Discursive Textual Analysis & IRaMuTeQ: Potentials of the Blended Process

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ABSTRACT

Background: For years, scholars have been studying possibilities for science teaching. Science Clubs became an alternative since they are spaces around collective interests. **Objectives:** How is the discursive textual analysis method configured in a blended process, given its three analytical stages, supported by the IRaMuTeQ software? The objective was to present, in full, the discursive textual analysis method, supported by the IRaMuTeQ software, to understand the blended procedure that includes the analytical stages. **Design:** The research approach is qualitative. The global corpus is based on four dialogues about the universe of Science Clubs. **Setting and participants:** The participants are two researchers with extensive experience. The information analysed is four dialogues about Science Clubs. **Data collection and analysis:** There were five meetings lasting approximately 120 minutes each. The analysis method adopted is the discursive textual analysis, supported by the IRaMuTeQ software. In the software, the baseline analysis was descending hierarchical classification. **Results:** The emergence of five intermediate categories was identified, and it is possible to observe, as the main result, from the subcorpus analyses, the recognition of the composition of each intermediate category by other five to seven initial categories. **Conclusions:** The subcorpus analysis procedure is vital for understanding the constructions of each emerging intermediate category, configuring itself as an advanced level of understanding of categorisation. Thus, we concluded that the discursive textual analysis, with software support, is a blended analysis process.

Keywords: Discursive textual analysis; Blended process; IRaMuTeQ.

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Análise textual discursiva & IRaMuTeQ: potencialidades do processo híbrido

RESUMO

Contexto: Há anos que se buscam possibilidades para o ensino de ciências e os Clubes de Ciências são uma alternativa, uma vez que são espaços em torno de interesses coletivos. **Objetivos:** Como o método de análise textual discursiva se configura em um processo híbrido, frente as suas três etapas analíticas, tendo como apoio o software IRaMuTeQ? O objetivo foi apresentar, na íntegra, o método da análise textual discursiva apoiado pelo software IRaMuTeQ, com vistas à compreensão sobre o procedimento híbrido que contempla as etapas analíticas. **Design:** A abordagem da pesquisa é qualitativa. O corpus global é baseado em quatro diálogos sobre o universo dos Clubes de Ciências. **Ambiente e participantes:** Os participantes são duas pesquisadoras com larga experiência. As informações analisadas são quatro diálogos sobre Clubes de Ciências. **Coleta e análise de dados:** Foram cinco encontros com duração aproximada de 120 min cada. O método de análise adotado é a análise textual discursiva, apoiado pelo software IRaMuTeQ. No software, a análise de base foi a classificação hierárquica descendente. **Resultados:** Identificou-se a emersão de cinco categorias intermediárias, sendo possível observar, enquanto principal resultado, a partir das análises de subcorpus, o reconhecimento da composição de cada categoria intermediária por outras cinco a sete categorias iniciais. **Conclusões:** O procedimento de análise de subcorpus é vital para a compreensão das construções de cada categoria intermediária emergente, configurando-se, enquanto um nível avançado de entendimento da categorização. Ratifica-se que a análise textual dscursiva, com apoio de software, configura-se em um processo híbrido de análise.

Palavras-chave: Análise Textual Discursiva; Processo Híbrido; IRaMuTeQ.

INTRODUCTION

The thematic core of this text is the nuances related to Science Clubs (Mancuso et al., 1996; Viêra & Lima, 2016; De Prá & Tomio, 2014, Camors, 2013; Bernet, 2013; Lima, 1998; Albuquerque *et al.*, 2016) in basic education schools from the point of view and experiences of experienced researchers on the subject and teacher education in the state of Rio Grande do Sul, Brazil (Rosito & Lima, 2020). For about 50 years, possibilities have been sought for the conventional way of teaching science in South America (Camors, 2013) and Science Clubs are an alternative, as they are configured as spaces organised around collective interests (Tomio & Hermann, 2019) on themes, in general, parallel to the syllabus contained in the menus of formal school subjects.

Therefore, with a view to understanding the topic in question, we adopted as analytical methodology the discursive textual analysis (Moraes & Galiazzi, 2016), supported by the IRaMuTeQ software (Ratinaud, 2014;

Camargo & Justo, 2013; Ramos *et al.*, 2019; Martins *et al.*, 2020). The emphasis of the discursive textual analysis is concentrated on exposing the three analytical steps that make up the method, based on the support of the IRaMuTeQ software (Moraes & Galiazzi, 2016; Lima & Ramos, 2017; Moraes et al., 2013; Ramos et al., 2019; Martins et al., 2020), since software intended for research with qualitative data is increasingly present and necessary due to the range of information generated to be managed (Gray, 2012; Stake, 2011; Mayring, 2014).

The approach of the method at stake is of a qualitative nature (Moraes & Galiazzi, 2016). To avoid misunderstandings, we must note two aspects related to the support of the IRaMuTeQ software: i) the qualitative approach of the method remains unchanged (Ramos *et al.*, 2019; Martins et al., 2020), due to its strong hermeneutic interpretative character (Moraes & Galiazzi, 2016); and ii) the role of the researcher is not replaced by the software, as the application of operational procedures is insufficient without the required understanding of what is being done in the face of the analyses within the software (Costa & Amado, 2018).

