

## ARTICLE

**BIRDSONG LICENTIATES IN RURAL EDUCATION IN NATURAL SCIENCES****ANTONIO MARCOS TEIXEIRA DALMOLIN<sup>1</sup>**ORCID: <https://orcid.org/0000-0002-9634-622X>**ROSANE NUNES GARCIA<sup>2</sup>**ORCID: <https://orcid.org/0000-0002-4647-6245>

**ABSTRACT<sup>3</sup>:** The research presented in this paper was structured around the following problem: how Rural Education dialogues with the Sciences of Natural, in teacher training in licentiate courses? The objectives were: a) Understand how the dialogue between Rural Education and Nature Sciences is established in LEDOC/UFRGS, based on the experiences reported by the graduates; b) Identify experiences of graduates of LEDOC/UFRGS, developed during the course, from the interviews conducted. The theoretical framework was composed of texts: related to Rural Education, marked out by the educator Paulo Freire and contribution by other authors. This was a qualitative case study that used semi-structured interviews as a research instrument. The research participants were the first graduates of the Licentiate's in Rural Education – Natural Sciences, from the Federal University of Rio Grande do Sul. Discursive Textual Analysis (DTA) was used on the answers obtained from the interviews. The results were discussed based on four categories which are: the marks resulting from the training, pedagogy of alternation, training in Natural Sciences and interdisciplinarity. In response to the research problem, interdisciplinarity aimed at understanding the lived world, is the central element that articulates the dialogue between the Rural Education and the Sciences of the Nature, in the teachers training in the rural context.

**Keywords:** Rural Education, Natural Sciences, Interdisciplinarity, Teacher Education, Discursive Textual Analysis.

**O CANTO DOS PÁSSAROS EGRESSOS DA LICENCIATURA EM EDUCAÇÃO DO CAMPO EM CIÊNCIAS DA NATUREZA DA UFRGS**

**RESUMO:** A pesquisa apresentada neste artigo se estruturou a partir do seguinte problema: como a Educação do Campo dialoga com as Ciências da Natureza, na formação em nível de licenciatura, de educadores e educadoras? Os objetivos foram: a) Compreender como se estabelece o diálogo entre a Educação do Campo e as Ciências da Natureza, nas LEDOC/UFRGS, a partir das vivências relatadas

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pelos egressos e egressas; b) Identificar vivências dos egressos e das egressas das LEDOC/UFRGS, desenvolvidas durante o curso, a partir das entrevistas realizadas. O referencial teórico foi composto de trabalhos relacionados à Educação do Campo, balizados pelo educador Paulo Freire e contribuições de outros autores. A investigação foi qualitativa, do tipo estudo de caso, e utilizou as entrevistas semiestruturadas como instrumento de investigação. Os participantes da pesquisa foram os egressos e egressas das primeiras turmas das Licenciaturas em Educação do Campo – Ciências da Natureza, da Universidade Federal do Rio Grande do Sul. A técnica de análise das respostas obtidas nas entrevistas foi a Análise Textual Discursiva (ATD). Os resultados foram discutidos com base em quatro categorias que são: as marcas resultantes da formação, a alternância, a formação por área de conhecimento em Ciências da Natureza e a interdisciplinaridade. Na resposta ao problema de pesquisa, a interdisciplinaridade voltada a compreender o mundo vivido, é o elemento central que articula o diálogo entre a Educação do Campo e as Ciências da Natureza, na formação de educadoras e educadores do/no campo.

**Palavras-chave:** Educação do Campo, Ciências da Natureza, Interdisciplinaridade, Formação Docente, Análise Textual Discursiva.

## LA CANCIÓN DEL PÁJAROS EGRESOS DE LA EDUCACIÓN RURAL EN CIENCIAS DE LA NATURALEZA DE LA UFRGS

**RESÚMEN:** La investigación presentada en este artículo se estructuró en torno al siguiente problema: ¿cómo la Educación Rural dialoga con las Ciencias de la Naturaleza, en la formación del profesorado?. Los objetivos fueron: a) Comprender cómo se establece el diálogo entre Educación Rural y Ciencias de la Naturaleza en LEDOC / UFRGS, a partir de las experiencias reportadas por graduados; b) Identificar experiencias de egresados en LEDOC / UFRGS, desarrolladas durante el curso, a partir de las entrevistas realizadas. El marco teórico estuvo compuesto por: trabajos relacionados con la Educación Rural, obras de Paulo Freire y contribuciones de otros autores. La investigación fue cualitativa, del tipo estudio de caso y utilizó entrevistas semiestruturadas como instrumento de investigación. Los participantes de la investigación fueron los graduados de las primeras clases de las Licenciaturas en Educación Rural - Ciencias de la Naturaleza, de la Universidad Federal de Rio Grande do Sul. La técnica de análisis de las respuestas obtenidas en las entrevistas fue el Análisis Textual Discursivo. (ATD). Los resultados se discutieron en base a cuatro categorías que son: las marcas resultantes de la formación, alternancia, formación por área de conocimiento en ciencias naturales y Interdisciplinariedad. En respuesta al problema de investigación, la interdisciplinariedad dirigida a comprender el mundo experimentado, es el elemento central que articula el diálogo entre la Educación Rural y las Ciencias de la Naturaleza, en la formación de educadores en el contexto rural.

**Palabras clave:** Educación Rural, Ciencias de la Naturaleza, Interdisciplinariedad, Formación del Profesorado, Análisis Textual Discursivo.

## INTRODUCTION

In the context of this research is the loving and rigorous encounter between Natural Sciences and Rural Education, in the shade of a Jacaranda<sup>4</sup>, located in front of the College of Education (FACED) on the Central Campus, and also in the shade of a Fig tree<sup>5</sup>, in front of the Litoral Norte Campus (CLN), of the Federal University of Rio Grande do Sul (UFRGS). UFRGS offers two courses with the same pedagogical project in the two mentioned university units. The present article is an excerpt from broader

<sup>4</sup> Popular Name: Blue Jacaranda – Scientific Name: *Jacaranda mimosifolia* D. Don.

<sup>5</sup> Popular Name: Small-leaved fig tree – Scientific Name: *Ficus cestrifolia* Schott.

research at the doctoral level<sup>6</sup>, whose intention was to understand the dialogue between Natural Sciences and Rural Education in the Licentiate's in Rural Education at UFRGS.

Inspired by the work of Paulo Freire (1995), "À sombra desta mangueira," we dialogue with the expertise and experiences of graduates from the first classes of the Licentiate's in Rural Education – Natural Sciences, in the two university units, FACED and CLN. We consider these new graduates as birds that left the welcoming shade of Jacaranda and Fig tree at the University. During curricular completion, under the trees' branches, these *birds* landed, rested, and experienced the Licentiate's Degree in Rural Education (LEDOC) to, with graduation, take on new flights, new challenges.

LEDOC are training courses for educators to act, by area of knowledge, in the rural context, resulting from public policies built with peasant social movements' participation. They search contextualized education, with the countryside as the main problematization object in the educational process. The history of creating these courses was presented by Molina (2017, p. 3), with emphasis on Selection Notice No. 02/2012 SESU/SETEC/SECADI/MEC (BRASIL, 2012), which originated more than forty undergraduate Licentiate's Degree in Rural Education at federal universities across the country, including UFRGS. The number of active courses was systematized by Paula (2020, p. 207), indicating the existence of 36 LEDOCs, distributed in universities and federal institutes, located in the area of Natural Sciences, or combinations of this area with Agricultural Sciences and/or Mathematics.

Concerning Licentiate's Degree in Rural Education – Natural Sciences at UFRGS, according to its Pedagogical Course Project (PPC) (UFRGS, 2013, p. 12), the course trains teachers by area of knowledge, in alternating education periods, aimed at the development of "interdisciplinary pedagogical projects in the area of Natural Sciences in school and non-school educational spaces." In school spaces, the performance is restricted to the final years of Elementary School, High School, and Youth and Adult Education.

Regarding alternation, the student experiences moments at the university, called University Times (UT), and moments in the community, designated as Community Times (CT), as shown in Figure 1, below.

**Figure 1** - Semiannual alternation regime at LEDOC/UFRGS



Source: Prepared by the authors (2020).

