

# The Reflexes of Teaching Practice in Chemistry Teaching: Searching for Interdisciplinary Dialogues

Mayki Jardim Sivico <sup>a,b</sup>  
Rodrigo Da Vitória Gomes <sup>a,b</sup>  
Ana Néry Furlan Mendes <sup>b</sup>

<sup>a</sup> Universidade Federal do Paraná – UFPR, Programa de Pós-Graduação em Educação em Ciências e em Matemática, Curitiba, PR, Brasil

<sup>b</sup> Universidade Federal do Espírito Santo – UFES, Programa de Pós-Graduação em Ensino na Educação Básica, São Mateus, ES, Brasil

*Received for publication 12 Nov. 2022. Accepted after review 22 Aug. 2023*

*Designated editor: Renato P. dos Santos*

## ABSTRACT

**Background:** Interdisciplinarity arises in the search to rescue and direct learning between students and educators. **Objective:** The objective of this paper is to understand the discussions and reflections conveyed from Theses and Dissertations aimed at the articulations between the Teaching of Chemistry from the interdisciplinary practice in Basic Education. **Design:** Through this, we seek to build the state of the art available on the CAPES portal in the period from 2011 to 2021. **Participants:** The research classified as qualitative, portrays the analysis of 44 works that were obtained in the review carried out. **Data collection and analysis:** The analysis of the results emerged from three categories in the light of the analysis method proposed by Bardin (2011), namely: i) Construction of scientific knowledge; ii) integration process; and, iii) interfaces between learners and educators. **Results:** Based on the results, it was possible to analyze throughout the discussions that interdisciplinarity has led to reflections that intertwine theory and practice in Chemistry Teaching, through more critical attitudes in school spaces. **Conclusions:** This corroborates that the researches present a concern to lead the students to be true protagonists of their learning.

**Keywords:** Interdisciplinarity; Chemistry teaching; State of art.

---

Corresponding author: Mayki Jardim Sivico. Email: [mayki.0809@gmail.com](mailto:mayki.0809@gmail.com)

## Os reflexos da prática docente no Ensino de Química: Buscando por diálogos interdisciplinares

### RESUMO

**Contexto:** A interdisciplinaridade surge na busca de resgatar e direcionar a uma aprendizagem entre educandos e educadores. **Objetivo:** O objetivo deste artigo é compreender as discussões e reflexões veiculadas a partir de Teses e Dissertações direcionadas para as articulações entre o Ensino de Química a partir da prática interdisciplinar na Educação Básica. **Design:** Por meio disso, buscamos construir o estado da arte dispostos no portal da CAPES no período de 2011 a 2021. **Participantes:** A pesquisa classificada como qualitativa, retrata a análise de 44 trabalhos que foram obtidos na revisão realizada. **Coleta e análise de dados:** As análises dos resultados emergiram três categorias a luz do método de análise proposto por Bardin (2011), sendo elas: i) Construção do conhecimento científico; ii) processo de integração; e, iii) interfaces entre educandos e educadores. **Resultados:** A partir dos resultados foi possível analisar ao longo das discussões que a interdisciplinaridade tem conduzido a reflexões que entrelaçam a teoria e a prática no Ensino de Química, por meio de atitudes mais críticas nos espaços escolares. **Conclusões:** Corroborando assim, que as pesquisas apresentam uma preocupação em conduzir os educandos a serem verdadeiros protagonistas de suas aprendizagens.

**Palavras-chave:** Interdisciplinaridade; Ensino de Química; Estado da arte.

### INTRODUCTION

Experiencing everyday school life shapes us as subjects, and through this contact, it provides an opportunity to reflect more on what it means to be a teacher (Sivico et al., 2021; Bondía, 2002; Tardif, 2002). In this way, through reflection on teaching practice, classroom learning is built, which allows not only conceptual learning, but also a broad set of capabilities that in actions involve skills, attitudes and values that result in the construction of knowledge that goes beyond the classroom.

In this context, in the paths of acting as a teacher in basic education, the role of the educator is one of the key points in the mediation of knowledge (Vigotsky, 2000), in addition to leading students to a more reflective thinking, from the moment they it should broaden the look at the school environment and teach from the reality of this student in a way that does not lead to an exclusively analytical view (Gil-Pérez et al., 2001; Gomes, Mendes & Aires, 2021). In line with these reflections, the National Curricular Common Base (BNCC) discusses the need for an organization of curricular components that strengthens the pedagogical skills of teams, in order to adopt dynamic,

interactive strategies that collaborate with interdisciplinary teaching (Brasil, 2018).

In view of this, it is necessary to reflect on the pedagogical project that allows each teacher to know the reasons for choosing a certain set of practices and which skills are sought to be developed with them. For Santos and Schnetzler (2010, p. 129), “the importance of preparing teaching materials is justified by the need for teachers to have several alternative sources to compose their course [...]”. Thus, Gil- Perez et al. (2001) also point out that these activities must be elaborated through the unification and construction of coherent bodies of increasingly ample knowledge, or the treatment of “bridge problems” between different fields of knowledge that can come to be unified as has already been verified so many times and that the History of Science evidences. In any case, the teacher's lack of knowledge in the elaboration of these activities, as well as the devaluation and forgetting of the unification processes as a fundamental characteristic of the evolution of scientific knowledge, constitutes a real obstacle in current scientific education (Gomes & Aires, 2023; Gomes & Mendes, 2021).

Thus, in the midst of this educational movement, interdisciplinarity appears in the search to rescue and direct learning that has the possibility of transforming the way students and educators intertwine with different branches of knowledge. In this way, we propose in this research to reflect on how interdisciplinarity is conducted in the classroom and what reflections are raised by educators focused on the Teaching of Chemistry in these spaces.