The main contribution of discursive textual analysis is the production of new understandings of the material under analysis (Moraes & Galiazzi, 2016; Lima & Ramos, 2017; Moraes et al., 2013). The procedure is based on three stages: i) identification *of sense units* (unitisation); ii) establishment of chain agglutinations (categorisation); and iii) construction of new understandings (metatexts) (Moraes & Galiazzi, 2011; Lima & Ramos, 2017; Moraes et al., 2013). Among the benefits of IRaMuTeQ are the free software, the execution of textual data analysis at different levels and the agility in processing and generating information (Camargo & Justo, 2013; Kami et al., 2016; Ramos et al., 2019; Martins et al., 2020). Regarding the support software, the attention is on the subcorpus analysis resulting from the descending hierarchical classification analysis (DHC) (Ratinaud, 2014).

The relevance of the study is declared based on three aspects: i) the unprecedented use of subcorpus analyses in research supported by the IRaMuTeQ software; ii) an in-depth understanding of the emergence of intermediate categories, which is a nebulous point in the use of qualitative software; and iii) the presentation of the analytical process of the discursive textual analysis in full, supported with software [IRaMuTeQ], a point, until then, unexplored in the literature. With this, it is declared the unprecedented aspects of the analytical perspectives for qualitative research in the use of IRaMuTeQ as a tool to support the discursive textual analysis method (Ramos

et al., 2019; Martins et al., 2020; Moraes & Galiazzi, 2016; Lima & Ramos, 2017; Moraes et al., 2013).

Therefore, the guiding question is: *How is the discursive textual analysis method configured in a blended process, given its three analytical stages, supported by the IRaMuTeQ software?* Therefore, the central objective was to present, in full, the discursive textual analysis method supported by the IRaMuTeQ software, to understand the blended procedure that includes the analytical steps.

Concerning the structure, in addition to the introduction, we present three sections: i) *methodological procedures,* with a focus on exposing the strategies assumed*;* ii) *results and discussions,* whose core are the results achieved with the subcorpus analysis of the material being examined in the IRaMuTeQ software, the construction of the metatext and the connections with the literature; and iii) *conclusions,* in which the guiding question is resumed and the contributions of the subcorpus analyses in the categorisation procedure with the support of the IRaMuTeQ software and the advantages of the blended process of the discursive textual analysis method are declared.

METHODOLOGICAL PROCEDURES

Object of Study

The object of study is the procedures that make up the discursive textual analysis method (Moraes & Galiazzi, 2016). Due to the characteristics of the analytical process, we admit that the process to cover the three stages of the method is both supported by software [IRaMuTeQ] and handmade, thus constituting a blended. The steps supported by the IRaMuTeQ software are the steps of unitisation, initial categorisation, and intermediate categorisation (Ramos et al., 2019; Martins et al., 2020; Lima et al., 2021). The final categorisation stages and the construction of metatexts are only possible to be carried out by hand (Lima & Ramos, 2017; Moraes et al., 2013). The contributions of the subcorpus analysis, supported by the IRaMuTeQ software (Lima et al., 2021), are essential for fully understanding the initial and intermediate categorisation stages. The subcorpus analyses are possible from the execution of the *descending hierarchical classification* (CHD) analysis on the corpus duly prepared and already inserted and analysed in the IRaMuTeQ software (Ratinaud, 2014; Camargo & Justo, 2013; Ramos et al., 2019; Martins *et al.*, 2020; Lima *et al.*, 2021), in a kind of intra-analysis. The theme of analysis is the nuances that encompass the essences, organisation, teachers' learning,

and investigative activities of Science Clubs in basic education schools in Brazil from academic dialogues between researchers with lived experience on the subject.

Participants and Corpus of Analysis

The participants are two researchers, Participant 1 (P1) and Participant 2 (P2), from the area of science education with extensive experience in teaching secondary and higher education. The information to be analysed is based on four Science Club dialogues. The guiding points were, namely: i) *the essence of a Science Club;* ii) *the organisation of a Science Club;* iii) *teachers' learning at the Science Club;* and iv) *the investigative activities developed in a Science Club.* The main intention of the four dialogues is the dissemination of renewed ideas on the themes surrounding science teaching through Science Clubs (Rosito & Lima, 2020). It is worth emphasising that the guiding points are not configured, as a priori categories, since they were not topic limiters but worked as a starting point for dialogues.

The dialogues took place throughout 2019. There were five meetings lasting approximately 120 minutes each. They emerged due to the desire to update information about the Science Clubs and culminated in the launching of the book *Conversas sobre Clubes de Ciências* (Conversations about Science Clubs) (Ibid.). The search for understanding the nuances of the material can generate analytical and theoretical developments in future actions.

In the case of those interviews, the research was not submitted to the Research Ethics Committee. This decision is justified because the dialogues analysed are published in the book *Conversas sobre Clubes de Ciências* (Rosito & Lima, 2020) and are of public access. However, both respondents agreed to have their dialogues analysed. Moreover, one of the authors being analysed is also the author of this current work. In this way, we exempt *Acta Scientiae* from any harmful consequences to the participants that may emerge from this research.