The UT position above the CT in the figure is only an aesthetic option, with no hierarchical character. Times are equally necessary and interconnected, with differences being observed only concerning the workloads between Times.

In this context, students' profile in the first year at this LEDOC sought to reach people from the countryside, as set out in Article 2 of Decree No. 7352/2010 (BRASIL, 2010). However, it also encompassed education workers working in the different levels and modalities of education. The type of admission that the *birds* experienced was a unique selection process, consisting of a test of knowledge of the Portuguese language and an essay at the High School level.

Based on these first-year students with the objectives of LEDOC to train for interdisciplinary teaching in educational spaces in the countryside, the "course was designed based on thematic axes and

<sup>6</sup> This article is the result of the doctoral research carried out by Dalmolin (2020).

cross-cutting themes. The themes were organized into generating ones, in which the teaching activities will be articulated, including the possibility of shared teaching throughout the course (UFRGS, 2013, p. 12)”.

Concerning the area of Natural Sciences, the discussions on this topic included in the course matrix are associated with the so-called field of Science Education or Science Teaching. Within this field, our discussions take place from authors who seek to mark Education in Natural Sciences under Freirean assumptions, such as Delizoicov, Angotti, and Pernambuco (2002). As we understand, the conception of the generating themes of Paulo Freire (2019) potentiates the construction of interdisciplinary curricula in Education in Natural Sciences.

Thus, we understand that the educational conception of Paulo Freire talks and also partially supports the theoretical-philosophical matrix of Rural Education (EdoC). The education desired by rural people is, according to Caldart (2011, p. 149), what happens where people live and is thought from the place of life and work of those people, i.e., contextualized. Thus, we rely on the approximation between Paulo Freire and Rural Education to better understand this research’s birdsong, recorded in their narratives obtained through the graduates’ interviews’ answers.

As a result of these aspects, the present investigation started from the following research problem: *how does Rural Education talk with Natural Sciences to educate educators at the undergraduate level?*

The objectives were: a) understand how the dialogue between Rural Education and Natural Sciences is established, at LEDOC/UFRGS, based on the expertise reported by graduates; and b) identify the expertise of graduates of LEDOC/UFRGS, developed during the course, based on the interviews carried out.

We justify the research problem given our interest in the relationship established between public policies and Rural Education. This is born linked to social movements in the countryside and the area of knowledge of Natural Sciences, with a more consolidated epistemological construction in the mastery of the disciplinary fields of Physics, Chemistry, and Biological Sciences. We also highlight the challenge of training educators in Natural Sciences in Rural Education as a movement to break the existing dichotomy between Human Sciences and Exact Sciences, constituting an intersection between these two distinct theoretical fields.

In this context, Arroyo, Caldart, and Molina (2011, p. 13) understand that the biggest challenge of Rural Education is to “understand the educational processes in the diversity of dimensions that constitute them as social, political, and cultural processes; trainers of the human being and of society itself.” This challenge’s problematization makes us uncomfortable searching for Rural Education’s further study and its relations with the Natural Sciences in teacher education.

Thus, the theoretical framework comprises three main contributions: Paulo Freire’s works, productions linked to Rural Education, and other authors’ contributions.

Educator Paulo Freire wrote books, concepts, methods, his own life, the relationship with the people he lived with, and the places he went. In this way, we bring to light some moments in which Freire meant and re-signified experiences that problematized the world lived by the oppressed, the liberation of these subjects, and the overcoming of conditions to the historical and ontological vocation of people to “be more” (FREIRE, 1992; 1995; 2006; 2019). According to Freire (2006), each human being has no pre-established history, i.e., they have a history in the writing of their lives as a time of possibilities and not of determinism. The future is the object of questioning and not of inexorability.

In this sense, the people who live and work in the places known as the countryside constitute a group marked by the plurality, richness, and diversity of cultures. According to Decree No. 7352/2010 (BRASIL, 2010), which provides for the Rural Education policy and the National Education Program on Agrarian Reform (PRONERA), the populations and countryside schools are defined:

I - Countryside populations: family farmers, extractivist workers, artisanal fishermen, riverside dwellers, agrarian reform settlers and campers, rural wage workers, *quilombolas*, *caíçaras*, forest people, *caboclos* and others who produce their material conditions of existence from work in rural areas;

II - Rural school: one located in a countryside area, as defined by the Brazilian Institute of Geography and Statistics - IBGE, or one located in an urban area, provided that it predominantly serves rural populations (BRASIL, 2010).

In this rural context, we situate the contribution of Rural Education to this research. To debate historical issues and conceptions of Rural Education, we rely on Arroyo, Caldart, and Molina (2011), Caldart (2008; 2011), and Gimonet (2007). Regarding the discussion about the Licentiate's in Rural Education and socialized experiences, we seek support from Begnami (2019), Brick and Borges (2017), Dalmolin and Garcia (2020), Janata (2019), Molina (2014; 2017), and Molina and Hage (2016).

For Caldart (2008, p. 70), the "materiality of origin (or root) of Rural Education requires it to be always thought/worked in the triad: Countryside – Public Policy – Education." Over the years, these three elements became central to the discussion of Rural Education, as

[...] the identity of this movement for rural education is the rural people's struggle for public policies that guarantee their right to education and education in and of the countryside. In: the people have the right to be educated in the place where they live; Of: the people have the right to education thought from their place and with their participation, linked to their culture and their human and social needs (ARROYO; CALDART; MOLINA, 2011, p. 149-150).

Some texts use the term Education of/in the Countryside to demarcate the countryside's presence and relevance as the place where Rural Education's processes take place and the contextualization in rural schools' curricular guidelines. In this sense, it is impossible to restrict the debate to the scope of Basic Education, curricular configurations, and reconfigurations in rural schools. It requires building up training of educators committed to the values of EdoC. Thus, the Licentiate's Degree in Rural Education is placed to provide teacher training committed to acting in the field. According to Molina and Hage:

The Licentiate's Degree in Rural Education has an integrated curricular proposal and referenced in Pedagogical Alternation and organizes the curricular components in four areas of knowledge: Languages (oral and written expression in Portuguese, Arts, Literature); Human and Social Sciences; Natural Sciences and Mathematics, and Agricultural Sciences, seeking to overcome the traditional fragmentation that gives centrality to the disciplinary form and focus on the mode of knowledge production at the university and in the rural school, to understand the totality and complexity of the processes found in reality (MOLINA; HAGE, 2016, p. 02-03).

LEDOC has three main pillars: the alternation of training spaces-times, training by area of knowledge, and interdisciplinarity. Thus, we have incorporated the discussion on interdisciplinarity from other authors, such as Japiassu (1994), Fazenda (1994), Delizoicov, and Zanetic (2002), into the dialogue. Delizoicov, Angotti, and Pernambuco (2002), Auler, Dalmolin, and Fenalti (2009) on the thematic approach in curricular configurations in Science Education based on Freirean assumptions; and Santos (1997; 2002) in the context of the conceptualization of geographic space.

## **METHODOLOGICAL GUIDELINES**

Concerning the methodological guidelines, the research was classified as qualitative in terms of its approach, which, according to Minayo (2002, p. 16), works with "meanings, reasons, aspirations, beliefs, values, and attitudes, which corresponds to a more of relationships, processes, and phenomena." For Moraes and Galiazzi (2016, p. 33), qualitative research aims to understand phenomena in-depth and does not intend to "test hypotheses to prove or refute them at the end of the research."

As for the research method, the case study was used. According to Stake (1998), this method is studying a special case's particularity and complexity. According to the author's definitions, this research constituted an instrumental case study, as the case enables the comprehension and problematization of broader questions (STAKE, 1998). In this context, the case encompasses the particularities of teacher education for graduates at UFRGS LEDOC in the area of Natural Sciences.

Educators from the Licentiate's in Rural Education – Natural Sciences, from the College of Education and the UFRGS Litoral Norte Campus participated in this research, who experienced



transformations in themselves, in the shade of the Jacaranda located at FACED, or the Fig tree in front of the Litoral Norte Campus.

