contribution in promoting interdisciplinarity in the didactic-pedagogical process in the school environment, seeking to understand how this process occurs and evidence that there are elements in the literature that signal a rupture of the disciplinary work and its replacement by an interdisciplinary practice in the teaching and learning relationship.

Origins of fragmentation in education

In a brief historical review, Modernity brought with it the transformation of a period in which the world, man, and phenomena were explained by mystical visions. The Enlightenment points to the need to understand, act, and explain nature and society through scientific rationality. It is influenced, among other philosophers, by the work of Frenchman René Descartes (1596-1650) and the "Discourse of Method".

Cartesian thought advocates doubt as the driving element of science. It is necessary to raise questions for which only scientifically proven, measurable and reproducible answers through method could satisfy them. In a brief definition, Descartes proposes the division of the object of study so that, by understanding the parts, the whole can be explained.

Rationalism influenced all modern science in the West and, as a consequence, fragmentation ended up influencing the educational field as well, in such a way that these characteristics remain present in contemporary education. At school, reality, as we know it, is divided into specific approaches and studied in a watertight manner, delimited within the curricular components themselves.

It is necessary, however, as Yves Lenoir (1998) points out, to differentiate school subjects from scientific disciplines, since the latter "respond to another logic of internal structuring, and have other purposes" (LENOIR, 1998, p. 47, our translation). While the objective of science is research, that of the school is teaching. At any rate, we must reiterate, this fragmented logic ends up influencing the educational field.

The very organization of the curricular matrices indicates the need for limits established by school subjects, in such a way that what is studied is classified as belonging to a specific branch of scientific knowledge, with the establishment of formal boundaries. Within the disciplines, this fragmentation is reproduced and accentuated in the study of the objects of knowledge, also done in a watertight and compartmentalized manner. Obviously, this causes a certain distance between what is worked on in the classroom and the reality experienced by the students in their daily lives, often resulting in a lack of interest caused by the loss of real meaning, given the way the content is presented in school.

For Severino (1998, p. 37, our translation), this fragmentation is expressed in several ways:

Without a doubt, the first thing that strikes one, such is its visibility, is that the contents of the various curricular components, as well as the didactic activities, are not integrated. The various activities and contributions of the disciplines and the work of the teachers happen only to accumulate by juxtaposition: they do not add up by integration, by convergence. It is as if culture were something purely multiple, without any internal unity. For their part, students experience learning as if the cultural elements that give content to their knowledge were watertight and coming from sources isolated from each other.

The proposal of an interdisciplinary education aims, in general terms, to provide teachers and students with the dialogue between these "parts", promoting a more comprehensive understanding of the object of study and its complexity, reconstituting and

exploring it in the existing interfaces between the different curricular components when placed in context. As Morin states (2001, p. 566, our translation),

If we want a segmented knowledge, closed to a single object, with the sole purpose of manipulating it, we can then eliminate the concern to gather, contextualize, globalize. But if we want pertinent knowledge, we need to gather, contextualize, globalize our information and our knowledge, and therefore, seek complex thinking.

This challenge proposes changes on several fronts. These range from the initial teacher training process, in-service training, organization of school work, to the incorporation of this perspective in the pedagogical project of the educational institutions. The task is not easy, because it involves changes in the conception of the educational act.

The educational act demands knowledge of the subject matter (content), instrumentality and the way to make this content accessible to the student (methodology), and most importantly: to know the importance of this content for the student's education in the short, medium, and long term (training). These three elements in the educational act greatly enrich the teaching-learning relationship. Teaching becomes more coherent and learning more effective.

The process of effective learning occurs more quickly when the contents worked on have a certain degree of significance. The greater the degree of significance that an object of knowledge has for the student, the less time it takes for assimilation, appropriation of information, and learning to occur. This significance can refer to aspects of daily life, to issues present in everyday life, or to phenomena that occur in the social context in which students are inserted.