In the IRaMuTeQ software, the corpus of analysis included a total of 16,316 words, with 61 individual narratives (Texts), evenly distributed between both researchers (n = 32; n = 29), and an average of ~268 words per text and an average of ~ 35 per Text Segments (STs). The total number of graduate STs was 460, and the retention/use rate for the corpus was ~83% (376 STs). The total number of single-occurring words was 799 (Hapax index 4.90%). In the

subcorpus, the total number of STs formed was 352 and the mean retention/usage rate was ~73%, with the mean Hapax rate ~14% of occurrences.

Regarding the analyses carried out, for the corpus, the base analysis was the *descending hierarchical classification (DHC)*. It is necessary for the generation of intermediate categories. To generate the subcorpus, the 100 STs with the highest density (score) in each intermediate category were adopted as a parameter. This was the maximum number of STs reached in the generation tests of each subcorpus. And the analyses used were, in the same way as for the corpus, the *descending hierarchical classification (DHC)*.

Regarding the decisions for data entry in the IRaMuTeQ software (Ratinaud, 2014), the following was adopted: i) language: *Portuguese*; ii) construction of STs: *occurrences;* iii) size of STs: *40;* iv) generation of subcorpus: *Absoluta (absolute) score*; and v) number of STs: *100.* The other entry points are the pre-selected standards of the IRaMuTeQ software (Ibid.).

Data Analysis

Data analysis was based on the precepts of the discursive textual analysis (Moraes & Galiazzi, 2016) supported by the IRaMuTeQ software (Ramos *et al.*, 2019; Martins *et al.*, 2020; Lima *et al.*, 2021). Faced with the three procedural stages of discursive textual analysis (unitisation, categorisation, and production of metatexts), the emphasis here is on the entire analytical process (Moraes & Galiazzi, 2016). Thus, it is configured as a blended matrix as a whole since it includes the support of the software, with an automated root in the stages of unitisation, initial and intermediate categorisation, and an artisanal aspect, as is the case of the final categorisation and the construction of the metatext.

The analyses performed for corpus and subcorpus are two different procedures. However, they are dependent and sequential processes, having the same database as the foundation of information. Therefore, for the subcorpus analyses, the following were performed: i) the corpus analysis compared to the *descending hierarchical classification* (DHC) (Ratinaud, 2014; Ramos *et al.*, 2019; Martins *et al.*, 2020, Lima *et al.*, 2021); and ii) DHC analysis for the subcorpus of each of the intermediate categories generated from the 100 highest density STs (Lima *et al.*, 2021). This form is the only possible alternative for subcorpus analysis, without manipulation, secondary preparation of information in advance or fractional analysis with a new insertion in the IRaMuTeQ software.

Thus, we confirm that the interpretative analyses of the ramifications arising from the corpus in the DHC analysis are configured as subcorpus analysis. This is because, initially, it is necessary to generate data on the corpus for subsequent generation of subcorpus analysis of each intermediate category, individually. We also endorse that the corpus and subcorpus analysis, even in the automated procedural moments that, at first sight, are more mechanised, do not dispense with the researcher's interpretation actions on the originated data, thus being in line with the recommended in the discursive textual analysis method (Moraes & Galiazzi, 2016; Lima & Ramos, 2017; Moraes *et al.*, 2013).

PRESENTATION AND DISCUSSION OF RESULTS

To obtain the results from the discursive textual analysis method (Moraes & Galiazzi, 2016) supported by the IRaMuTeQ software (Ramos et al., 2019; Martins et al., 2020) regarding both the corpus and the subcorpus of information about the nuances of Science Clubs, we used four dialogues between two experienced researchers in the science teaching area (Rosito & Lima, 2020). We must remember that via the IRaMuTeQ software, the initial and intermediate unitisation and categorisation procedures occur concurrently and automatically, based on statistical calculations, without the direct interference of the researcher (Martins *et al.*, 2020) in the procedure. The final categorisation and construction of the metatext steps are carried out manually, since the software does not apply to such analytical steps.

The saturation is essential information for interviews, narratives, and dialogues in qualitative research (Gray, 2012; Stake, 2011). The IRaMuTeQ software provides the Hapax coefficient in the execution of the basic statistical analysis for all the information entered (Ratinaud, 2014) and can be used as a preliminary indication of the occurrence –or not– of corpus saturation (Martins *et al.*, 2020) and also of the subcorpus (Lima *et al.*, 2021). In the corpus, only 4.90% of occurrences were unique, suggesting that the four dialogues occurred in convergence with the proposed guiding points, without loss of focus or digressions on disconnected subjects in the speeches, an aspect that demonstrates the rigour in conducting as a data collection method.