The research participants were six graduates of the first UFRGS LEDOC classes, with admission in 2014 and graduation in 2018, at the Porto Alegre and Litoral Norte campuses. The interviewed group's size was constructed based on the participants' convenience and availability among the 23 graduates that make up the sample. However, it is understood that the number of participants reached met the potential for the production of the narratives, enabling to analyze them in-depth, paying attention to the objectives of this research. The first six male and female education workers who responded to the invitation were interviewed. Of these, two work as teachers directly in the course area, two are teachers in the early years of Elementary School, and two work in schools in administrative and pedagogical support. The age range varied from 33 to 52 years. The interviews were conducted from August 27 to September 25, 2019.

All ethical and legal aspects were fulfilled, with prior submission of the project to the UFRGS Ethics Committee, through the Brazil platform, under CAAE 16100819.9.0000.5347, as well as the signing of the Informed Consent Terms. The participants' integrity and confidentiality were preserved, and the speeches' authorship was identified only with the name of a bird of the Brazilian fauna, namely:

- Saffron finch – Scientific name: *Sicalis flaveola*;
- Cardinal – Scientific name: *Paroaria coronata*;
- Monk parakeet – Scientific name: *Myiopsitta monachus*;
- Rufous hornero – Scientific name: *Furnarius rufus*;
- Green kingfisher – Scientific name: *Chloroceryle americana*;
- Blue-black grassquit – Scientific name: *Volatinia jacarina*.

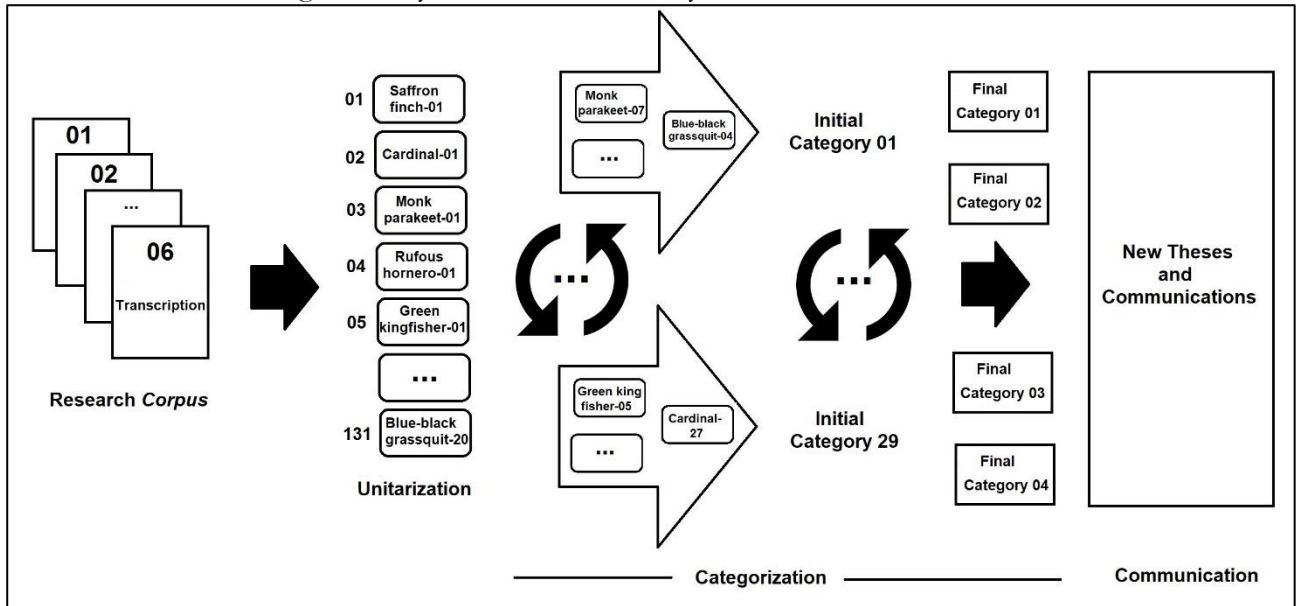
The graduates participated regardless of sex or gender; all were over 18 years of age and residents or workers in the cities of Tramandaí-RS and its neighboring municipalities and Porto Alegre-RS and its neighboring municipalities because it is the region covered by the courses.

The research instrument used to answer the research problem was the semi-structured interview, based on a script composed of 19 questions of interest. This allowed the deepening of specific questions that emerged in the interview. The script included questions such as: Do you have a personal relationship with the countryside?; Do you have a professional relationship with the countryside?; Talk about Alternation in the training space-times, in that course; Talk about interdisciplinarity in the course; Talk about training by area of knowledge; Talk about the relationship between Natural Sciences and Rural Education in your pedagogical practice as a teacher.

The interviews were conducted in person, with an average duration of 48 minutes. The voice was captured with the aid of a voice recorder. After the interviews, the speeches were transcribed in full and sent by e-mail to the interviewees, allowing them to comment on possible corrections in their speeches. According to the Textual Discursive Analysis (TDA) of Moraes and Galiazzi (2016), the narratives were analyzed after the research participants' feedback.

TDA, according to Moraes and Galiazzi (2016, p. 34), is a self-organized process composed of an analysis cycle with three components: unitarization, categorization, and communication. Figure 2 below presents the systematization of the TDA analysis process adopted in this investigation.

Figure 2 - Systematization of analysis route of the interviews



Source: Prepared by the authors (2020).

In the unitarization step, there was a movement of deconstruction/dismantling of the texts that constituted the research *corpus*. We started the reading and meaning process of the six transcripts of the interviews. Afterward, the constituent elements of the texts were mapped and detailed, from which we selected 131 fragments (or extracts), called units of analysis. These were coded, replacing the interviewee's name with a bird's name, as already mentioned, accompanied by the number of the fragment extracted from his/her interview.

The second step of the analysis cycle was categorization, consisting of the first moment of synthesis, organization, and communication of the new understandings resulting from the analysis. We chose to carry out a mixed categorization, defining three categories *a priori*: *alternation*, *training by area of knowledge*, and *interdisciplinarity*, as well as leaving the possibility of emerging new elements open during the analysis. The choice of categories *a priori* did not occur randomly, but due to these elements being present in the Pedagogical Course Project of LEDOC of the Federal University of Rio Grande do Sul (UFRGS, 2013), and also being discussed by Molina and Hage (2016).

In Chart 1 below, we present the details of the categorization process.

**Chart 1 – Categorization Process**

No.	No. of Analysis Units	Initial Categories	Final Categories
1	06	Job Market	Shade Marks of the Jacaranda and Fig Tree
2	13	Personal Change	
3	17	Professional Change	
4	06	Research and Teaching	
5	12	Alternation	Alternation in Spaces-Times of Teacher Education in Natural Sciences
6	01	Traditional Community	
7	06	Rural Context	
8	11	Life and Work Context	
9	02	Non-School Educational Spaces	
10	05	Countryside Populations	
11	06	Relationship with the Countryside	
12	14	Popular and Traditional Knowledge	

No.	No. of Analysis Units	Initial Categories	Final Categories
13	07	Popular and Traditional Knowledge	Training by Area of Knowledge in Natural Sciences
14	01	Agroecology X Agrobusiness	
15	01	Agricultural Sciences	
16	09	Natural Sciences	
17	08	Curriculum	
18	11	Natural Sciences Contents	
19	02	Educator-Educatee Dialogue	
20	04	Teaching Internship	
21	01	Rural Extension	
22	02	Planning	
23	04	Pedagogical Projects and Practices	
24	09	Area Relationship – Discipline	
25	08	Curriculum	Elements of Interdisciplinarity in the Teaching Practice in Natural Sciences in Rural Education
26	05	Shared Teaching	
27	05	Disciplinary Fragmentation	
28	20	Interdisciplinarity	
29	08	Collective Work	

Source: Prepared by the authors (2020).

In the categorization process, the 131 units of analysis were grouped by contrast and comparison and constituted 29 initial categories. According to Moraes and Galiuzzi (2016), each analysis unit can form one or more initial categories. Therefore, of these 29 initial categories, 25 were related to the three final categories defined *a priori*. However, four initial categories were not directly related to the categories previously defined and formed an emerging category, called *Shade Marks of the Jacaranda and Fig Tree*.