For David Ausubel (2003), there are three essential steps that enable meaningful learning: (I) the teacher exposes in a clear, logical and well-structured way the content to be assimilated and appropriated by the student; (II) the student already has in his cognitive structure some information, some notion of this content that makes it possible to establish some connection with it; and, explicit attitude in wanting to associate what is already known with what is being presented by the teacher.

This transition from the conceptual knowledge explained by the teacher in the classroom to the psychological knowledge that are the synapses arising from the association of what is already known with the content explained by the teacher, gradually overcoming the mechanical learning, memorized and meaningless to the student. In interdisciplinarity,

meaningful learning has the opportunity to be faster and more dynamic in and for the process of assimilation of curricular content.

The teacher training process in Brazil

Teacher education was characterized by slow progress and vagueness, which also marked the expansion of public education. It was only at the end of the third decade of the 20th century that education at the bachelor's level started to become a reality, even then as an addendum to the bachelor's degree in the few universities that existed. After the military coup of 1964, this process gains speed to meet the developmentalist project that starts to be implemented. According to Gatti (2019, p. 20, our translation), "The education that was proposed was aimed at operational objectives and goals, located in demands of the political project of the social and economic moment, with supports directed to specific initiatives."

The technicist character of education demanded the formation of educators focused on professionalizing education. A few decades later, the expansion of undergraduate courses gained momentum and spread throughout the country. The fragmented aspect, however, remains and the idea of training specialist teachers at a higher level is consolidated in the Education Directives and Base Law - LDB nº 9.394/1996 (BRAZIL, 1996). This framework reflects a trend in the Western world, whose education is influenced by scientific rationalism.

As far as the formation of pedagogical coordinators is concerned, it did not have a specific character. From the old normal schools, through the bachelor's degree phase, up to the current moment, pedagogues, who are the majority occupants of these positions, were trained to be, as Libâneo (2004, p.46) defines them, "teacher specialists". The set of their tasks and attributions translates them as managers of the teaching and learning process.

The discussions around interdisciplinarity in the teacher education process are historically recent and still cannot be reflected on a large scale in the teaching currently present in schools. As a result, teachers usually give a specialized and delimited focus to the work with school contents. Quoting Vars (1993), Julie Thompson Klein (1998, p. 110, emphasis added, our translation) states that:

Understanding any concept begins with historical perspective. "Interdisciplinary" is a 20th century word. The intellectual origin of the underlying concept of interdisciplinarity, however, is much older. In the West, the fundamental ideas of unified science, synthesis and integration of knowledge were developed by ancient philosophy. Over time, the general process of specialization in society has resulted in an increasing number of distinct disciplines and professions. However, the ideas of unity, integration,

and synthesis persisted as philosophical, social, educational, and personal values. The origins of modern interdisciplinary education are found in the concepts of "interdisciplinary" and "integrated" curricula; "holistic", "integrated" and "interdisciplinary" approaches to knowledge; models of "unified studies", "combined subjects", "common learning", "related studies" and "common curriculum".

Interdisciplinary work should not dispense with the dialogue between teachers of different curricular components and, as we will see below, can rely on a promoting agent of this interaction, acting as a link between teachers. However, without losing sight of what Lenoir (1998, p. 46, our translation) points out when he reminds us that "The interdisciplinary perspective is not, therefore, contrary to the disciplinary perspective; on the contrary, it cannot exist without it and, even more, it feeds on it".

The role of the pedagogical coordinators

As seen so far, the educational environment reproduces the fragmentation of knowledge typical of modern science. The work is organized pedagogically from a curriculum matrix composed of different components, which vary according to the stages of education. In the final years of Elementary School, this division does not exactly happen with the arrangement of different subjects in pre-defined schedules, but, even though there is usually only one person responsible for the class, teachers end up establishing specific moments to work with objects of knowledge from the different areas. In this way, they end up replicating with less formality the division that can be seen more explicitly in the final years of Elementary School, in High School and in Higher Education.