Regarding the subcorpus, the mean Hapax coefficient was 14.41% (Δ 9.94% to 21.47%) for the five intermediate categories generated. Regarding the Hapax values, the higher the percentage, the more unique terms are present in the speeches, which may indicate new topics in the interaction. However, here, the percentage increase in perceived Hapax compared to the subcorpus is due

to the natural course of the dialogues, with changes in moments of the dominance of the narrative between the interlocutors, making specific terms stand out over others, but which does not configure a new thematic direction in the narrative. Thus, the difference shown between the Hapax coefficients is considered acceptable. However, we consider that it is still necessary to deepen the relationship between the Hapax coefficient and the saturation of speeches with other corpora to understand the indicator in qualitative research analyses better.

Faced with the categorisation process in discursive textual analysis (Moraes & Galiazzi, 2016; Lima & Ramos, 2017; Moraes et al., 2013) supported by the IRaMuTeQ software (Ramos et al., 2019; Martins et al., 2020; Lima *et al.*, 2021), the analysis of the *descending hierarchical classification (DHC)* (Ratinaud, 2014). In the DHC analysis (Fig. 1), a dendrogram with five *categories[1]*, which are considered *intermediate categories* in the process of the DTA method (Ramos et al., 2019; Martins et al., 2020, Lima et al., 2021). The dendrogram is divided into branching levels (R): i) R1, category 5 only; and ii) R2, subdivided into R2(1) (category 3); and R2(2), with subbranches R2(2a) (category 1) and R2(2b) (category 4). All presented dendrograms follow the same logic of indications for the branches.

The intermediate categories are formed by approaching and distancing the units of meaning (Moraes & Galiazzi, 2016), which occurs through the formation of text segments (Ramos et al., 2019; Martins et al., 2020) according to the frequencies of lemmatised occurrences of their vocabularies, until reaching the most stable structure (Ratinaud, 2014; Camargo & Justo, 2013; Veraszto et al., 2018). The titles of the five intermediate categories result from the researchers' interpretation of the units of meaning (Moraes & Galiazzi, 2016) of greater density (score) in each intermediate category. The score value is given by the correlation between the highlighted words of each text segment generated in IRaMuTeQ. Thus, the intermediate categories, their colours, and respective concentrations are: i) *alternative to work dynamics* (red – 18.1%)*;* ii) *changing the space of learning* (grey – 15.7%); iii) *the science and habit of collective experimentation* (green – 28.2%); iv) *the importance of the Science Club* at school (blue – 25.3%); and v) *the image of science* (purple – 12.8%). The total concentrations add up to ~83%, as this is the retention rate leveraged

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[1]It is convenient to clarify the term in each instance: i) in IRaMuTeQ, it is *classes*; and ii) in the discursive textual analysis method, it is *categories.* Thus, as the core here is the discursive textual analysis procedure, we adopt *categories*.

from the corpus. Let us remember that the recommended retention is 70-75% (Ratinaud, 2014; Camargo & Justo, 2013).

Figure 1

*Intermediate categories about the nuances of Science Clubs.* (Data adapted from IRaMuTeQ).
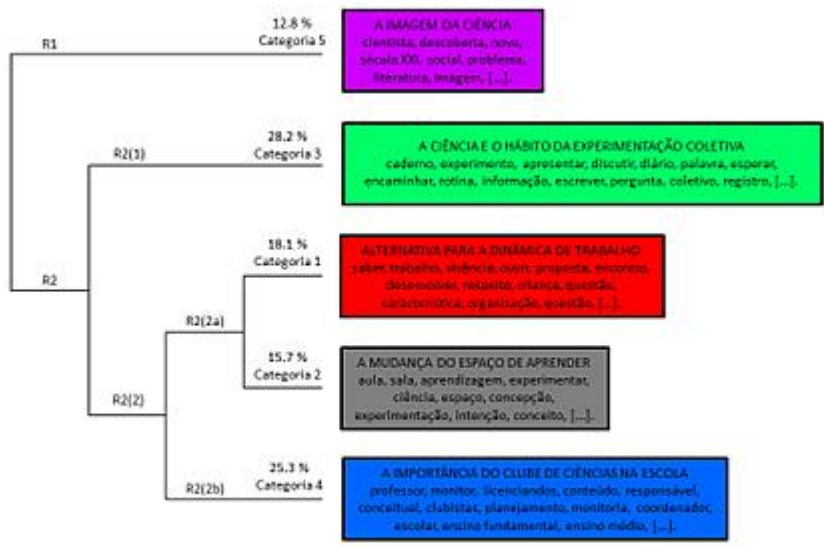
Supported by the DHC of the corpus, the subcorpus analyses were performed. In IRaMuTeQ, subcorpus analyses are performed for each intermediate category, which is the only analysis option for the subcorpus (Ratinaud, 2014). In relation to the discursive textual analysis method, the intention is to seek subsidies to understand the formation structures of each intermediate category (Moraes & Galiazzi, 2016). This type of analysis is a point of darkness in the literature when the subject is the use of IRaMuTeQ since they are not addressed. In the case of the DTA method, we can say that the subsidies correspond to the initial categories.