## DIALOGUES BETWEEN RESULTS AND THEORETICAL FRAMEWORKS

After completing the categorization, we started the third stage of the TDA analysis cycle, communication. In this movement to create new theses, new writings, communication is represented by productions from the four final, interrelated categories, described as a) *Shade Marks of the Jacaranda and Fig Tree*; b) *Alternation in Spaces-Times of Teacher Education in Natural Sciences*; c) *Training by Area of Knowledge in Natural Sciences*; d) *Elements of Interdisciplinarity in the Teaching Practice in Natural Sciences in Rural Education*. Below we explain each of these categories.

### Shade Marks of the Jacaranda and Fig Tree

The first category, called *Shade Marks of the Jacaranda and Fig Tree*, emerged from the transcripts' analysis, in contrast to the others defined *a priori*. Its title is based on the idea that the *birds* landed and rested in the Jacaranda of FACED and the Fig tree of CLN while living their experiences as students of the Licentiate's in Rural Education – Natural Sciences, at UFRGS.

These *birds* flew dialectically between the university and its communities during the course. When they were in the shade of the Jacaranda and the Fig tree (in University Time and Community Time), they experienced different moments, in the shade or outside it, that certainly marked their life stories.

This enabled this research to verify that the passage through LEDOC left marks on each of these *birds*. In the interviews, testimonies emerged that the experience at LEDOC produced personal and professional changes, discussed here from two movements, *teaching-learning*, and *change*.



The “teaching-learning, "according to Freire (2006, p. 28), is understood as the teaching-learning relationship, in which the horizontal dialogue between educator-educatee culminates, humbly, in the recognition that human beings are holders of knowledge historically constructed, which, although different, are equally important.

Cardinal cites an experience that passed through the Jacaranda shade. In the development of their teaching internship, there was an intense dialogue with students and community people, who participated in some classes and contributed with their experienced knowledge. Cardinal was then able to understand, from the alternating movements, that “*the school opened the gate for life to enter*” (CARDINAL-32), in a work whose response of the students exceeded expectations.

For Rufous hornero, his professional relationship was focused on the countryside, and the course problematized previously unthought issues. According to him: “*The course made me another teacher. The course allowed me to see through another window, opened a door for me to enter, (...), made possible a change. Moreover, today we research things in the countryside, we search and go to study, because there are things that we don’t know*” (RUFIOUS HORNERO-04).

The awareness of the unfinished and the recognition that the students, their families, and other people in the community constitute themselves as holders of knowledge from their life experiences lead the *birds* to re-signify, in practice, their conceptions of being human and community. It occurs when the knowledge of lived experiences are historical and legitimate constructions, typical of human beings.

Therefore, education as a gnosiological situation implies inseparability between educator and educatee in teaching and learning. We agree with Freire (2006, p. 23) when he says that: “there is no teaching without learning, the two explain themselves and their subjects, despite the differences that connote them, are not reduced to the condition of an object, one from the other. Whoever teaches learns when teaching and who learns teaches when learning”.

Teaching-learning and research, according to Freire (2006, p. 28), are undichotomizable. For Green kingfisher, the incentive to research at LEDOC/UFRGS was one of the essential innovations they had “*in Rural Education, with the pedagogy of alternation*” (GREEN KINGFISHER-05). When addressing the teaching-research relationship, Freire (2006, p. 29) describes: “I teach because I seek, because I asked, because I ask and I ask myself. I research to verify, verifying, intervening, intervening, educate and educate myself. I research to find out what I still don’t know and communicate or announce the news”. The author above does not admit the existence of teaching without research, or research without teaching, in the context of liberating education. Liberation is the action and reflection (praxis) of human beings on the world to transform it (FREIRE, 2019). In praxis, liberating educators, as they teach, also reflect on their pedagogical practices to modify them, in their being in the world, with people, and with the world itself.

Regarding the change, the analysis of the singing of all *birds* emerged, elements that point to positive personal and professional transformations, through the experience in the shades of Jacaranda and Fig tree. Saffron finch says that “*the countryside education has transformed me as a person, as a human being*” (SAFFRON FINCH-09). For Green kingfisher, “*there was one person before the course and another person after the course, very different?*” (GREEN KINGFISHER-14). According to Rufous hornero, LEDOC/UFRGS “*transformed me as a teacher: from looking, seeing others, seeing simple people and you talking, and empowering children to be subjects of this school, of this education*” (RUFIOUS HORNERO-25).

The speeches of the graduates of the LEDOC/UFRGS indicate that the changes that occurred in their lives, resulting from the course, were positive since they were offered other elements of the lived world, previously ignored or simply unknown. We understand that the *birds*’ observation of such changes is related to each person’s internal reflection, understanding, and awareness. They place themselves as aware of their inconclusions; they can transform, modify themselves, allow themselves to broaden their horizons of understanding the realities experienced. According to the course’s PPC, “the countryside is a territory for the production of life, for the production of new social relationships,” of new relationships between human beings and nature and between rural and urban (UFRGS, 2013, p. 8).

One goal of Paulo Freire’s liberating education (2006) is the constitution of human beings who, as subjects of their history, are inserted in the world to transform it in favor of social justice. The transformation of the world by people first goes through internal, individual processes of awareness. This is built from the problematization and the loving and rigorous dialogue about the world, which

piques curiosity. In becoming aware, it transforms it into epistemological curiosity (FREIRE, 2006) to then understand and modify reality lived.

Finally, the existence of reports that the experience in the shades of Jacaranda and Fig tree positively modified, to a greater or lesser extent, the lives of these people, enables us to infer that the training experience at LEDOC/UFRGS was successful in their training objectives. According to Paulo Freire, education no neutral and intentional has the function of changing people to transform the world where they live.

### **Alternation in Spaces-Times of Teacher Education in Natural Sciences**

We started discussing this category from two interrelated elements. They interact dialectically, under the context of alternating Education of/in the Countryside, in Natural Sciences: the university and the community.

The Pedagogy of Alternation, according to Gimonet (2007, p. 13), was born in France, in the *Maisons Familiales Rurales* (MFR) - Rural Family Houses (RFH) -, in the first half of the 20<sup>th</sup> century, at the initiative of farmers in the French southwest. They were concerned with the community's development and the curriculum implemented in local schools, which did not dialogue with life in the countryside. These farmers then thought about an education controlled by associations of people from the community. In addition to contextualizing the countryside, these farmers also enabled parents' more intense participation in sons and daughters' formation.

This experience of MFR resulted in the creation of Family Centers for Alternation Training (CEFFAs)<sup>7</sup>, in France, in the 1960s. Over time, CEFFAs reached other countries, including Brazil, with their first experience in the State of Espírito Santo, the so-called Agricultural Family Schools (EFAs), which are now in all regions of the country.

For Gimonet (2007, p. 15), the Pedagogy of Alternation presents four fundamental pillars, two of them related to the purposes, and two related to the means, which allow the respect for differences in each social context when using alternation. For educational purposes, people's integral education and local development (socioeconomic, political, human, etc.) are pointed out. Concerning the purposes, two elements stand out to construct the ends: the proposal's associative guideline and the alternation as a pedagogical method, establishing a new school-community relationship.

The alternation of training spaces-times at LEDOC/UFRGS was divided into two living spaces-times, called University Times and Community Times. According to their pedagogical course design, they take place in:

[...] three alternating moments per academic semester to enable different interfaces between rural lifeworlds. In particular, the worlds of teaching and countryside work and the academic world are duly mediated and problematized by pedagogical interventions from the University's faculty (UFRGS, 2013, p. 5).

This implies that, generally, there were three UT and three CT in each academic semester. According to Saffron finch, TU is "*27 days per semester that had classes 10 hours a day, from 8 am until 8 pm*" (SAFFRON FINCH-04), and TU had up to 10 days in a row, with the last time being shorter.

We understand the University and Community Times, not only as alternations of places but as space-times that interact dialectically. According to Dalmolin and Garcia (2020, p. 20), "in the University Times or School Times, the student experiences classes at the university, but in dialogue with the community times. In community times, activities are developed that were directed and will be debated and socialized in university times".