From the legal point of view, this position originated in the former Educational Supervision, created in the context of the Brazilian military dictatorship, through Law 5.692/1971 (BRAZIL, 1971). The evolution of the Pedagogy courses has promoted a series of transformations until we have the current understanding of the pedagogical coordinators' role. These professionals have become important players in the school environment, being responsible for several attributions, such as offering support to the teachers' work and advising the management on issues related to the teaching and learning processes, in addition to articulating the work among teachers and promoting the constant evaluation of the school results.

According to Celso Vasconcellos (2019, p. 129, our translation), pedagogical coordination:

is the articulator of the Political-Pedagogical Project in the Pedagogical field, organizing the reflection, the participation and the means to achieve it, in such a way that the school can fulfill its task of providing all students with effective learning, full human development and critical joy (*docta gaudium*), starting from the assumption that everyone has the right and is capable of learning. The core of the definition and articulation and of the pedagogical supervision/coordination should be, therefore, the pedagogical (which is the core of the school, as an institutional specificity) and, especially, the teaching-learning processes.

For not being exclusively involved in the teaching of a subject, the pedagogical coordinator occupies a privileged place to reflect on the nuances of all the fragmentation and/or engagement present in the school environment. In addition to the bureaucratic tasks that usually take up much of the time of these professionals, the analysis of the whole that constitutes the teaching and learning process should be part of their daily work.

The pedagogical coordinator is called to master concepts ranging from the organization of the teaching unit itself, its pedagogical project, the characteristics of the community, the programs of the higher instances, the diagnostic evaluation of the students' performance and the characteristics of the teaching staff, the dialogue between managers, teachers, students and students' families. All this scope demands constant dialog with all the active subjects in the school community, in order to guarantee effectiveness in the execution of what was planned.

For Lomanico (2005), the pedagogical coordinator is a person in the teaching staff, part of a hierarchical chain to exercise advisory functions to the school principal to whom he/she is subordinated. To exercise his or her attributions, the pedagogical coordinator has authority by delegation and by competence.

According to Franco (2008, p. 128, our translation),

This task of coordinating pedagogy is not an easy one. It is very complex because it involves clarity of political, pedagogical, personal, and administrative positions. Like every pedagogical action, this is a political, ethical, and committed action, which can only bear fruit in an environment that is collectively engaged with the pedagogical assumptions taken.

To perform their role well, the pedagogical coordinator, besides putting into practice the competencies and skills acquired during their training, must exercise leadership and be a teacher trainer in all pedagogical actions. But the success of his pedagogical work is linked to his leadership, to the way he leads the teaching staff under his responsibility. His communication link with parents and his interaction with the school management.

In this context, the educational networks increasingly see the pedagogical coordinator based on his role as a trainer. The daily routine of school institutions is usually organized with moments for meetings and complementary activities to analyze the progress of programs, design new projects and reflect on the results achieved. The coordinators are usually responsible for organizing and leading these meetings.

I missed making a hook from the previous paragraph to the next - there is an abrupt break in the subject: meetings and continuing education.

In-service continuing education starts from a position of "'unfinishing', linked to the life history of the subjects in a permanent process of formation, which provides professional training" (VEIGA, 2012, p. 15, our translation). They represent an opportunity for reflection on teaching practice, allowing teachers to review concepts, deepen their knowledge of their own discipline and, when this is provoked, open up to the understanding of the foundations and characteristics of other fields of knowledge. Thus,

The pedagogical coordinator can be an agent of change in teachers' practices through the external articulations he makes among them, in a movement of interactions permeated by values, convictions, attitudes; and through his internal articulations that his action unleashes in teachers by mobilizing their political, human-interaction, and technical dimensions, revealed in his practice (ORSOLON, 2001, p. 20, our translation).

The pedagogical coordinator, by the nature of his work, is responsible for proposing these exercises. At school, he or she is usually responsible for organizing these moments, planning and leading meetings, stimulating the creation of projects, presenting challenging scenarios, and mobilizing the team to overcome difficulties that are evidenced in the educational results or in the perception of factors that arise in the school environment itself, such as the motivation of the team itself and of the students. As Imbernón (2010) points out, the challenge requires diagnosing what is going well, defining practices and concepts that need to be abandoned and, based on what already exists, building new paradigms.