For subcorpus analyses, based on the 100 highest-density text segments (STs) (*score*) of the intermediate category, the DHC analyses were performed similarly to the corpus. In the DHC analysis, the generated material is always a dendrogram. The difference now is that they refer to the initial categories in the discursive textual analysis method (Ramos et al., 2019; Martins et al., 2020, Lima et al., 2021). Due to space availability, only the global image of the intermediate categories and their respective initial categories is presented here (Fig.2) and shortly after, only the construction of the initial categories referring to Category 1 – *Alternative to work dynamics* (red) (Fig.3).

Figure 2

DHC of the global categorisation – intermediate categories and initial categories. (Data adapted from IRaMuTeQ)[2].
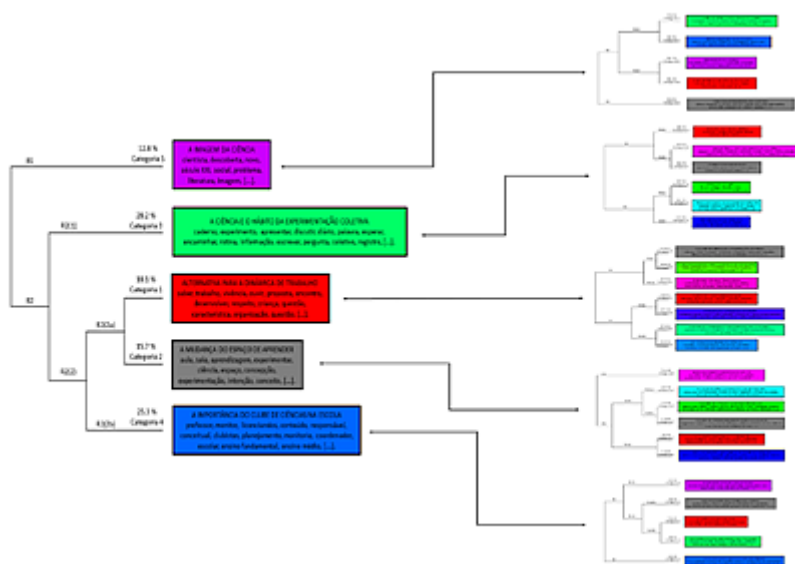
[2]Despite the lack of clarity of the categories on the right in the figure, it is fundamental for understanding the formation of categories as a whole. In the image, the priority is the demonstration of the general disposition and not the individualized understanding of each category.

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Figure 3

DHC of the early categories – intermediate category 1 [Fig. 1., Red]. (Data adapted from IRaMuTeQ).
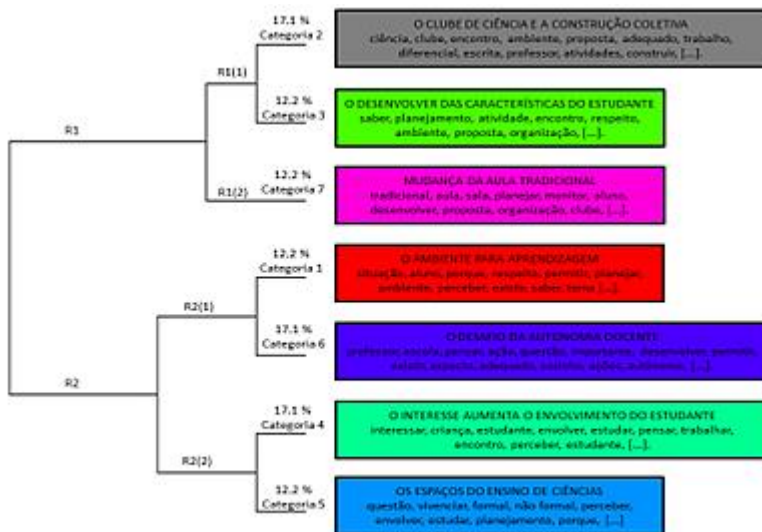
According to the frequencies of the lemmatised occurrences of STs that make up Category 1 – *Alternative to work dynamics* (Fig.1, red), the most stable structure (Ratinaud, 2014; Camargo & Justo, 2013; Veraszto *et al.*, 2018) showed retention of 82% and seven initial categories, grouped into three internal branches: i) in R1, initial categories 2, 3, and 7; ii) in R2(1), the initial categories 1 and 6; and iii) in R2(2), the initial categories 4 and 5. To better understand the relationship between the initial categories, correspondence factor analysis (CFA) is necessary. However, they are not presented here due to the space available given the necessary data demonstrations and arguments.

The titles and the intermediate categories are also a result of the researchers' interpretation based on the STs of the highest scores for each initial category. In this case, intermediate category 1 (Fig.1, red) formed 41 total STs among the seven initial categories formed, corresponding to ~12% of the total 352 STs used for the subcorpus analyses. Finally, carrying out the three stages of discursive textual analysis (Moraes & Galiazzi, 2016) supported by software (Ramos et al., 2019; Martins et al., 2020) demands much effort, and here only one metatext will be presented (Moraes & Galiazzi, 2016). We intended to

advance with the process of categorisation of the method, having as a central point of attention the formation of intermediaries through the initial categories with the analysis of subcorpus in the software aimed at IRaMuTeQ (Ratinaud, 2014) qualitative analyses.