Space and time are inseparable for Milton Santos (2002), understanding space as an unequal accumulation of time. For Santos (1997, p. 63), the geographic space is "formed by an inseparable, solidary, and contradictory set of systems of objects and systems of actions, not considered in isolation,

<sup>7</sup> An International Association of Family Movements for Rural Training (AIMFR) represents training entities by alternation in rural areas in 40 countries. E-mail address: <<http://www.aimfr.org/>>.

but as the unique framework in which history takes place." Thus, we consider that the geographical space contains material elements (objects) and subjective aspects of social life, produced and reproduced by human beings (actions). It is relevant for Geography to reflect on how human beings act in producing and reproducing this space. Therefore, space-time can be understood as the lived world of people built, reconstructed, verified, or preserved by them.

Thus, we explain that UT and CT are not just times, but University Spaces-Times and Community Spaces-Times, since the space-time changes in the experience are continuous and dynamic. At each turn of the clock hand, it repeats its movement, but at each turn, it is no longer the same; it is in another minute, another day, another year, with other conditions of itself. What brings us closer to Freire (2006, p. 76) when defining that the world is not, is being, and each person seeks to be the subject of their history. In his individual and collective processes of *humanizing* himself, the human being registers space-time marks in his life history, which developed in the three-dimensional space of the experience, orthogonally disposed to the temporal dimension.

Thus, alternation appears in LEDOC as a differential, as Molina and Hage (2016) said. Also, as stated in the PPC of UFRGS LEDOC (UFRGS, 2013, p. 9), the alternation allows "the necessary dialogue between technical and technological knowledge and knowledge of cultural traditions arising from life experiences in the countryside." According to Monk parakeet, CT was also crucial for "*the professors to experience a little of our day-to-day*" (MONK PARAKEET-07). During this Time, the students are accompanied by the faculty *in loco* visits. Therefore, the alternation is not only experienced by students but also by the professors of LEDOC/UFRGS, who are not restricted to university walls and allow themselves to "live further."

Without the alternation, it would not be possible to experience, in the necessary intensity, the reality of the different countryside contexts. Blue-black grassquit states that the alternation is consistent with the "*proposal of Education in the countryside, the education of the subject in the countryside*" (BLUE-BLACK GRASSQUIT-04) on climate issues, plantations, and seasons.

Among the experiences built in the course, closely related to alternation, is research, one element of studying the realities lived. Cardinal highlights the contribution of the university that "*taught him to see, to discover, to research, to go after, because there was [...]*" (CARDINAL-27) something that could enrich his teaching practice. Green kingfisher considers the incentive to research one of the main points of "*Rural Education, with the Pedagogy of Alternation*" (GREEN KINGFISHER-05).

Another vital element is the feedback provided to the communities, from the research and projects carried out in the CT, made possible by the alternation, in the different movements of coming and going, highlighted by Saffron finch. The activities in the CT allowed students to enter the discussion about traditional and popular knowledge. According to Monk parakeet, she "*did not know that it was possible to work with what I learned from my grandfather, my father, my mother and that she could approach these topics and talk about them, within a university*" (MONK PARAKEET-03). For Cardinal, his father and the farmworker knew more about horses than he did, but he did not know that "*this was very important*" (CARDINAL-28) in the university's eyes.

As for popular and traditional knowledge and its relationship with academic knowledge, Monk parakeet argues that "*they have to go hand in hand, neither can overlap the other. There has to be a balance*" (MONK PARAKEET-11). This aspect brings us back to Paulo Freire, who postulates no greater or lesser knowledge, but different knowledge. According to Freire (2019, p. 81), "there is only knowledge in the invention, in reinvention, in the restless, impatient, permanent search that human beings do in the world, with the world, and with others." However, many people are unaware of the value of their knowledge, for others and the world.

The experiences made possible by the CT brought students closer to situations that until then had no more applied knowledge. For example, Green kingfisher showed surprise with the knowledge of the experience demonstrated by a fisherman in work carried out in the CT. When researching the school's surroundings where he works, he identified a community of fishermen. When interviewing one of them, he understood specificities of fishing, such as the most caught fish on full moon nights, "*the place where he had to put the net, which was where the fish would be most and how deep the net, due to the moon's luminosity*" (GREEN KINGFISHER-12).

Cardinal, worried about the reasons for Lagoa dos Patos<sup>8</sup> changing color, taking on a silver, bluish or greenish hue, took to his school, for the first time, a couple from the community, a humble fisherman and his wife. They, due to their experience, explained the relationship between the lagoon and the riverside population. For Freire (1992), progressive educators do not allow themselves to underestimate or deny the knowledge of experience made by educatees, who, although different, are equally important. Nor is it up to these education professionals to deny people's lived experience in the community, regardless of their education levels, as there is no way to measure people's knowledge, just by the number of hours they spent sitting on school benches.

As for the curricular organization by Alternation, all participants in the research highlighted it positively. For Rufous hornero, it was essential in reconciling his work with the study. Cardinal points out that it was only possible to attend the LEDOC due to such a curricular organization because "*if there were no alternation, I would not have done it because it is not feasible to go to UFRGS every day*" (CARDINAL-15).

In this sense, we understand that Pedagogy of Alternation is more than a method; it is a form of construction, curricular organization, and the relationship between the university and the community. Thus, the thematic research process, for which Freire (2019) proposes the research, planning, and development of generating themes in communities, constitutes a potential instrument for the construction of curricula committed to the social context in which they are inserted, insofar as the program is structured according to themes, authentic and meaningful, for the contexts experienced in the students' communities.

In this context of the relationship between alternation and thematic research (FREIRE, 2019), we emphasize that both carry out dialectical movements between university and community. Thus, in the occasional exercise of investigating a generating topic, the "preliminary survey" can coincide with the 1<sup>st</sup> Community Time, as well as the "decoding dialogues" with the 2<sup>nd</sup> CT. We highlight the role of students in investigating topics in their communities during the occurrence of all CT.

The idea of alternation carries some terminological confusions, whether it is a pedagogy, a system, or an alternation regime. Gimonet (2007) uses the term Pedagogy of Alternation as a pedagogical method. However, as the operationalization of alternation in different educational spaces gains its outlines, depending on local specificities, we agree with Begnami (2019, p. 276), who, for LEDOC, believes there is an "alternation regime with the development of alternation principles" applies.

This situation is observed in the Agricultural Family Schools in the Rio Grande do Sul, which use a weekly alternation regime, with a week of school time, followed by a week of community time, and so on. Otherwise, LEDOC/UFRGS uses an alternation regime with three UT and three CT per academic semester. Pedagogy of Alternation supports both exemplified educational experiences but with different alternation regimes. According to Begnami:

The fact is that the alternation revolutionizes the curricular organization and the pedagogical work; it diversifies and complexes the ways and places and times of teaching and learning, of building knowledge in the logic of dialogue, and exchange of knowledge, challenging the fragmentations and hierarchies of knowledge (BEGNAMI, 2019, p. 276).

Finally, the alternation of training spaces and times constitutes a counter-hegemonic educational proposal, one of the greatest richnesses of the LEDOC projects. It enables access and permanence of the rural peoples in Higher Education. According to Dalmolin and Garcia (2020, p. 20), this allows "to respect the space-times of life and work in the countryside, be it planting, harvesting, fishing, rituals, peasant struggles," among others. In this proposal, the UT and the CT interact dialectically to soak the community with university and the university with community, with respectful and horizontal dialogues.

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<sup>8</sup> Largest Brazilian lagoon, located in the coastal region of the State of Rio Grande do Sul.



## Training by Area of Knowledge in Natural Sciences

From the birdsongs, source of the transcribed and analyzed interviews, elements emerged that dialogued with this category, defined a priori, called formation by area of knowledge in Natural Sciences (NS). In Rural Education, such a category is related to alternation and interdisciplinarity through the curriculum. Communication movements in this metatext were centered on two elements: training by area of knowledge at LEDOC and the contradictions experienced by *birds* in Basic Education, on performance by area.

In the context of training by area of knowledge in Natural Sciences, the PPC of the UFRGS course defines this professional's performance in his/her graduate profile.

The graduate in Rural Education will be able to work in the Science subject in the Final Years of Elementary School and the subjects of Chemistry, Physics, and Biology or the respective area of knowledge of High School, in the Youth and Adult Education modality and combination with Professional Education (UFRGS, 2013, p. 12).