Therefore, the objective of this study is to understand the discussions and reflections conveyed from Theses and Dissertations directed to the articulations between the Teaching of Chemistry from the interdisciplinary practice in Basic Education. The purpose of carrying out this type of research reverberates with the notes made by Romanowski and Ens (2006), when they state that the state of the art seeks to bring an inventorying and descriptive methodology of the academic and scientific production on the subject that seeks to investigate, at the light of categories and facets that are characterized as such in each work and in the set of them, under which the phenomenon starts to be analyzed.

## TEACHING CHEMISTRY IN INTERDISCIPLINARY RELATIONS

To conceptualize the term interdisciplinary, Fazenda (1994; 2012) dialogues according to the considerations elucidated by Gurdorf (1976), mentioning that interdisciplinarity is an attitudinal conception and that to understand the concept it is necessary to inhabit it, and to inhabit the concept. It means to permeate this aspect little by little, until attitudes happen naturally.

The implications of conceptualizing “being interdisciplinary” in the teaching and learning process led Fazenda (1994) to conclude that, in this sense, interdisciplinarity is born from people's attitudes towards knowledge. Having said that, it still claims that,

[...] the true interdisciplinary spirit is not always well understood. There is a danger that interdisciplinary practices either become empty practices, products of a fad in which, because there is nothing to discuss [...] or they become mere ideological propositions, preventing the questioning of real problems (Fazenda, 1994, pp. 49-50).

In this sense, it is necessary to impose oneself in order to understand and change the world, but also to restore the lost unity of different knowledge, in which a practice that is dialogic predominates, in the form not only of eliminating the barriers that exist between the disciplines, but to overcome the barriers that exist between people (Fazenda, 2012).

When looking at school practices, a dialogue is often not established between what is presented in the educational documents and the reality of the school environment, which is a strictly important action to insert the contents built with the student in their daily life. About this, Santos & Mortimer (2002) elucidate a curriculum in which science inserts the student in the search to provide a better understanding of the world established in these social instances. However, this action is not understood by many educators because it is not reflected in teacher training.

The National Curricular Common Base guides that curricula should align, complement and ensure the essential learning defined for Basic Education (Brasil, 2018). Therefore, establishing an academic coexistence that allows building collective reflections in the light of theoretical advances assumes an important role in the training of future teachers (Maldaner, 2013). However, interdisciplinarity goes beyond a pedagogical relationship based on the transmission of knowledge of a discipline or subject, which is established

according to a linear hierarchical model, to a dialogical relationship. In this sense, the interdisciplinary process must understand the “subject” and its practical relationships with space (Fazenda, 2012).

Understanding the interdisciplinary approach goes far beyond overcoming a fragmentation of teaching, its partial division of studies, its limited and simplifying character (Japiassu, 1976; Gil-Pérez, et al., 2001; Fazenda, 1994, 2012). In this sense, the role of epistemology dialogues with the need for reflection, regarding a study of purpose on a constituted science, as pointed out by Fleck (1986), it is possible to subsidize an even greater debate about interdisciplinarity in education, considering knowledge historically constructed and the practice of professionals who integrate the area (Aires et al, 2021). Thus, interdisciplinarity can also be taken as the principle of maximum exploration of the potential of each science, of understanding its limits, but above all, as a principle of diversity and creativity (Etges, 1995).

Paraphrasing Salgado et al., (2019), when interconnecting a path of different knowledge between the disciplines linked to the areas of Natural Science, it becomes necessary to build interpersonal relationships between the subjects involved collectively, so that interdisciplinarity it is built through the interfaces established in teaching practices.

By transposing such discussions to Chemistry Teaching (EQ), for example, due to the nature of its object, the discipline allows establishing interfaces with other areas of knowledge, configuring an interdisciplinary approach (Beltran, 2013; Jardim, Gomes & Mendes, 2023b). Santos & Porto (2013) emphasize that the challenge for chemistry educators is how to help students understand chemistry.

By bringing EQ closer to an interdisciplinary approach, Zanon & Maldaner (2011) have other discussions in which they question: “[...] why or what is it important for every citizen to learn/know Chemistry? How is the knowledge learned in chemistry classes mobilized and used outside of school? [...]” (Zanon & Maldaner, 2011, p. 105).

As a result, when analyzing the directions that would be taken in relation to the discipline of Chemistry within this new scenario, Barroso et al. (2020) criticizes, pointing out that one of the main changes regarding the curricular organization of the discipline is the spraying of various contents, due to the poor structuring of contextualization in the classroom.

However, Maldaner (2013, p. 205) “considers that the construction or reconstruction of chemical knowledge among adolescents is also the responsibility of Chemistry teachers”. In this case, by assuming this responsibility for building a contextualized curriculum, it prioritizes a more grounded EQ.

In this sense, the BNCC and the curricula must align, complement and ensure the essential learning defined for Basic Education. For High School, it defines the essential learning to be guaranteed to all students and guides the (re)design of curricula and pedagogical proposals (Brasil, 2018).

Regarding these considerations, Santos & Schentzeler (2010) and Jardim, Gomes & Mendes (2023a) defend the EQ based on the importance of developing in the individual an interest in social issues linked to the applications of Chemistry in society. Another conception that we can highlight is to present to the student a vision of science as a process under construction (Gil-Pérez et al, 2001), this conception also emphasizes the social role of science, which is better understood when considering its character of history (Gomes, 2020; Gomes, Lorenzetti & Aires, 2022).

Therefore, it is necessary to impose oneself in order to understand and reestablish different knowledge, predominating a practice that is dialogic, in the sense of not only eliminating the barriers between the disciplines, but also overcoming the barriers that exist between people (Fazenda, 1998; 2012; Jardim, Gomes & Mendes, 2022). However, conducting an approach in different areas is not a very easy path (Santos & Porto, 2013).