Interdisciplinarity requires practical action, initiative, search, and improvement in effective pedagogical practice. It needs to be stimulated, given that the reality of the educational institutions is often marked by little flexibility in the curriculum, immense difficulties imposed on the teaching staff, such as work overload, and inadequate structural conditions. In this sense, the pedagogical coordinator can and should be an agent that encourages changes in the search for overcoming the paradigms so deeply rooted in the educational process. It is necessary, however, to remember that this perspective does not

annul the importance of specific curricular components and the vision of the specialists in each subject:

[...]Therefore, we understand the following: each discipline needs to be analyzed not only in the place it occupies or would occupy in the grid, but also in the knowledge it contemplates, in the concepts enunciated and in the movement that this knowledge engenders, proper to its locus of scientificity. This scientificity, originating from the disciplines, gains interdisciplinary status when it forces the teacher to review his practices and rediscover his talents, when his own movement is incorporated into the movement of the discipline. (FAZENDA, 2008, p. 18, our translation).

This approach is necessary because the initial resistance to any change in perspective is not only peculiar to teachers, but is characterized as a human phenomenon. To change, to open up to new horizons in pedagogical work requires convincing, debate, revision of postures, and permanent reflection on and with the practice. For this reason, the performance of the coordination must be properly planned, starting from the contextualization for the teaching staff of the reasons for an interdisciplinary approach.

Without this, the initiative for the development of joint projects may even be superficially accepted, but it is unlikely to carry out what interdisciplinarity proposes as a concept. As Perrenoud (2002, p. 30, our translation) reminds us and helps us to think that

reflective practice can be understood, in the most common sense of the word, as reflection about the situation, the objectives, the means, the place, the operations involved, the provisional results, the foreseeable evolution of the action system.

The mere organization of a work with the participation of two or more curricular components does not necessarily represent that interdisciplinarity is being promoted. If this were so, as Ivani Fazenda (2008) reminds us, it would be enough just to think about the formatting of the curriculum matrix. "However, if we define interdisciplinarity as a daring and searching attitude towards knowledge, it is worth thinking about aspects that involve the culture of the place where teachers are trained" (FAZENDA, 2008, p. 17, our translation).

The teacher needs to reflect on the epistemology of the curricular component he/she works on, understanding that it brings with it history, premises, objectives, philosophical positions that guide it. Thus, the understanding of its foundations promotes a series of connections with other curricular components, conceptual links that are configured in paths that interdisciplinarity can take and that demand dialogic action between different fields of knowledge. Such reflection can be stimulated by the presence of a pedagogical coordination

that understands its formative role, its possibilities of action and the multiplicity of opportunities that arise from the promotion of the intended dialogue.

The Pedagogical Project as an ally of/in/for Interdisciplinarity

Interdisciplinarity should not be seen as an event, a punctual happening, something fortuitous, spontaneous or voluntary. This approach needs to be part of the Pedagogical Project as a result of a collective and political decision, which stems from the conviction that the search for overcoming the paradigms of a fragmented education is a goal of the educational institution. This being so, it will be more easily incorporated into pedagogical practice.

The Pedagogical Project, as it is known, should not be the product of the elaboration of just one of the subjects of the institution or a mere document required by higher bodies, but the result of participative, collective planning, which will not only guide the objectives and practices of the school in principle, but will be improved during its own effectiveness. For this reason, the moment of its construction is favorable for the pedagogical coordinator to promote reflection, by all the players involved, about the current models of education and what the teaching unit intends to be. This step is fundamental for the acceptance, understanding, and commitment to the interdisciplinary perspective.

When defining the Pedagogical Project, for which still included in the nomenclature the expression "political", Vasconcellos (2019, p. 25, our translation) states:

It is an important path for the construction of the institution's identity. It is a theoretical and methodological instrument for the transformation of reality. As a process, it implies the expression of the options of the institution, the knowledge and judgment of reality, as well as the proposals for action to achieve what is proposed from what is being done; and goes beyond: it supposes the putting into practice of what was projected, accompanied by the analysis of the results.