For Blue-black grassquit, the area of knowledge of Natural Sciences comprises the domain of “*three disciplines, they are the three areas, Chemistry, Physics, and Biology [...]*” (BLUE-BLACK GRASSQUIT-16). These three knowledge fields represent the most significant contributions to this area's construction, but they are not the only ones. In our understanding, the constitution of the area of Natural Sciences in the context of Rural Education permeates more strongly the fields of Physics, Chemistry, and Biological Sciences, but also moves towards dialogue with knowledge from other areas, for example:

- Astronomy and its representations for life in the countryside;
- Agricultural Sciences, on issues related to food production in the field, with emphasis on Agroecology;
- Mathematics in its contributions to the rural context;
- Social and Human Sciences, from the interaction with philosophical, historical, geographic, anthropological, sociological, psychological, educational, traditional, and popular assumptions;
- Health Sciences;
- Arts and their different languages.

In Higher Education, the term area of knowledge is present in some contexts, such as, for example, in the CAPES assessment areas<sup>9</sup>, which are applied to Graduate Studies in Brazil. The divisions between such areas of knowledge have historically been constructed, legitimized, and validated by scientific communities over time. Humanity has fragmented reality into areas, fields, disciplines to deepen it and has been exercising ways to bring it back together, as observed in studies that seek interdisciplinary perspectives, due to the need to understand contemporary social dynamics.

As for the intentions of Higher Education in proposing teacher training in LEDOC, by area of knowledge, we understand that the objective is to tension and problematize for the creation of new curricular configurations in Basic Education in the Countryside, organized by areas and themes, or, according to Freire (2019), structured around generating themes.

Thus, we do not intend to be prescriptive about the knowledge that is (historically) composing and defining the boundaries of this new field of knowledge of Natural Sciences. This occurs because the contents covered by this area may vary according to local specificities, given the breadth and diversity of field contexts listed in Decree No. 7,352/2010 (BRASIL, 2010). However, it is important to argue that learning/understanding concepts meaningful in the context of communities of/in the countryside require considering that these dialogues between different areas of knowledge, whether academic and scientific or from traditional and popular knowledge, need to happen.

For Green kingfisher, the Rural Education teacher, coming from training by area, in Natural Sciences, is a new professional. Therefore, this graduate's thought corroborates the argument that this

<sup>9</sup> There are 49 assessment areas, grouped into 9 major areas. The list is available at: <<http://www.capes.gov.br/avaliacao/sobre-as-areas-de-avaliacao>>.



new professional trained by LEDOC is not a Physics professor, neither of Chemistry nor Biology, but Natural Sciences from an interdisciplinary perspective.

According to Brick and Borges (2017, p. 2), there is, in the academic scope, “an initial consensus on what the area of knowledge is not, i.e., it is not a production of knowledge in a disciplinary way.” Given this position, we problematize the knowledge area’s possibilities to present itself as disciplinary or not. We understand that the issue has a level of relativity because what is perceived may depend on the lens through which it is observed. Considering the NS area’s idea as the result of the sum of Physics, Chemistry, and Biology knowledge, with no syllabus problematization and contextualization, the reality tends to be blurred. The reality is limited to the three fields’ intersections, or linear developments in the textbook summaries of the three disciplines, within the area. Thus, the area’s concept leads to a new discipline, which replaced the three mentioned, but different from their configuration separately.

On the other hand, the scenario presents itself differently if the NS knowledge area is built from different curricular intentionalities. The lived world of people is the object of problematization (Paulo Freire) and in the condition to contemplate the original assumption of Edoc, in which the people of the countryside “guarantee their right to education and an education that is in and of the countryside (ARROYO; CALDART; MOLINA, 2011, p. 149-150).” Thus, we understand that the NS knowledge area, from such lenses, allows a more transparent and more understandable view of the reality experienced, establishing a deeper relationship with people and their contexts, considering the field’s richness as a space for life work.

However, we emphasize that the emergence of this new field of knowledge, with NS professionals’ training, does not replace or dispense with the existence of disciplinary licentiate degrees. On the contrary, we understand that they can coexist and work collectively to understand the lived world due to their formative differences.

Therefore, teacher education in NS is not located in the “neoliberal context of individualized polyteaching,” according to Brick and Borges (2017, p. 8), but in the context of curricular organizations by areas and themes focused on Basic Education of/in the Countryside, in which the teacher acts interdisciplinarily, depending on the context lived. The current governments in Brazil indeed advocate policies of reducing public expenses, with a neoliberal vision of the minimum state, having these policies immediate consequences in the educational field. We highlight the State of Rio Grande do Sul (RS), the context of this research.

Regarding the contradictions experienced by *birds* in Basic Education, we highlight the experiences reported in the teaching stages on training by area of knowledge. To different situations were identified: one with the development of interdisciplinary internship projects (RUFOUS HORNERO-18) due to the favorable conditions found in the school; and the other, reported by Green kingfisher, who “*had to work with discipline, because the school is disciplinary*” (GREEN KINGFISHER-16). For Blue-black grassquit, the teacher with training by area in NS has difficulties working at school by discipline. During graduation, he/she did not experience the entire list of contents of disciplinary Physics, Chemistry, and Biology courses. The disciplinary training and by area of knowledge are distinct in educational terms. Therefore, they constitute different professionals, equally crucial for the understanding of the lived world.

In the disciplinary scenario, Blue-black grassquit mentions that “*the curriculum that the course proposes is very different from the curriculum that high schools require*” (BLUE-BLACK GRASSQUIT-03). They are different because the LEDOC proposal is interdisciplinary teaching by area of knowledge, which is different from the current disciplinary proposal. Also, LEDOC is not affiliated with the theoretical concepts that guide the National Common Curricular Base (BNCC)<sup>10</sup>, the New High School Program<sup>11</sup>, as well as the Rio Grande do Sul Curriculum Reference<sup>12</sup>, in RS, which although they discuss the idea of the area of knowledge, are based on neoliberal educational assumptions.

<sup>10</sup> Available at: <<http://basenacionalcomum.mec.gov.br/>>.

<sup>11</sup> Available at: <<http://novoensinomedio.mec.gov.br/#!/pagina-inicial>>.

<sup>12</sup> Available at: <<http://curriculo.educacao.rs.gov.br/>>.

When we refer to these assumptions, we discuss the theoretical place in which the previous curricular proposals are supported and the pedagogy of competencies, which peaked in the second half of the 1990s. The curricula inspired by such pedagogy replace the idea of knowledge with competencies and skills. The pedagogy of competencies, in our opinion, constitutes a neoliberal proposal in education, as it individualizes the educational process with the prescription of which competencies and skills students should develop in each step of school education. This creates tension in the education systems, which induces the constitution of specific public policies for Education up to the structuring of curricula guided by this logic.

According to Santomé,

As the current economy is based on knowledge, business organizations try to put educational systems exclusively at their service. This explains why they do everything to ensure that the focus of attention is on the generation and exploitation of knowledge with the most significant possibilities of being applied to the production and generation of profitable new businesses. We see how a particular type of knowledge is leveraged by all possible means and incentives that have greater concrete possibilities of becoming a commodity, a consumer good (SANTOMÉ, 2013, p. 96-97).

The referred author problematizes a perspective antagonistic to Paulo Freire's liberating educational conception. Such perspective cognitively situates the student in the condition of adaptation to a commercialized reality. This is not directly concerned with the understanding of the lived world. As for historicity, the pedagogy of competencies comes close to the ahistorical characteristic, as it is excessively pragmatic. It does not allow the understanding of reality's historical character because it reduces the curriculum to sets of competencies and bureaucratic skills developed nationally, thus neglecting local contexts' value for the curriculum.

In the neoliberal sense, the discussion of knowledge has the characteristic of training general professionals, intending to reduce public education costs. Such a position does not agree, according to Molina (2017, p. 591), with the formative matrix of Rural Education, which is structured in the perspective of human formation of people and denies the narrow vision of school formation, aimed exclusively at training labor to the market.

The graduate experienced the contradictions between the proposal of interdisciplinary projects, some developed, and the strict fulfillment of menus of the disciplines of Physics, Chemistry, and Biology in an individualized/disjointed way.

We think that the education systems are not in line with the legislation. As a result, recently graduated teachers, from the perspective of LEDOC, find an educational system that is not structured to receive them. The State Council of Education of the State of Rio Grande do Sul (CEED-RS) built and approved two documents defining (CEED-RS, 2018a) and consolidating (CEED-RS, 2018b) the Curriculum Guidelines for Basic Education in Rural Schools, as well as the conditions for its offer in the State Education System. However, the implementation of these guidelines by executive bodies of State Education has not yet materialized. There is no prediction of effectiveness, given the country's adverse political and economic circumstances and RS state.