This exchange of experiences should be strengthened since the reality of schools is often overshadowed by curricular documents. And bringing these discussions to initial training is to reveal and really understand the role of the teacher, who in addition to being an educator must broaden the understanding of the very understanding of teaching beyond the school space.

## **METHODOLOGY**

This research assumes a qualitative character, which, as stated by Ludke & André (2014), allows greater contact with the situation to be studied, through a broader construction of the discussions woven throughout the work. Thus, the research is of a bibliographic nature, of the state of the art type, seeking to identify a discussion that permeates Chemistry Teaching (EQ) and interdisciplinary practices in school environments.

Romanowski and Ens (2006) reveal that a bibliographic survey like this one seeks to map and explain the production of knowledge in a given area, highlighting the aspects that are privileged in some times and places. Thus, they are important because they provide a grouping of information that will be located, being an important source of data.

As for Ferreira (2002), the state of the art seeks to identify which theories are being used, to substantiate and support the analyzed research. Thus, this type of research directs the discussion of certain themes in specific areas of knowledge. Therefore, when looking at the data that were obtained from this contact with the analyzed works, it was possible to organize the results and discuss them in the format of categories, as paraphrased by Bardin (2011). Thus, the categories of analysis emerge to further support the research proposal, which seeks to direct the notes and reflections in which the EQ goes through when discussing interdisciplinarity in the teaching-learning process.

To carry out the same, a thematic cut was carried out in Theses and Dissertations that were defended in the period from 2011 to the first half of 2021. The works were obtained through the Bank of Theses and dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES), using the following descriptors: “Interdisciplinarity/Interdisciplinary”; “Chemistry/Chemistry Teaching” may be presented in the titles or abstract.

It is worth mentioning that the research focused on discussing only the teaching methodologies focused on classroom practices, so the focus is to obtain works that dialogue with their experiences in the classroom, precisely to understand in which notes the authors of these publications point out that their practices go through an interdisciplinary process, reporting the experiences and challenges. In this context, the intention to carry out a state of the art of these works, stems from the need to highlight the discussions arranged in the academic works, which contributed to the understanding of what it is to be interdisciplinary when starting with a practical approach to everyday school life, which draw a parallel with the EQ in these spaces.

Thus, through the analysis of the works, which comprise the readings of the research discussions, the results of this article were organized into three categories that were entitled, i) The construction of scientific knowledge; ii) Process of integration in Education; iii) Interfaces between educators and learners. In this way, such categories emerged from the readings carried out in the academic works, being grouped in the field of discussions that are similar to the contemplated categories. Thus, the dialogues that were being built lead

to a necessary look at the paths that lead to interdisciplinary practices in school spaces, unfolding in reflections that elucidate in a discourse that enhances the relationships that permeate the teaching and learning processes directed to EQ.

## **RESULTS AND ANALYSIS**

### **Presentation of Theses and Dissertations on the interdisciplinary field in Chemistry Teaching**

This topic of work seeks to present the interdisciplinary practices in Chemistry Teaching (EQ) in the school environment. Directing to a discussion that permeates the veracity of how these works that were developed describe what is necessary for a practice carried out to be interdisciplinary.

The works were obtained through the research of those described: “Interdisciplinarity/Interdisciplinary”; “Teaching Chemistry/Chemistry”, contained in the titles or abstracts of these academic productions. At the end, 44 works were obtained that are directed to EQ and interdisciplinarity. Thus, of the total quantity of analyzed productions, only 5 of these are from Doctoral research, which represents 11.37%, and a number of 39 works resulting from Master's research, reflected in 88.63% of the analyzed productions.

A reading was carried out in the part of the methodology of Theses and Dissertations, it was observed that many of these works quantified in Table 1, discussed the EQ and interdisciplinarity aimed at initial and continuing education and bibliographic reviews or, in other perspectives. Thus, these works were not analyzed, since they were not directed to practices that were carried out directly in Basic Education, which is the purpose of this article.

**Table 1**

*Results of the bibliographic research in CAPES Theses & Dissertations Catalog in the period 2011 to 2021\**

---

<b>Year</b>	<b>Interdisciplinarity in Chemistry Teaching (classroom methodologies)</b>	<b>Interdisciplinarity in Chemistry Teaching (Bibliographic review, analysis of curricula and official documents, teacher training)</b>	<b>Total works</b>
<b>2011</b>	1	2	3
<b>2012</b>	3	1	4
<b>2013</b>	3	2	5
<b>2014</b>	3	2	5
<b>2015</b>	3	2	5
<b>2016</b>	2	0	2
<b>2017</b>	4	2	6
<b>2018</b>	2	0	2
<b>2019</b>	3	1	4
<b>2020</b>	5	2	7
<b>2021*</b>	2	1	3

---

\* Research carried out in the period of 2021 comprises only the first semester.

After selecting the works, the research extends to focus on the discussions of the authors in the part of the "results and discussions" in the search to understand the looks and reflections carried out by the authors in the search to intertwine the interdisciplinary teaching with the EQ. Thus, this stage dialogues precisely with the process of grouping in common the elements presented in the works through the reading carried out, on which the categorization of the results proposed by Bardin (2011) is based.

Therefore, of the 44 works that were selected, 31 of them were actually analyzed, because, as already highlighted here, they presented the characteristic of discussing practices related to the school space, as illustrated in Table 2 below.