In discursive textual analysis (Moraes & Galiazzi, 2016) performed by hand, the categorisation is built after the corpus unitisation stage. In sequence, constant revisits and reclassifications of available ideas are carried out. This movement produces *initial categories* (In IRaMuTeQ, achieved only via CHD analysis for subcorpus), *intermediate categories* (In IRaMuTeQ, possible via DHC analysis for corpus) and *final categories* (In IRaMuTeQ, it is not possible to reach this step). The latter categories are broader and express the essential meanings to meet the research objectives. The set of categories, in particular, the *final categories*, give structure to the text to be produced, called *metatext*. This text presents the ideas reconstructed during the analytical process, constantly moving between interpreting and describing (Moraes & Galiazzi, 2016; Lima & Ramos, 2017; Moraes *et al.*, 2013).

In this text, we will complete the analytical cycle by hand, with the construction of the metatext, since such elaboration is not possible with the direct support of the IRaMuTeQ software. Thus, the DTA is essentially a blended process whenever supported by the software. The handmade rearrangement of the intermediate categories, generated with the aid of the software, gave rise to three final *categories*, namely: i) *Social and school view of science; ii) Learning and Science Club*; and iii) *Contributions of club culture to the classroom and teacher education*. By way of example, the metatext for the third final category is presented below.

Contributions of club culture to the classroom and teacher education

Because it is a non-formal educational space, but one that generally operates within schools, the characteristics that define the Science Club end up spreading in different ways in the school environment. This final category discusses the developments organised around the following central argument: *Science Clubs in basic education schools can influence the classroom dynamics and the education of future science teachers who participate in the club, supporting the coordinating teacher*.

The uses of non-formal spaces are linked to the theoretical assumptions of different traditions, as this concept is a growing form of diversified methodological use for the development of

school contents, since formal environments are criticised for their aridity and low interactivity with the world being studied (Santos & Terán, 2013, p.8).

At the *World Conference on Science for the Twenty-first Century: A New Commitment*, the role of scientific education was discussed, understood as a prerequisite for democracy and, consequently, for achieving a balanced, social, and sustainable development of the planet. Among the measures proposed for a greater expansion of scientific education, the following, indicative of three spheres, stand out: i) in the formal sphere; ii) in the informal context; and iii) in the non-formal scope. In the first, curricula, teaching methods, infrastructure, and the incentive to research and teacher education qualification are improved. In the second, the concern is with science journalists' education; and, finally, in the third, investment and development in science museums and centers is mentioned (Rocha & Terán, 2013).

In this way, by establishing provisions for formal, informal, and non-formal science education, the conference recognises that education cannot be considered just a formal school act. However, the school and its syllabus occupy a relevant space in the learning process. Therefore, those responsible for formal education need to (re)think about the methodological approaches and the teaching resources available to educate students (Ibid.) scientifically.

The classroom dynamics may suffer alterations motivated by the students' experiences in the Science Clubs, emphasising: i) students' protagonism in the learning processes; ii) development of scientific thinking; and iii) the students' perception of the grades assigned to them. Regarding the protagonism in classroom activities, participant P1 says: "*When we talked to the coordinating teachers about the attitudes of the club's students in regular classes, they indicated that the students became very participatory, even encouraging other colleagues to interact more in class*.". Students' attitude in class reflects the pedagogical practice at the Science Club. There, the activities are investigative, and the club members organise research projects on topics of their interests, continuously going through the formulation cycle of questions and the search for answers. Although they do so with the supervision of the coordinating professor and monitors, the participation of club members is essential for the sequence of the work.

Another aspect that leads students to play a leading role in actions is related to the fact that the administrative management of the clubs is usually the club members' responsibility, with the distribution of activities and collective management of demands (Mancuso *et al.*, 1996). P1's narrative also

points to another perspective. The club member's participation in the classroom encourages colleagues who do not attend the Science Club to respond differently to the actions proposed by the teachers.

Regarding students' protagonism, it is desirable, relevant, and necessary in the school context since, through this perspective, more comfortable situations are possible in terms of interaction with the activities. Thus, it is vital that "students feel encouraged to participate in the class and develop their autonomy to seek answers to their own questions, becoming true protagonists of their learning" (Volkweiss *et al.*, 2019, p. 9). The formation of student autonomy supports the development of skills before acting in society. In this sense, autonomous students can think, act, and transform their reality and the reality of those around them, being able to decide and reflect on acts independently and assuming their responsibilities as social subjects who can transform their habitats (Ibid.).

"Respect for the autonomy and dignity of each person is an ethical imperative and not a favour that we may or may not grant to others" (Freire, 1996, p. 59). However, Brazilian teachers generally find dealing with students' autonomy difficult, mainly due to their usually authoritarian formation –within a unilateral scholastic curricular perspective. Thus, they cannot accept and work on the development of student autonomy and, therefore, not infrequently have repressive attitudes (Volkweiss et al., 2019).

It is worth highlighting, even briefly, another instance necessary for respecting autonomy for protagonism in the classroom: affectivity. Affectivity is present in all human actions, from childhood manifestations, throughout life (Puhl *et al.*, 2021). The human being constructs feelings of affectivity through lived experiences, thus, a singular and unique construction. Thus, the learning process occurs through people's interaction with their culture (Oliveira & Rego, 2003).