Given the above, we understand that the curricular disciplinary organization has its limitations. The advocacy in favor of addressing themes in the curricular referrals of rural schools consists of the conviction this curriculum represents the possibility of building education of/in the countryside. Such education contextualizes and approaches rural populations' experiences, avoiding situations like the one reported by Cardinal, who defined his workplace as "*a rural school with the city's words*" (CARDINAL-26).

However, without effecting Rural Education regulation in RS, graduates have difficulties entering the job market as teachers in knowledge, especially in High School, where the disciplinary perspective requirement is more intense. In the final years of Elementary School, the discipline that contains knowledge of Physics, Chemistry, and Biology is called Science, allowing greater flexibility and creativity in the teaching performance. However, often, it falls short of the perspective of interdisciplinary teaching in Natural Sciences.

## Elements of Interdisciplinarity in the Teaching Practice in Natural Sciences in Rural Education

In the fourth category, representing the song of *birds*, elements of interdisciplinarity in the teaching practice in Natural Sciences, in Rural Education, enter into the debate in movements that permeate two elements extracted from the interviews carried out. They are the *relationship of disciplinary fragmentation with the integration of knowledge and the relationship between collective work and shared teaching*.

Disciplinary fragmentation appears as a characteristic of curricula, both in Basic Education and in Higher Education. According to the PPC of LEDOC (UFRGS, 2013, p. 4), teacher training by area of knowledge “aims for teachers who have graduated to contribute significantly in overcoming the disciplinarization of knowledge, which is still hegemonic in school curricula in general.” According to Blue-black grassquit, “*in schools [the curriculum] is very fragmented*” (BLUE-BLACK GRASSQUIT-18) into isolated disciplines, which do not interact with each other. The fragmentation of knowledge in disciplines precedes interdisciplinarity, as a movement for integrating this knowledge, historically isolated. Cardinal reflects that “*life is not divided into boxes, or folders*” (CARDINAL-19) and that fragmentation at school makes it difficult to understand reality as a whole.

As for integrating this knowledge, we advocate interdisciplinarity; however, the *birds* expressed their understandings on this theme with very generic arguments closer to common sense. We understand it necessary to demarcate the difference between common sense and traditional and popular knowledge. On common sense, we understand how each person’s cognitive constructions, resulting from his/her life experiences and come close to knowledge at the level of the “doxa,” which means mere opinion. However, we respect the legitimacy of each person’s common sense knowledge in his/her context of constitution. Concerning traditional and popular knowledge, they are knowledge that, in our view, are at the level of “logos,” which means authentic and valid knowledge, as they are cultural, concrete constructions, systematized by specific social groups and spanning generations. Thus, we agree with Freire (2019, p. 97), who understands educational practice as a gnosiological situation, aiming to problematize knowledge at the “doxa” level to build knowledge at the “logos” level.

In this sense, we justify the reference to the understanding of *birds* as generic and close to common sense. For Green kingfisher, “*that is interdisciplinarity, it is a proposal to think of the whole, of all chemical, physical, and biological processes of the contents, but without separating them*” (GREEN KINGFISHER-07). While the statement contains elements that lead to an understanding of interdisciplinarity concepts, it is incomplete. According to Rufous hornero, interdisciplinarity means “*relating not only the contents to other disciplines, but it is also able to relate to daily practice*” (RUFIOUS HORNERO-13). We agree with the exposed position that there is a practical component, as signaled by Japiassu (1994, p. 51), for which “interdisciplinarity is perceived as an ‘eminently political’ practice [...]”.

According to Cardinal, he understands to be interdisciplinarity, that interdisciplinarity lives in him and that this understanding came from the experience at LEDOC/UFRGS. Although he places his position close to that of Fazenda (1994, p. 67), in the perspective of an interdisciplinary attitude related to the individual, in which “the action becomes the point of convergence and departure between doing and thinking interdisciplinarity,” there are no elements to affirm that this author supports it. It allows us to infer that it is an understanding of this *bird* after the formative process at LEDOC/UFRGS.

Thus, regarding the interdisciplinary perspective, we have established a position in Delizoicov and Zanetic (2002, p. 13), who, supported by Freirean assumptions, understand interdisciplinarity as a lens through which the generating phenomena or themes are observed. The generating themes, defended by Freire (2019), are identified by the thematic research process. They are accurate, social, and representative themes of the life context of each community, neighborhood, or city. The generator theme, according to Delizoicov and Zanetic (2002, p. 13), is decomposed through the lens of interdisciplinarity into “different lights of knowledge (physics, chemistry, biology, history, geography, arts, etc.), allowing to reveal fragmented aspects of reality.” After this decomposition in different lights, corresponding to the disciplines, each specialty, in its field of knowledge, answers the question cited by Auler, Dalmolin, and Fenalti (2009, p. 12): “what content, what knowledge is necessary for understanding, for decoding the theme”?

For Delizoicov, Angotti, and Pernambuco (2002, p. 189), the thematic approach constitutes a curricular perspective based on themes, whose “scientific concept of programming is subordinated to the theme.” It implies that there is no definition of content *a priori*, but according to the theme. According to Auler, Dalmolin, and Fenalti (2009, p. 12), “the theme appears to streamline, contextualize, motivate the development of curricula, often structured in a linear and fragmented way.”

In this perspective, Cardinal understands that the curricular organization by generating themes facilitates understanding the disciplinary contents and the relationships built between the disciplinary components, because at “the concept level it is easier, to create, to make these connections” (CARDINAL-21). In this way, we understand the movement of integration of knowledge as an essential contribution of interdisciplinarity. We highlight the potentiality of defining the generator theme, through thematic research (FREIRE, 2019), in the communities where students live and work. This theme’s decomposition in different fields of knowledge, the interaction between them, and the summary of each one’s contribution are understandings to be carried out initially by the teacher. Based on that, a decision is made about what knowledge will comprise the program to be developed with the students, thus constituting arguments to exemplify the themes’ movement as curriculum organizers.

The process of decoding the theme and building the program is related to the second movement of synthesis in this category, the relationship between collective work and shared teaching. The systematization of knowledge and the program’s construction can contain individual movements in each discipline and collective movements with different knowledge fields. As for this collective stage, we think it is indispensable for the construction of an interdisciplinary curriculum.

Collective work is a movement for articulating different specialists, whether legitimized by academic knowledge or traditional and popular knowledge, in favor of the same objective. This articulation contemplates not only the execution but also the planning of the actions. According to Janata:

Understanding the starting point of articulation and integration of knowledge does not concern approximating what each discipline has in common. In our understanding of the Licentiate’s Degree in Rural Education, curricular integration, which leads to collective work, or vice versa, has the understanding of life, in its social and natural phenomena, with its contradictions, as central (JANATA, 2019, p. 313).

In this sense, collective work can lead to the construction of an understanding of a theme via curricular integration, or the curricular objectives lead to collective work. The specialists’ performance must be systematically articulated and the coordination of processes democratically defined among the process participants.

In an interdisciplinary curriculum construction process, collective work encompasses all steps, from planning and research to development in the classroom. The process does not imply that all specialists are together in all activities. Instead, from the coordination and articulation of the process, each one contributes when the demands are presented.

In this classroom context, another vital issue emerged from the interviews: shared teaching. Our understanding of shared teaching is that it is an element of collective work and is based on planning and developing the classroom program. However, the sharing of interdisciplinary teaching can involve specialists from different fields of knowledge, not just those who share the same training or the relationship of an effective teacher and graduating in the same area.

As for collective work, it should be noted that it does not imply being restricted to school disciplines’ domains. Monk parakeet considers that interdisciplinary work goes beyond the classroom’s limits, articulating with other spaces around the community. According to this *bird*, he worked with the Basic Health Unit professionals in his interdisciplinary experiences in the teaching stages, with people from the fishermen’s colony and in the indigenous village, with these groups’ leaders. This corroborates the importance of other knowledge being integrated into educational processes, beyond just scientific knowledge, also considering those systematized by traditional and popular knowledge.