**Table 2**

*Research Results of Dissertations and Theses*

<b>Year of publication</b>	<b>Title</b>	<b>Author</b>
<b>2011</b>	Science Teaching: perspectives in interdisciplinary practice	Simone Corrêa Souza
	Medicinal plants in Youth and Adult Education: An interdisciplinary proposal for Chemistry and Biology	Maria Cristina dos Santos Cavagliar
	Continuing teacher education for Science Teaching: A contextualized and interdisciplinary strategy	Tatiana Santos Mello
<b>2012</b>	Environment used as a resource for the Teaching of Chemistry and Environmental Education in the training of future teachers	Hélio Ernani Capilé
	Teaching Chemical Solutions through the Science-Technology-Society (CTS) approach	Tania Maria Niezer
	Pesticides and the environment: CTS approach in a Freirean perspective for Chemistry Teaching in Culturama, MS	Osmar Luiz Nascimento Gotardi
	Energy source and environment: An interdisciplinary proposal in the teaching of exact sciences	Nara Regina Scheibler Hennemann
<b>2013</b>	Interdisciplinarity in Chemistry Teaching: A proposal for an integrated action involving food	Kelly Carine Cardoso

	studies	
	Interdisciplinary islands of rationality: a proposal to integrate regional popular knowledge with scientific knowledge in chemistry learning	Frank Dieter Kindlein
	Contextualization and interdisciplinarity in Chemistry Teaching: an analysis of ACID-BASE textbooks and pedagogical proposals made by teachers on the subject	Hoizam Hidson Xavier Rocha
	The Amazon rainforest as a multiplier for teaching chemistry. "The use of andiroba oil as a natural repellent: an interdisciplinary methodological proposal at IFRR / Campus Novo Paraíso"	Cintiara Souza Maia
	School interdisciplinarity: A possible path	Odoaldo Ivo Rocheford Neto
<b>2014</b>	Alcoholic fermentation as a teaching strategy for chemical transformation at high school in an interdisciplinary perspective	Flávia Tocci Boeing Duarte
	Educational interdisciplinarity in the contextualization of the concept of chemical transformation in a biological sciences course	Marlie Spargolla Bernardelli
	Contributions of the elaboration of teaching-learning sequences dealing with interdisciplinarity, daily life and History of Science trends in the scope of teacher training at the Federal University of Sergipe	Erivanildo Lopes da Silva
	The interdisciplinarity in the degrees of the constituent areas of	Carla Batriz Sabino Silva

	the natural sciences: a case study at the Federal University of ABC	
	Interdisciplinary approach from the energy theme: contributions to meaningful learning in EJA	Andrade Taschetto Gomes
<b>2015</b>	Physics, Chemistry and History - An interdisciplinary proposal for High School	Juliano de Almeida Elias
	“Wanting, weaving, knowing” project: interdisciplinary and self-management actions and reflections in elementary schools	Patrícia dos Santos Correa
	Insertion of the theme of nanosciences in Chemistry in High School: Interdisciplinary didactic module on the Lotus effect.	Daiane Kist
<b>2016</b>	Forensic Science as an Interdisciplinary Place in High School: A Teaching Experience	Thaina Alvim de Souza
	The insertion of the nanotechnology theme from investigative activities in Chemistry Teaching.	Argeu Cavalcante Fernandes.
<b>2017</b>	The interdisciplinarity between Physical Education and Chemistry: A proposal of pedagogical intervention for High School.	Maikon Moises de Oliveira Maia.
	The interdisciplinary teaching of batteries and radioactivity in the scope of Environmental Education.	Alysson Benite de Freitas
	Development of a study situation on the water theme for high school chemistry classes.	Rívia Arantes Martins
	Geoilhas: The teaching of Geosciences in Basic Education articulated with the	Rafhael Brum Werlang

	interdisciplinary island of rationality.	
	The interdisciplinary teaching of science from a physical-chemical perspective: didactic sequence on plant physiology.	Ana Helena Carlos Brittes.
	Chemistry in Elementary School: investigating environmental issues in an interdisciplinary island of rationality.	Milene Ferreira Mietto.
<b>2018</b>	Experimentation in Chemistry Teaching in Basic Education.	Raquel Pereira Neves Gonçalves.
	Inorganic Pigments as a Theme for Interdisciplinarity and Contextualization in Chemistry Teaching.	Andre Luis Della Volpe
<b>2019</b>	Interdisciplinarity in teacher education: investigating contributions of a process and continuing education of teachers in the area of Natural Sciences based on the theme Nanoscience and Nanotechnology.	Paulo Ricardo da Silva.
	The use of samba as a motivator in Chemistry Teaching: Electrochemistry through an interdisciplinary approach.	Thiago Caldas de Oliveira
	Soybean as an interdisciplinary topic for the learning of chemical concepts.	Junior Alessandro
	Environment and interdisciplinarity in public schools in Rialma.	Cristina Rodrigues de Assunção Borges
<b>2020</b>	Development of a teaching material to discuss the content of polymers in High School: Focusing on interdisciplinarity and	Adriana Marmelo Arruda

	contextualization in Chemistry Teaching	
	Bean crop as a context for experiencing interdisciplinarity in a high school	Aquiles Vieira Cavalcante
	Interdisciplinary approach: the chemical bonds and conformational interactions of hemoglobin with molecular oxygen	Carla thayse Andrade Silva
	An interdisciplinary proposal for the contextualization of physical concepts in the training course of Science teachers in the Distance Education modality (EAD)	Emanuelle São Leao de Lima
	The teaching of organic chemistry through the topic of drugs: A didactic sequence for the third year of high school.	Daiany Rosa de Oliveira Jeronimo
	Study of the properties of methane from the biodigester: a mediating tool developed in Chemistry classes	Jeames Oliveira Gomes
	N&N in a CTSA Approach to Chemistry Teaching in an Augmented Reality	Antonia Roselucia Correa Belmiro
<b>2021</b>	Games like Chemistry Assessment	Geovanio Barreto dos Anjos
	Use of the generator theme "Solos" for an interdisciplinary methodological practice in Chemistry Teaching	Mayki Jardim Sivico
	The history of sciences and interdisciplinarity: Discourses of graduates of degrees offered by the Federal University of ABC.	Soraya Aparecida Cordeiro

---

The Theses and Dissertations presented in Table 2 were obtained from the CAPES work catalog. They argue about methodologies that were developed in the school environment that permeates EQ and interdisciplinarity, prioritizing the student's role in this teaching and learning process, through guided proposals.