Since they began to incorporate educational institutions, coordinators are almost always responsible for leading the construction or even the revision of pedagogical projects. It is not uncommon, however, for some to make the mistake of elaborating this document alone, since collective construction requires effort, time, and a lot of dialog. However, this choice will end up causing even more problems and work in the future, since it is unlikely that an institution that does not collectively define the paths it wants to follow will achieve satisfactory results. Besides this, the adoption of the interdisciplinary approach will be even

more difficult, since it will seem to be the result of the pedagogical coordinator's own individual initiative.

Analysis results: The pedagogical project in action

The advancement of teaching practice encouraged by the critical and post-critical curriculum requires a classroom attitude that is consistent with the current social scenario in which the school is inserted. Therefore, contents, methodologies, and evaluation processes that contemplate a quick association with the context lived and/or observed by the students lead to a much faster assimilation and learning process.

This association between what is transmitted in the classroom with what is lived/observed by students in their daily lives produces what we commonly call contextualized teaching, contextualized education. But this only happens in an interdisciplinary way. It is much more meaningful for the student to understand how a certain phenomenon occurs and to understand its impacts and its relations with other phenomena.

It is at this moment that the pedagogical coordinator makes all the difference when he or she leads the pedagogical project, stimulates collective work, and positively interferes in the conduction of the curriculum, because there is no interdisciplinarity where there is no dialog between the disciplines and where there is no coordinated action.

Let's take an example of a study traditionally seen in chemistry classes when studying the periodic table. Here the teacher has two choices when designing his or her teaching plan: Prioritize the memorization of the table, the exact location of the families and their respective atomic number (number of electrons). But the periodic table can be studied, learned and understood when it is seen in a project directed towards a study that uses the knowledge of the elements that make up the periodic table associated with other knowledge (mathematics, history, geography, science, among others), and the positive and negative impacts of the association or misuse of these elements for health, for the environment. In this perspective of teaching work, it demands collaborative and coordinated work, since it involves teachers from several curricular components. This is the routine of most interdisciplinary work in contextualized teaching or contextualized education.

In a teaching project that studies the importance and use of chalcogenics in modern society, it involves knowledge of chemistry, environment, health, economy, history, and geography, among others.

In this project, the chemistry teachers can discuss the following topics Origin and composition of the periodic table, atomic number, composition of the families and characteristics and location of the halogenes: oxygen (O), sulfur (S), selenium (Se), tellurium (Te) and polonium (Po) which are elements produced by nature and Livermonium (Lv) which is a synthetic product.

Figure 1 – Periodic Table

Tabela periódica

1 H hidrogênio 1,008
2 He hélio 4,003

3 Li lítio 6,941
4 Be berílio 9,012

5 B boro 10,811
6 C carbono 12,011
7 N nitrogênio 14,007
8 O oxigênio 15,999
9 F flúor 18,998
10 Ne néon 20,180

11 Na sódio 22,990
12 Mg magnésio 24,305
13 Al alumínio 26,982
14 Si silício 28,086
15 P fósforo 30,974
16 S enxofre 32,06
17 Cl cloro 35,45
18 Ar argônio 39,948

19 K potássio 39,098
20 Ca cálcio 40,078
21 Sc escândio 44,956
22 Ti titânio 47,887
23 V vanádio 50,942
24 Cr cromo 51,996
25 Mn manganês 54,938
26 Fe ferro 55,845
27 Co cobalto 58,933
28 Ni níquel 58,693
29 Cu cobre 63,546
30 Zn zinco 65,38
31 Ga gálio 69,723
32 Ge germânio 72,631
33 As arsênio 74,922
34 Se selênio 78,971
35 Br bromo 79,904
36 Kr criptônio 83,796