Thus, in the context of LEDOC/UFRGS, Rufous hornero says he believes “*that teachers try the interdisciplinarity. [...], but it is not something you can always do*” (RUFIOUS HORNERO-11). For Blue-black grassquit, at the beginning of the course, the teachers shared teaching with “*two or three teachers together in*



*the classroom*” (BLUE-BLACK GRASSQUIT-13). However, at the end of the course, it did not happen anymore.

According to Molina, collective work is a fundamental element in the design of LEDOC.

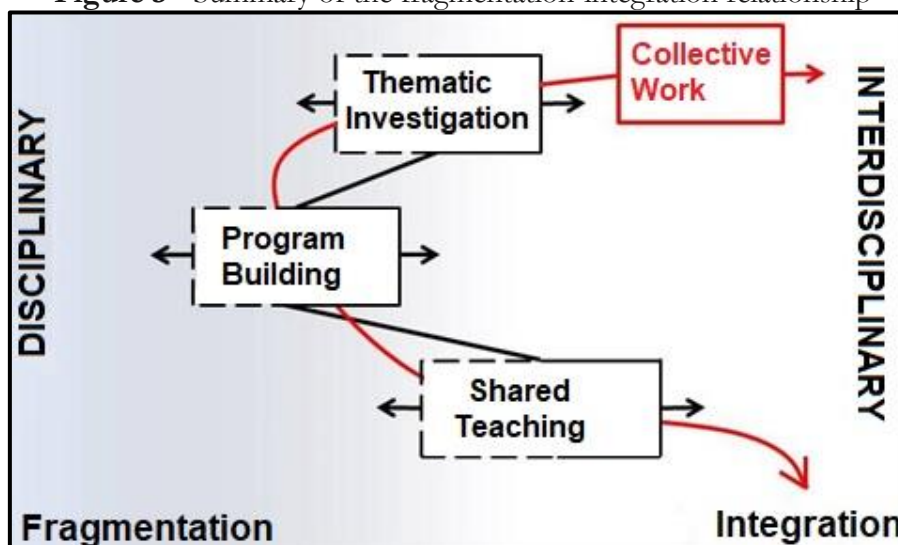
Conceiving and executing training by area of knowledge, thinking of interdisciplinarity as a requirement of the materiality itself, of the complexity of the real problems we want to understand and explain, fundamentally requires collective work (MOLINA, 2019 p. 203).

As for the difficulty of organizing the interdisciplinary collective work in LEDOC, we can identify numerous reasons, but we emphasize that the training of educators of LEDOC occurred, mainly in the disciplinary model. Molina (2014, p. 18) sees as a challenge “the training of the trainers themselves from whom this practice is expected. Mostly from an extremely disciplinary and fragmented training path”.

Collective work, regardless of the curricular area or component, necessarily requires planning by the teacher and, subsequently, by the collective, to jointly execute and evaluate the process. Therefore, shared teaching is an element of collective work, which adds visibility to this work due to the physical presence in more than one teacher’s classroom.

As a summary of this category of the relationship between fragmentation and integration with collective work, we present Figure 3 below.

**Figure 3** - Summary of the fragmentation-integration relationship



Source: Prepared by the authors (2020).

In this summary, the relationship between fragmentation and integration is dialectical, and between these two extremes, thematic investigation, construction of the program, and shared teaching move. Collective work cuts across all steps, acting on all movements, because, for interdisciplinarity, collective work is a central element. The thematic investigation, located on the border between integration and fragmentation, allows it to move between the two extremes, according to the need to investigate the themes.

According to Freire (2019) and Delizoicov, Angotti, and Pernambuco (2002), the first step of the thematic investigation is the “Preliminary Survey,” in which the specialists go to the community, of the students, together with them, to carry out a systematic study to identify the contradictions experienced, in a movement towards integration. We understand that moving towards the community has the meaning of integration, as the world lived is not divided into disciplines or fields of knowledge.

In the second moment, towards fragmentation, the specialists carry out the “analysis of situations and choice of codifications,” They select the main situations that end the contradictions



experienced, return to the community, and continue the dialogue. This movement is fragmented because specialists systematize the lived world elements based on their knowledge fields.

In the third step, towards integration, in the “decoding dialogues,” the specialists return to the community to dialogue with their actors about the experienced contradictions that most disturb them, thus obtaining the generating theme or the generating themes.

In the fourth step, “thematic reduction,” from the identified generator theme, begins the construction of the program, an integral part of the thematic investigation, which, although able to also move between the two extremes, is located more in the direction of fragmentation, seeking the necessary dialogue with the different fields of knowledge.

In the fifth step, the “development of the program in the classroom,” we understand it to be another movement, primarily towards integration, in which shared teaching comes into evidence.

Finally, shared teaching, as an element of collective work, together with the program’s construction and enriched by the collaboration of different fields of knowledge. A movement in this stage towards fragmentation is recognized, but to a lesser extent, located closer to integration. This is also the moment for the program’s development, intending to understand the generator theme, joining efforts to go beyond the mere fulfillment of textbook summaries or lists of skills dictated by official documents in a non-contextualized way. Thus, the option for generating themes consists in the fact that they are representative of the contradictions present in the communities in which students live and work. Also because the generating themes represent the construction of a curriculum that, from an axiological point of view, respects the student in his/her “right to compare, choose, break, decide, and encourage the assumption of this right by educatees (FREIRE, 2006, p. 71).”

Therefore, interdisciplinarity appears to integrate what was separated, favoring the understanding of the reality lived, which cannot be divided. However, above all, it appears as the central element in the dialogue between the Natural Sciences and Rural Education in this research. Thus, the *bird’s* song, which landed and rested under the branches of the Jacaranda of FACED and the Fig tree of CLN, represents part of the experiences built by them in the space-time of LEDOC and now fly into other shades and challenges.

## FINAL CONSIDERATIONS

In the shade of a Fig tree and Jacaranda, six *birds* lived their experiences during curricular integration in the courses of Licentiate’s in Rural Education – Natural Sciences of UFRGS. I identified an emerging category in the research movements, the Jacaranda and Fig Tree shade marks. They represented the personal and professional changes resulting from the teacher education process, which, to a greater or lesser extent, in the individuality of each *bird*, promoted changes that allow us to infer a portion of success to the training in LEDOC/UFRGS in its formative objectives.

From the *birds’* Pedagogical Course Project, we selected three central elements to dialogue with the interviews’ results: alternation, training by area of knowledge in Natural Sciences, and Interdisciplinarity. In this journey, we find ourselves with the alternation of training spaces-times. It constituted itself as a counter-hegemonic educational proposal, one of the most outstanding richness of the LEDOC projects, which enable access and permanence of the rural peoples in Higher Education. It allows respecting the space-times of life and work in the countryside. In this proposal, the UT and the CT interact dialectically to soak the community with university and the university with community, with respectful and horizontal dialogues.

In this context, training by area of knowledge allowed us to reflect on Natural Sciences’ boundaries and the contradictions experienced by *birds* in their teaching internships in schools. Also, there is a discussion about interdisciplinarity, which moved us to debate aspects of the relationship between disciplinary fragmentation and the integration of knowledge and the relationship between collective work and shared teaching. However, even though the *birds* expressed their understanding of interdisciplinarity with very general arguments, the discussion led us to understand this theme’s importance for the LEDOC.

The investigation journey led us to answer the defined research problem: *How does the Rural Education dialogue with the Natural Sciences in educators’ undergraduate level education?*

The dialogue between Rural Education and Natural Sciences is established mainly by interdisciplinarity. Freire's perspective proposes a curricular configuration based on actual, generating themes capable of establishing other connections between the university and the community and an integrative relationship of disciplinary knowledge. Such dialogue seeks to understand the lived world, problematize, and decode it, interdisciplinarily, from the Natural Sciences and other knowledge fields.

Faced with an unfavorable social and political situation of these times, we have to live the true hope of the verb "to hope," which does not allow us to give up, nor to accommodate ourselves to the injustices promoted by other human beings in the world. According to Freire (1992, p. 6), "as an ontological necessity, hope needs the practice to become historical concreteness. That is why there is no hope in pure waiting, nor is it achieved what is expected in pure waiting, which thus, turns into waiting in vain".

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