When unfolding on the data that were being built along the reflections woven in the Theses and Dissertations analyzed, highlights focused on the spheres that interrelate the educational, scientific and social fields were considered. The works lead to a reflection of a theory constituted in the practice of school life, put by Japiassu (1976), being necessary to raise these perspectives, since the interdisciplinary work makes a direct appeal to reflection, unfolding in knowledge that little by little is being constituted between students and educators.

Therefore, to talk about the learning and knowledge that are built in school spaces, is to transpose a discussion elucidated by Fazenda (2008) when he states that interdisciplinarity reverberates the knowledge that contemplates the enunciated concepts and in the movement that are conducted inside and outside the classrooms. of class.

Thus, the next topic presents the three categories that emerged, through the grouping carried out through this proposed categorization process, for the analysis of the results.

## **Reflection of the categories of analysis**

### **i) Construction of knowledge scientific**

This category arises through reflections that emerge mainly from the notes built in the dialogues described in the results of the theses and dissertations analyzed. Thus, 67.74% of the works directed to discussions about the relationships that culminate in the importance of conducting an interdisciplinary practice as a potential that intensifies the shaping of knowledge aimed at the construction of scientific knowledge in school spaces.

The Common Basic curriculum of Espírito Santo explains that scientific knowledge in Chemistry Teaching must transpose and expand the student's ability to reflect, create and act (Espírito Santo, 2009). This also corroborates the notes elucidated in the skills of the National Common Curricular Base (BNCC), in which the need to better understand society is

discussed, at the moment that this interdependence of scientific and technological development occurs.

In this way, the works guide the need for the construction of scientific knowledge, the research with the title "*The insertion of the nanotechnology theme from investigative activities in the Teaching of Chemistry*" the author emphasizes that the educator must encourage students to investigate and research about the proposed theme, and this leads to inserting it within an interdisciplinary perspective. Thus, it also argues that when covering this field mediated by interdisciplinarity, it also prioritizes a relationship of complementarity between the curricular subjects, and this action gradually shapes and configures scientific knowledge in school spaces.

Fazenda (2008) justifies that each discipline needs to be analyzed not only in the place it occupies or would occupy in the grid, but in the movements that knowledge transits, in its enunciated concepts and in the path that this knowledge travels. Therefore, when configuring the discussions that concern scientific knowledge in the school space, the Dissertations and Theses are mainly concerned with how the student develops in this teaching and learning process, thus discussing the importance of a teaching work that encourages the student to always question.

The work entitled "***Interdisciplinary islands of rationality: a proposal to integrate regional popular knowledge with scientific knowledge in chemistry learning***", presents a reflection in which, by intertwining Chemistry Teaching in an interdisciplinary methodology, it leads to scientific learning through the student's social and personal context.

Abreu & Lopes (2011) lead that the use of interdisciplinarity as a teaching strategy capable of making Chemistry Teaching associated with the formation of values and critical attitudes considered essential for the individual as a citizen.

Therefore, 67.74% of the works bring a conception that to reflect the interdisciplinarity in the school, is also to make possible the stimulus to a scientific knowledge, however they emphasize that the simple fact of unifying the fragments of a scientific knowledge, in turn, many times does not is able to establish this interdisciplinary process. The research carried out summarizes in their results that many practices do not allow the construction of a learning process, being only the reflection of an activity without foundation.

## ii) Integration process

This category arises through reflections that emerge from the inquiries made by Fazenda (1994, 1998), when it transposes the need to better re-signify the understanding of what it is to be interdisciplinary. Thus, the author states that “[...] it is necessary, therefore, in addition to an integration between theory and practice that establishes a constant training in interdisciplinary work, because interdisciplinarity is not taught, nor is it learned, it is only lived, it is exercised. (Fazenda, 1993, p. 56).

Thus, some works elucidate the use of the term “integration” in their research, and outline perspectives that are related to a true understanding of the effectiveness of interdisciplinarity in the classroom, through different perspectives.

In this way, 22.58% of the works discuss aspects that draw a parallel that integration arises to unify the disciplines, but to achieve interdisciplinarity it goes far beyond that.

Fazenda (1993) states that integration would then effectively be the final product and not a step towards interdisciplinarity, whose main focus would be “interaction” and whose final objective would be the establishment of a dialogic attitude with a view to understanding and changing of reality itself.

In this way, part of the works that were analyzed reverberate that interdisciplinary attitudes start from an integration between the parties involved. Tavares (2008) states that in an interdisciplinary team work it is essential that everyone is open to dialogue at any time, so it is necessary, in addition to the disciplines involved, to integrate is related to an evolution of the way of acting in the school space.

The work entitled “*Physics, Chemistry and History - An interdisciplinary proposal for High School*” by Juliano de Almeida Elis, states that a criticism that is made of interdisciplinary proposals when put into practice is that they often fail to integrate the disciplines, restricting itself to the development of sub-themes and questions within a common theme.

Therefore, when paraphrasing with Lenoir (1998) who also outlines a discussion on interdisciplinarity in a didactic field, the author states that the integrative processes and the appropriation of knowledge as cognitive products with students, and this requires an organization of school knowledge

about the curricular, didactic and pedagogical plans. Thus, it draws attention to the views that extend over the curriculum.