37 Rb rubídio 85,468
38 Sr estrôncio 87,62
39 Y itríbio 88,906
40 Zr zircônio 91,224
41 Nb nióbio 92,906
42 Mo molibdênio 95,94
43 Tc tecnécio 98
44 Ru ródio 101,07
45 Rh ródio 102,91
46 Pd paládio 106,42
47 Ag prata 107,87
48 Cd cádmio 112,41
49 In índio 114,82
50 Sn estanho 118,71
51 Sb antimônio 121,76
52 Te telúrio 127,6
53 I iodo 126,91
54 Xe xenônio 131,29

55 Cs césio 132,91
56 Ba bário 137,33
57 a 71 Lantanídeos
72 Hf háfnio 178,49
73 Ta tántalo 180,95
74 W tungstênio 183,84
75 Re rênio 186,21
76 Os ósmio 190,23
77 Ir irídio 192,22
78 Pt platina 195,08
79 Au ouro 196,97
80 Hg mercúrio 200,59
81 Tl tálio 204,38
82 Pb chumbo 207,2
83 Bi bismuto 208,98
84 Po polônio [209]
85 At astato [210]
86 Rn radônio [222]

87 Fr frâncio [223]
88 Ra rádio [226]
89 a 103 Actinídeos
104 Rf rutherfordio [261]
105 Db dubnio [262]
106 Sg seabúrgio [266]
107 Bh bóhrio [264]
108 Hs hássio [265]
109 Mt meitnério [268]
110 Ds dársio [271]
111 Rg roentgênio [272]
112 Cn copernício [285]
113 Nh nihônio [284]
114 Fl fleróvio [289]
115 Mc moscóvio [288]
116 Lv livermório [293]
117 Ts tenesão [294]
118 Og oganessônio [294]

89 La lantânio 138,91
90 Ce cério 140,12
91 Pr praseodímio 140,91
92 Nd neodímio 144,24
93 Pm prométeo [145]
94 Sm samário 150,36
95 Eu európio 151,96
96 Gd gadolímio 157,25
97 Tb térbio 158,93
98 Dy disprósio 162,5
99 Ho hólio 164,93
100 Er érbio 167,26
101 Tm támio 168,93
102 Yb ítrio 173,05
103 Lu lutécio 174,97

90 Ac actínio [227]
91 Th tório 232,04
92 Pa protactínio 231,04
93 U urânio 238,03
94 Np neptúlio [237]
95 Pu plutônio [244]
96 Am amerício [243]
97 Cm curió [247]
98 Bk berquílio [247]
99 Cf califórnio [251]
100 Es einsteínio [252]
101 Fm fermió [257]
102 Md meaditérvio [258]
103 No nobélio [259]
104 Lr lawrêncio [260]

Source: www.tabelaperiódica.org⁴

Science and Environment teachers can relate the use of these elements in substances that can be used to benefit health and quality of life and others in polluting substances that are bad for health such as radioactive waste, for example.

Economics teachers can relate the use of these elements as the fertilizer and pesticide industry in the fight against fungi and insects. These industries employ people, pay salaries, feed the Gross Domestic Product (GDP), and are part of the production of fruit and vegetable chains and of international trade. It is present in the construction of artificial satellites, plastics, synthetic fibers.

History teachers can narrate the use of some of these elements in substances that make up gunpowder (sulfur) and in radioactive equipment (polonium). How the use of these substances, for example, in wars changed the scenarios of places such as Nagasaki and Hiroshima, in China. Wouldn't it be in Japan?