Because affectivity is a social construction, the school needs to recognise the importance of this feeling. Affectivity is not just emotion (biological origin) or feeling (psychological origin) but a complex process that relates these elements. Hence, affectivity is built from humans' anxieties, desires, and experiences (Puhl *et al.*, 2021).

> Regarding the school environment, the teacher is the main responsible for creating a harmonious and pleasant environment for the teaching and learning processes. The teacher's didactic choice contributes to the establishment of

affective, positive student(s)-student(s), student(s)-teacher(s), and student(s)-school subject(s) relationships. (Ibid., p.13)

On the second aspect, the *development of scientific thinking*, it is important to point out that this quality has historically been one of the objectives of the Science Clubs. Today, however, the understanding of scientific thinking is not the same as it was in force in the last decades of the 20th century, when doing science meant reproducing scientific concepts in the club through experimental activities. "The incentive to do science was based on demonstrative experiences that presented the physical and natural phenomena in a finished and indisputable way" (Rosito & Lima, 2020, p. 18).

Participant P2 presented a contemporary perspective on the theme. She makes it clear that the importance of scientific education remains but that, today, the referrals for the development of scientific thinking are carried out "*through activities that help build a logic of thinking that privileges the understanding, interpretation, and criticism of the studied phenomena*." Continuing her narrative, she cites as an example of activities the proposition of challenges for club members: read the authors' ideas critically, contextualise the concepts/phenomena studied, observe patterns, formulate plausible hypotheses, develop arguments supported by evidence, and establish criteria for comparison. "*Club members must, therefore, mobilise attributes that lead to the learning of scientific concepts, attitudes, and procedures that will help young people to be more aware of world events*" (P2).

In a similar reflection, a teacher who coordinates Science Clubs corroborates the idea when commenting on changes in the club member's behaviour when he is in the formal classroom: "I believe in scientific literacy. We managed to perceive the presence of scientific literacy in a powerful way in the club and also in other spaces" (Rosito & Lima, 202, p. 87). What is on the agenda in this analysis is how scientific thinking is presented in classes and how this fact can change the classroom routine. With a greater ability to deal with scientific knowledge, club members formulate questions relevant to the concepts studied, seek information about concepts, and take a critical position on the relationship between science and society, favouring teachers to structure classes to take advantage of those attributes so that the group of students qualify their ideas and expand their knowledge.

As for the third aspect, *students' perception of the grade assigned to them*, much has been written about assessment at school but the tendency to associate grades with learning still prevails, mistakenly considering that grades measure the quantity and quality of learning. This tendency is called normative

assessment (Hadji, 2004; Tardif, 2006). Nowadays, this idea coexists with another understanding of assessment considered as an intrinsic moment in the learning process, serving its results to reorientate the learning process, i.e., the assessment is formative (Hadji, 2004; Tardif, 2006).

The Science Club is not committed to assigning a degree to students. However, some evaluative processes aim to reorient learning (Pedron, 2020).

> *In the Science Club, the actions are assessed to identify the knowledge constructed, the development of autonomy, the improvement of skills, so that the coordinating teacher can make decisions about new referrals, although it is not appropriate to assign a degree to the club members' performance* (P2).

The classroom assessment originates from teachers' educational theories and beliefs about teaching and learning (Ramos & Moraes, 2010). Therefore, understanding how the subject learns directs how to assess this subject. In general, the role of assessing what is learned is to verify quantitatively students' performance in standardised exams, which, on several occasions, are merely focused on memorising, choosing formulas, or solving questions often trained in previous classes, with predefined tips. Thus, when the emphasis is merely on aseptic classification, the assessment ends up displacing the primary function of the act, which is to analyse and reflect on planned learning (Ramos & Moraes, 2010).

By getting used to formative assessment, students capture its main purpose, which is to guide learning, valuing less the assessment grades assigned to them in the formal classroom. Students' appreciation of the learning process to the detriment of the grade can influence the teacher in the sense that the teacher makes the assessment more aligned with the purpose of continuous learning monitoring than with the attribution of a grade at some point in the process.

As a general reflection, it is possible to say that ideas about students' role in learning processes, the development of scientific thinking in students, and their perception of the grade assigned to them, when mirrored by club members in formal classes, can be opportunities for teachers to reorganise activities in any subject. The proposition of pedagogical situations that privilege teamwork, the debate of ideas, written productions, problematisations, and formative assessment overcome the idea of reproduction and copying of concepts and qualify the formation of all students. Science club

culture can permeate classroom dynamics and create a virtuous circle of participation and collective learning.

Regarding the *relationship between Science Clubs and prospective teachers' education*, the second perspective of the central argument of the category, the monitor (tutor) is quite present in the club environment. Although the presence of pre-service teachers in the daily activities of the Science Club depends on the partnership between universities and basic education schools, prospective teachers in the science area often join it to promote pedagogical actions under the supervision of the club coordinator. On such occasions, a developing learning community influences teachers' education to some extent, as shown below.