Also highlighted is the research “*The interdisciplinarity between Physical Education and Chemistry: A proposal for a pedagogical intervention for High School*”, by Maikon Moises de Oliveira Maia, in which he argues that for the development of an interdisciplinary practice, especially at the time of integration of the disciplines involved, the teacher must be open to navigating other knowledge that often has been studied for a long time. When this does not happen, a barrier is created, on the part of the teacher, between the disciplines involved.

Something in common, reflected in the works that fall into this category, is that the term integration is used as a step that mediates a true interdisciplinarity. Thus intensifying the need for this dialogue that has to exist between the disciplines, and especially with the subjects involved there and this reflects on the contents taught.

When discussing this category, some questions focused on the Teaching of Chemistry, evidenced in the works, consider that in addition to the knowledge mediated in the discipline of Chemistry, it is necessary to rethink the way in which learning should be built amid the activities that are configured in the processes interdisciplinary.

Thus, Abreu & Lopes (2011) corroborate that the EQ disciplinary community defends the integration with other disciplines and with other knowledge. In order to expand the construction of meanings for the understanding of chemical knowledge and its interrelationships, however, there is a concern of an even greater fragmentation focused on EQ, from practices being developed in school environments, but which are actions that do not bring a foundation that helps in the teaching and learning process.

In summary, all the researches that fit into this category, externalize that in order to achieve interdisciplinarity, integration is an important step. But it is not just about integrating the curriculum, it is necessary to expand it through effective participation between teachers, managers, students and the community in which the school is inserted.

### **iii) Interfaces between educators and learners**

When discussing the curricular proposals, the methodologies adopted and the activities developed, and the very construction of research, something

that is fundamental for any environment and which is also directly related to interdisciplinary practices, are the interfaces established between the subjects involved in these paths.

This category emerges from the moment it is observed that 22.58% of the works bring discussions about the need to achieve interdisciplinarity collectively. In this way, teaching work requires the exchange of experiences between teachers from the same area of knowledge and from different areas as well.

Salgado et al. (2019) use the term disciplinary interfaces as a path that seeks to connect the different knowledge that dialogue between the disciplines linked to the areas of Natural Sciences. They bring, through a collective construction, different methodologies that, in the light of the interdisciplinary field, create these bridges that enhance the teaching practice. Therefore, these authors argue that for the elaboration of this process in the search to break a fragmentation in Teaching, it is essential as a group to grow collectively as subjects as well. Therefore, this interpersonal relationship must also prevail in the elaboration of a proposal that transits in interdisciplinarity (Salgado et al., 2019).

And when conducting this discussion for the researches that were analyzed, it reverberates the importance of bringing into the school spaces this dialogic relationship that interdisciplinarity leads. And this happens, as everyone is willing to reinvent themselves within their practices.

In this way, research shows discussions in which they reveal that, in addition to any practice carried out in school spaces, it is necessary to direct attention to the relationships that are constituted in the school environment. Some works discuss these points that were detailed (TABLE 3).

**Table 3**

*Research Results of Dissertations and Theses*

<b>Work titles/author</b>	<b>Established interfaces in the researches</b>
Use of the generator theme "Solos" for an interdisciplinary methodological practice in Chemistry Teaching	Interdisciplinarity has become a path of possibilities in which it seeks to bring different types of knowledge closer to the school environment. And this

---

Mayki Jardim Sivico

movement does not become possible through a real approximation between the subjects involved in the search for a growth that happens collectively, through the interfaces that are built.

Energy source and environment:  
An interdisciplinary proposal in  
the teaching of exact sciences.

Nara Regina Scheibler  
Hennemann

It became evident how interdisciplinarity helps the process of building learning for the totality. We emphasize the importance of the conversations and discussions generated that morning, rich in knowledge, information and experiences, creating interdisciplinarity.

Interdisciplinary approach from  
the energy theme: contributions to  
meaningful learning in EJA.

Andrade Taschetto Gomes

In an interdisciplinary project, there are multiple barriers, including institutional and personal, that can hamper its implementation.

The interdisciplinary teaching of  
batteries and radioactivity in the  
scope of Environmental  
Education.

Alysson Benite de Freitas

The interdisciplinary classes are proposals to overcome what is set in the teaching of Chemistry. The involvement of students with classes and their teachers enabled a reciprocal relationship in teaching and learning.

Bean crop as a context for  
experiencing interdisciplinarity in  
a high school.

Aquiles Vieira Cavalcante

It was possible for the teachers to help in the planning of interventions in the garden and modifying their own lesson plans in order to give, in the classroom, their disciplinary contributions to the project. In this way, it was possible to build the necessary parts for the construction of interdisciplinarity.

---

This relationship between teachers is fundamental in this interdisciplinary practice, since as stated by Salgado et al., (2019) interdisciplinarity is possible between teachers when it is supported by a solid relationship of complicity existing between the parties.

The work entitled “*Use of the generative theme 'Solos' for an interdisciplinary methodological practice in Chemistry Teaching,*” within a

historical-cultural perspective, highlights the importance of looking at the interpersonal relationships that are created in the school environment. Thus, it leads the discussion into a dialectical movement that further directs the need to conduct interdisciplinarity not only for a product to be obtained, but in the search for a growth that must happen between educators and students through the interactions that go being created.

In this way, an overview of the works explains that, when the subjects involved are not open to being interdisciplinary, it is difficult for such work to be actually developed in its entirety. Since there is still a resistance towards interdisciplinary research, often associated with a lack of time for planning, but also due to a lack of desire for change.