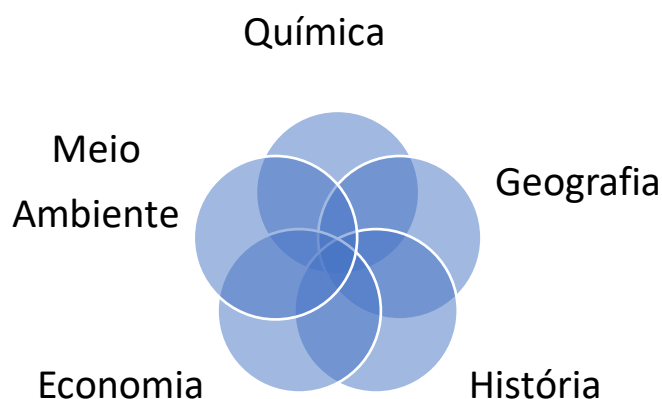
In Geography, teachers can deal with the benefits caused in the territories by the use of these products in agrotoxics in the production chains of large farms and point out the damage

⁴ Creative Commons By-NC-SA 4.0 license for use - Use for educational purposes only IUPAC/SBQ version (en-br) with 5 significant figures, based on DOI:10.1515/pac-2015-0305 - updated March 19, 2019.

caused to riverbeds, soil contamination, among other possibilities of approaching the theme, given the various possibilities of use and application of the chalcogenides.

This kind of project is made easier when the pedagogical coordination is able to articulate the teachers of the most varied areas of knowledge, making an intersection of the curricular contents contained in the components. It is a model that produces several effects in the organization of the pedagogical work in the school environment: in the teaching staff we consider as more important the collective work and in the students the several possibilities of observing a phenomenon helping in the formation of a critical and reflexive person. It is a strategy that is also possible without even the existence of the coordination figure, but that would demand another kind of collective organization of the teachers.

Figure 2 – Usage of Calvogens⁵



Source: Prepared by the authors

When the pedagogy of projects becomes a reality in the school scenario, mechanical learning, stimulated by the expedient of memorizing content to fool the teacher through good concepts in evaluations, ceases to exist, because the exercise of interdisciplinarity involves both the teachers of the curricular components and the students. The process is dynamic and everyone wins at the end of each project, after all, the whole process leads to new knowledge, experiences from the exchanges, the sharing and the sense of cooperation among educators.

⁵ Química = Chemistry; Geografia = Geography; História = History; Economia = Economy; Meio Ambiente = The Environment

Final remarks

Interdisciplinarity represents an initiative to overcome the paradigms present in contemporary educational systems, resulting from the strong influence of scientific rationalism originated in Modernity, as pointed out by the proposals to understand reality from a compartmentalized, fragmented perspective, in order to reach truly acceptable knowledge as a production of science. To rebuild the forgotten bridges, promoting the constant dialog between the different disciplines, is a proposal that not only gives the student an opportunity to look at the whole, but also tries to offer meaning to what is studied.

For this challenge to be successfully met, the participation of teachers from different areas is fundamental. However, the environment in educational institutions is still strongly characterized by fragmentation and separation among curricular components, with an absence or rare experiences of joint construction, as a result of an organization that is also fragmented in the curriculum of the educational systems, unfavorable working conditions for teachers, and little investment in continuing education.

It is in this context that the figure of the pedagogical coordinator emerges as an important ally of the interdisciplinary perspective. He is, by the nature of his work, a strategic actor in promoting dialogue among teachers, proposing permanent reflections through in-service training, being the articulator of projects and other interdisciplinary initiatives.

This work, as we have seen, begins with the participatory preparation of the Pedagogical Project. Once again, at this moment, the coordinator plays an important role so that interdisciplinarity becomes a collective search, incorporated into the objectives of the institution itself and assumed by the teachers as a teaching proposal capable of offering more effectiveness to the teaching and learning process.

The effectiveness of interdisciplinarity as a school practice demands conceptual and attitudinal changes that will not be possible, on a considerable scale, without being stimulated, promoted and incorporated into the institutional environment. As can be seen, the role of pedagogical coordination is of outstanding importance in this process because it presupposes the need to promote constant articulation and stimulus to dialogue among the deans.

The apparently insurmountable distances that we talked about at the beginning of this article may be shortened and even disappear through the collective effort of the teachers, with the coordinator as a fundamental element to this end. Such a challenge cannot be postponed if the educational institution intends to be meaningful for the student, stimulating for the teacher, and relevant for the contemporary social context.

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