Contributions to prospective teachers' education are evident in the authors' reflections and, as central points, they highlight aspects that are within the scope *of the construction of professional identity*, as the following excerpts reveal*: "Working with club students is an experience that will reduce the distance between the theory studied when they take the disciplines of pedagogical practices and the practice*" (P2)*. "Another important aspect that the experience in the club can help is in the definition of being, or not, a teacher*" (P2)*.

> *They realise there is another way of teaching science, a different way from the one they are familiar with, either because they were trained that way in basic education or because the university still encourages them to continue thinking about a more traditional class. The Science Club provides the opportunity for prospective teachers to realise that pedagogical proposals differ from those they are used to.* (P1)

The teaching professional identity, configured by a set of principles and concepts inherent to teaching, is built continuously, supported by real experiences and dialogue with professional colleagues (Nóvoa, 2009; Imbernón, 2011). The Science Club, a non-formal educational environment, brings together conditions for teaching practice and reviewing concepts studied in university. In a dialogic relationship with other prospective teachers and the coordinating teacher, debate and reflection foster this revisiting of the concepts. It is possible, for example, to critically analyse pedagogical conceptions by contrasting traditional pedagogical models centred on teaching and the teacher with pedagogical models centred on learning and on the ability of the club member to elaborate a personal construction of the phenomenon/concept they are studying.

Prospective teachers report positive development also regarding emotional strengthening to work in teaching (Teixeira et al., 2018). This dimension is pointed out in the conversations the participants held. They talk about overcoming fears and facing frustrations when dealing with club members, as shown in the following passages:

> *Several of them talk to the club's coordinating teacher, saying they fear facing the club members and being responsible for an activity. But as the work at the club progresses, they are encouraged to take responsibility for activities.* (P2)

> *Dealing with frustrations is another learning experience, because what prospective teachers plan so carefully is not always so well-accepted by club members. This condition does not only occur with the club teacher.* (P1)

Teaching involves the teacher as a whole, with pedagogical practice influenced by professional formation, the pedagogical and scientific axes, and by elements of the personal dimension, such as beliefs and conceptions about reality in general and teaching in particular. by providing opportunities for teaching practices, monitoring (tutoring) in Science Clubs allows reviewing representations about the profession, contributing to consolidating professional identity.

Finally, we resume the central argument: *Science Clubs in basic education schools can influence the classroom dynamics and the education of the prospective teachers who participate in the club, supporting the coordinating teacher.* Science Clubs are assumed to also: i) spread changes in the classroom triggered by theoretical, methodological, and pedagogical assumptions that support the practices idealised by the coordinating teachers of the Science Club; and ii) qualify the prospective teachers' education through real teaching experiences, studies, and debates with the community that constitutes the club.

CONCLUSIONS

The principle of this work was to present the process, in its entirety, that composes the discursive textual analysis method supported by the IRaMuTeQ software to understand a blended whole. Therefore, the guiding question is: *How is the discursive textual analysis method configured in a*

blended process, given its three analytical stages, supported by the IRaMuTeQ software? Considering the presented, the following are exposed:

i) on the analysis of subcorpus: it is configured as internal, sequential movements of the corpus and individual for each intermediate category, not being possible to execute otherwise. They are essential for understanding the formation of intermediate categories because, in their absence, the first stage of the categorisation process is not reached. In addition, it is defined as an advanced level of initial categorisation, with groupings (resulting from the unitisation stage). It is not exactly the first movement of the initial categorisation, but still, it is within that stage.

ii) on the metatext: we reiterate the belief that by safeguarding the normative aspects that govern the formal structure of the school, it is possible to incorporate everyday strategies of the Science Club in formal classes, and that such permeability effectively happens due to the presence of students who attend both spaces. Furthermore, as a place for teaching practice, Science Clubs are *loci* where prospective teachers can add elements to their professional identity related not only to the construction of specific knowledge of the profession but to strengthening personal dimensions essential to professional practice. We conclude by referring to the highlighted conditions that are neither unique nor definitive and can be expanded and added to by other propositions.

iii) on the blended process: the IRaMuTeQ software can contribute to data organisation and the establishment of initial and intermediate categories, being characterised as an adequate tool that offers agility, rigour, and new possibilities to the analytical process. However, it is still essential to understand that there are important decisions only the researcher can take, such as recognising the central idea of the established categories, forming the final categories, and constructing the metatext. With this, we verify that the support of the IRaMuTeQ software, in the entirety of the constitutive stages of the discursive textual analysis method, is always, at best, blended.

Finally, with a view to improving this research, it is worth dealing in detail with the formations of the other intermediate categories presented. However, the effort here was to meet the demand for subcorpus analyses and

present the analytical process of the discursive textual analysis method supported by the IRaMuTeQ software.

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AUTHORSHIP CONTRIBUTION STATEMENT

VRL is the creator of the manuscript and directly responsible for structuring the metatext. MAR is responsible for the general writing, analysis, and processing of data in IRaMuTeQ. MGR (in memoriam) was responsible for overall oversight with writing and data analysis.

DATA AVAILABILITY STATEMENT

The data supporting the results of this study will be made available by the corresponding author, MAR, upon reasonable request.

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