And when we approach such reflections to the EQ, In this format, interdisciplinarity must be a construction that does not limit students to expand their specific disciplinary knowledge of Chemistry (Maldaner & Zanon, 2011; Nuora & Valisaari, 2019). Thus, regardless of the number of disciplines involved in a practice in which it will be carried out, the dialogic process is fundamental, as it aligns different types of knowledge that culminate in the same objective.

Abreu & Lopes (2011) justify that interdisciplinarity should be understood as a natural consequence of contextualization. Therefore, whenever a certain content is contextualized, an interrelationship between the different disciplinary fields should be established. However, the biggest problem also resides in the considerations that were previously recorded by Maldaner & Zanon (2011), which consists of perceiving whether in fact the contents developed in this sphere are enabling the construction of chemical thinking that does not disregard the specific knowledge of the discipline of chemical engineering. Chemistry.

This look is extremely important, because among the various practices developed there is the student, and he must be the main protagonist of his learning. Therefore, the disciplines that make up interdisciplinarity cannot be reduced to a dispute for space in the themes addressed, but rather a support in which the perspectives outlined are dialogued, leading students to a rich growth in the teaching and learning process.

Japiassu (1976) states that what is important in interdisciplinary dialogue is what is not only desirable, but also indispensable, is that the autonomy of each discipline is ensured as a fundamental condition of the harmony of its relations with the others. Therefore, the need for a good

relationship between teams of teachers, in which relationships are constituted in these interactions that touch the need for growth that is shaped collectively.

Therefore, this category reveals that interdisciplinary work directly appeals to reflection. And discussing interdisciplinarity in the school space is actually experiencing and reinventing yourself in each process.

Therefore, the research that is built in Basic Education, being potentiated in Dissertations and Theses, deserves to be highlighted, as they bring this reflection of situations that are happening in the educational field. Thus, each author brings their perceptions within their research, and bringing these particularities through the eyes of the other leads to a very subjective look.

Therefore, by redirecting the authors' reflections from different perspectives, but which in the end culminate in similar looks, it signals common categories. And these categories arise to transpose discussions that often potentiate the need for changes, which dialogue between the Curriculum and teaching practice.

## CONCLUSIONS

From the point of view of the realization of this research, which justified the realization of it, stems from an experience lived in Basic Education. Thus, experiencing interdisciplinarity in practice is completely different than weaving only discussions about its theory. Therefore, there is this need to understand the theory itself with practical approaches.

Therefore, by focusing on research arising from Theses and Dissertations, we sought to highlight the reflections of the proposals that come from the school environment. Therefore, immersed in this environment, a trend observed in the works was this articulation of the need to conduct interdisciplinarity linked to Chemistry Teaching, to a possibility of growth associated with scientific knowledge, the contribution of pedagogy to educational work and the understanding of science as an instrument for understanding life as one of the presuppositions to carry out interdisciplinary work.

In this way, when carrying out the state of the art of these works, it is reflected that Chemistry Teaching has walked the need for a reflection on teaching practice, but also to reflect on the role of Chemistry in the midst of this movement that are schools. Since, interdisciplinarity is not done alone,

but from the will for collective growth. Therefore, the collective use of knowledge cannot be intended only for the individual use of each area, but rather to feed the human capacity to interact socially, actively constituting a humanizing and integrating instrument.

Finally, it is observed in a unilateral way that by transposing dialogues between different areas of knowledge, and by the discussions carried out by the authors of the works, teaching Chemistry in these spaces, reflects a vast field of possibilities that leads the student to a reflection of their learning. . We believe that teachers can be inspired by works that have more adequate definitions of interdisciplinary actions, considering that collective work is much more promising than solitary work in terms of interdisciplinary actions in schools.

## REFERENCES

- Abreu, RG de & Lopes, AC. (2011). Interdisciplinarity and Chemistry Teaching: A reading from curriculum policies. In: Santos, WLP & Maldaner, OA (org.) *Chemistry Teaching in Focus*. Unijuí.
- Aires, JA, Barbosa, FT, Gomes, RV, Silva, ECC, Silva, EP & Souza, ILN. (2022). Reflexões sobre história, filosofia e sociologia da ciência no ensino de ciências. In: Zimer, TTB, Camargo, S, Godoy, EV. (Org.). *O Lócus Investigativo da Prática Pedagógica em uma Sociedade Informatizada: o lugar da pesquisa e a condição do ser docente*. (p. 1-156) 1ed. Editora CRV.
- Bardín, L. (1976). *Content analysis*. Martins Fontes.
- Barroso, MCS et. al. (2020). National Curricular Common Base and the transformations in the area of Natural Sciences and Technologies. *Research, Society and Development*, 9(2), 1-13..
- Brasil, Ministry of Education (2018). *Common National Curriculum Base. Ministry of Education and Culture*. <http://portal.mec.gov.br/docman/abril-2018-pdf/85121-bncc-ensino-medio/file> .
- Espírito Santo. (2009). *High School: area of natural sciences/Department of Education. Basic Curriculum State School ; v.02, SEDU*, [https://sedu.es.gov.br/Media/sedu/pdf%20e%20Arquivos/Curr%C3%ADculo/SEDU\\_Curriculo\\_Basico\\_Escola\\_Estadual\\_\(FINAL\).pdf](https://sedu.es.gov.br/Media/sedu/pdf%20e%20Arquivos/Curr%C3%ADculo/SEDU_Curriculo_Basico_Escola_Estadual_(FINAL).pdf) .

- Etges, NJ (1995). Science, interdisciplinarity and education. In: Jantsch A.P , Bianchetti , L. (Org.). *Interdisciplinarity: beyond the philosophy of the subject*. (p. 51-84). Vozes.
- Farm, I, CA (2012). Interdisciplinarity-transdisciplinarity: cultural and epistemological views and production conditions. *Interdisciplinarity*, 10(2), 34-42.
- Farm, ICA (2008). Interdisciplinarity – Transdisciplinarity: cultural and epistemological views. In: Fazenda, IC A (orgs). *What is interdisciplinarity?* Cortez.
- Farm, ICA (1998). The acquisition of an interdisciplinary training of teachers. In: Fazenda, ICA (Org). *Didactics and interdisciplinarity*. Papirus.
- Farm, ICA (1994). *Interdisciplinarity: history, theory and research*. Papirus.
- Ferreira, NSA (2002). The research called “State of the Art”. *Education & Society*, 79, 257-272.
- Fleck, L. (1986). *The genesis and the development of a scientific hecho*. Alianza.
- Japiassu, H. (1976). *Interdisciplinarity and the pathology of knowledge*. Imago.
- Jardim MS, Gomes, RV, & Mendes, ANF. (2023a). A construção dialética do conhecimento científico interdisciplinar da temática “solos” no Ensino de Química e Geografia. *Educação Química em ponto de vista*.
- Jardim MS, Gomes, RV & Mendes, ANF. (2023b). Ampliando discussões sobre a Interdisciplinaridade na História da Ciência a partir de Reflexões Tecidas na Formação de Futuros Professores de Química. *Revista Sustinere*, 11(1), 191-214.
- Jardim MS, Gomes, RV, & Mendes, ANF. (2022). The History of Science in an interdisciplinary approach in the curriculum: broadening horizons for building and mediating learning from the nature of scientific knowledge. *Revista De Ensino de Ciências e Matemática*, 13(6), 1–22. <https://doi.org/10.26843/rencima.v13n6a21>
- Gil-Perez, D., Montoro, IF, Alis, JC, Cachapuz, A., & Praia, J. (2001). For an undistorted image of scientific work. *Science & Education*, Bauru,7(2), p.125-153.

- Gomes, RV (2020). The History of Science in Chemistry Teaching: A Study on the Periodic Table developed with future Teachers. 159f. *Dissertation* (Master's in Teaching in Basic Education). Federal University of Espírito Santo, University Center of the North of the State of Espírito Santo, São Mateus.
- Gomes, RV & Aires, JA. (2023). Mitos na Organização dos Elementos Químicos: uma análise das Controvérsias Científicas na História da Tabela Periódica à luz do referencial Fleckiano. *Khronos*, (15), 1-29. <https://doi.org/10.11606/issn.2447-2158.i15p1-29>
- Gomes, RV, Lorenzetti, L., & Aires, JA. (2022). Descolonizando a educação científica: reflexões e estratégias para a utilização da história da ciência e ciência, tecnologia e sociedade em uma abordagem decolonial. *Revista Brasileira de História da Ciência*, 15(2), 437-450.
- Gomes, RV, Mendes, ANF, & Aires, JA. (2021). História da ciência no ensino superior: um estudo das concepções de licenciandos em química sobre a construção da tabela periódica. *Scientia Naturalis*, 3(4).
- Gomes, RV & Mendes, ANF. (2021) A Inserção da História da Química em Sala de Aula: “Qual Elemento Químico Sou Eu?”. *Revista de Ensino, Educação e Ciências Humanas*, [S. l.], v. 22, n. 5, p. 720–731, 2021. <https://doi.org/10.17921/2447-8733.2021v22n5p720-731> .
- Gusdorf, G. (1976). Preface. In: Japiassu, H. *Interdisciplinarity and Pathology of Knowledge*. Imago.
- Ludke, M. & André, MED A. (2014). *Research in Education: Qualitative Approaches*. EPU.
- Lenoir, Y. (1998). Didactics and interdisciplinarity: a necessary and unavoidable complementarity. In: Fazenda, ICA (Org). *Didactics and interdisciplinarity*. Papirus.
- Maldaner, OA (2013). *The initial and continuing education of Chemistry teachers*. Unijuí.
- Maldaner, OA & Zanon, LB (2011). Educational Research and production of knowledge of the Chemistry teacher. In: Santos, WLP; Maldaner, OA *Chemistry Teaching in Focus*. Unijuí.
- Nuora, P. & Valisaari, J. (2019). Kitchen chemistry course for chemistry education students: influences on chemistry teaching and teacher

- education-a multiple case study. *Chemistry Teacher International*, 2(1), 1-10.
- Romanowski, JP & Ens, RT (2006). The so-called “state of the art” research in education. *Dialogue Magazine Educational* , 6(19), 37-50.
- Salgado, TDM *et. al.* (2019). Disciplinary Interfaces in Science Teaching: A Teacher Perspective. *Química Nova na Escola*, 41(2 - May. Supplement), 200.
- Santos, WLPS & Mortimer, EF (2002). An analysis of CTS (Science-Technology-Society) theoretical assumptions in the context of Brazilian education. *Essay*, 2(2), 110-132.
- Santos, WLP & Schnetzeler , RP (2010). *Chemistry Education: Commitment to Citizenship*. Unijuí.
- Sivico, MJ; Gomes, RV; Ventura, LA & Mendes, ANF (2021). Reflection of teaching practice in the school environment: A necessary singular dialogue from the perspective of the Chemistry student in Basic Education. *Research, Society and Development*, 10(6).
- Tardif, M. (2002). *Teaching knowledge and professional training*. Vozes.
- Vygostky, LS (2000). 1929 Manuscript. *Education and Society*, 21(71). 21-44.
- Vygotsky, LS (2000). *The construction of thought and language*. Martins Fontes.
- Zanon, LB & Maldaner, OA (2011). School chemistry in the Interrelationship with other fields of knowledge. In: Maldaner, OA & Santos, WLP (Org.). *Chemistry Teaching in Focus*. Unijuí.