

Overview of the contents covered in Libras (brazilian sign language) courses in science teacher preparation programs: analysis of the syllabi in undergraduate teacher certification programs in the biological sciences and chemistry

ABSTRACT

The integration of the Deaf person into society has been marked by several historical and philosophical conflicts on the road to full rights of citizenship. In Brazil, there have been several legislative milestones in that regard, including Law n° 10.436/2002 (BRASIL, 2002), which recognizes the Brazilian Sign Language (Libras) as the official language of the Deaf people, and Decree No. 5,626/2005 (BRASIL, 2005), which regulates Libras as a first language (L1) and written Portuguese as a second language (L2). Of particular relevance for the present paper, the latter decree codified the inclusion of Libras (Brazilian sign language) as a core course in key teacher certification programs, including Speech Therapy and Education. This inclusion of Libras is, in fact, a remarkable achievement regarding the education of the Deaf in Brazil since proper teacher training may be conducive to better inclusion of deaf students (ANDRADE, 2013). Using a documentary analysis of syllabi, we thus set out to analyze how the syllabus content for Libras courses is structured concerning the content for undergraduate teaching certification degrees in Chemistry and Biological Sciences. This qualitative study draws on 139 publicly-available syllabi of Libras undergraduate teacher certification courses in Chemistry and Biological Sciences of Higher Education Institutions (HEI), restricted to those receiving the highest scores (4 and 5) in the 2017 government assessment exercise (henceforth called "Enade"). Through content analysis, five Context Units (CUs) were established to identify which syllabus contents are considered and taught in college Libras courses in Brazil. The CUs for analyzing the syllabi coverage related to the following: Conceptions about deaf people; Educational Interpreters (EI); Bilingual Education; The teaching of Chemistry or Biological Sciences for the Deaf; and Approaches to inclusion in general or conceptions about special education. Although the analysis has shown us numerous variations of the teaching of Libras, with some content such as a focus on the treatment of the deaf as a standout topic, more research is needed. In particular, there is a tendency for the subject to receive a limited number of dedicated course hours, which does not allow for a broader grasp of the theoretical and practical issues related to sign language and bilingual education for the Deaf — especially with regard to the teaching of science.

KEYWORDS: Brazilian Sign Language. Libras. Teacher training. Science teaching.

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INTRODUCTION

This article is derived from doctoral research that had as its central theme an examination of how Brazilian Sign Language — also known as Libras — is taught in teacher certification programs in undergraduate Biological Sciences and Chemistry programs in Brazil. The subject of Brazilian Sign Language (henceforth, Libras), which is a core course for Education and teacher certification programs, was included in Brazilian higher education from the year 2002 after the officialization of the law then known as the “Libras Law” (No. 10.436 of April 24, 2002). Since its enactment, Libras has been part of the curriculum of initial teacher training courses; however, there is still little guidance and discussion as to how the teaching of this subject should actually be implemented. Teacher training always passes a complexity of necessary knowledge and currently involves much debate around the inclusion of special needs students in regular education.

When performing a literature review on the theme of Libras as a curricular subject, we found studies that sought to investigate the contribution of the issue in the process of initial teacher training (e.g., RECH; SELL; RIGO, 2018), as well as how the meanings of Libras are being built, from an analysis of Law 10.436/2002 and the syllabi of Libras courses in undergraduate teacher certification courses at the State University of Rio de Janeiro (CORDEIRO, 2016). There is also the master’s research of Perse (2011), which aimed to answer the following question: What conceptions about Libras and language teaching in higher education are responsible for the training of teachers and future researchers? That research used a corpus of syllabi from courses related to teaching Libras and Portuguese as a second language for the deaf from the five public universities in Rio de Janeiro. Taking stock of the extant research, the present study differs because it aims to analyze the specific offerings of Libras in the courses of initial training of STEM teachers in public and private HEIs in Brazil.

This article aims to analyze how Libras courses are structured in undergraduate teacher certification programs in Chemistry and Biological Sciences through a documentary analysis using Libras course syllabi to find empirical evidence of the contents covered during the initial training process.

As a starting point, we present as a theoretical framework to support the analysis and discussion of the data several key conceptual underpinnings including Language and Culture of the Deaf (e.g., SKLIAR, 2005, PERLIN, 2003, QUADROS, 2004), Bilingual Education of the Deaf, and Libras as a curricular subject in the initial training courses for science teachers in Brazil.

LANGUAGE AND CULTURE OF THE DEAF

After centuries of cultural and social oppression, Deaf people have, in more recent years actively sought cultural and linguistic valorization (QUADROS, 2004, GESUELI, 2006; ALMEIDA, 2012), but not from a perspective of deficit or deficiency. In this view, the Deaf¹ are understood as individuals with visual practices capable of building their own identity, from the

coexistence with other Deaf people by sharing sign language and Deaf culture. From this cultural perspective, it is understood that

[...] the deaf identity is not a label applied to those who are born without hearing, or lose it in childhood, it is not related to a physiological condition, but to be in the visual world and develop their experience in Sign Language (ALMEIDA, 2012, p. 18).

Throughout the history of deaf education, there are two conceptions of deafness: the clinical pathological conception in which deafness is seen as pathology, and the Deaf as disabled, which considers hearing impairment treated with devices or surgery and oral language as essential for the cognitive and linguistic development of the Deaf (SKLIAR, 2005) and the socio-anthropological conception, which considers deafness a difference and the Deaf as a member of a minority community, with the right to their own language and culture (PERLIN, 2003).

Conceptions around deafness have been approached through socio-anthropological assumptions, aiming at a better understanding of the challenges posed in different social spaces and, especially, in educational contexts. It is important to understand that education should approach the cultural and social conceptions of individuals. According to Skliar (2005), Deaf education and deafness should be understood as the way these subjects understand and modify the world (SKLIAR, 2005).

To be Deaf, therefore, is to belong to the deaf community that has as a predominant factor the use of sign language manifested through visual cultural experiences and behavior, shared by Deaf people from shared experience with their peers, including values, beliefs, literature or social events, be they formal or informal, comprising a type of society (PERLIN; THOMAS; LOPES, 2004). In view of this, the deaf author Karin Strobel clarifies the difference between the Deaf People and the Deaf Community.

The deaf as a people is composed of a group of deaf individuals who have customs, history, traditions in common and belong to the same peculiarities, that is, they build their conception of the world through vision. The deaf community, for its part, comprises deaf and hearing persons, who are family, interpreters, teachers, friends and others who participate and share the same interests" (STROBEL, 2009, p. 6).

Discussions about Deaf culture as well as the Deaf (people) allow the future teacher to know that unlike hearing students who learn and interact with an auditory oral language, Deaf students communicate through the visual channel. According to Quadros (2004, p. 47), "sign languages are called visual-gestural languages because the linguistic information is received by the eyes and produced by the hands."

From these visual experiences arises the deaf culture represented by sign language, through the different way of being, expressing, knowing the world, and of appropriating scientific and academic knowledge.

LINGUISTIC ASPECTS OF SIGN LANGUAGE

Sign languages came to be characterized as natural languages in the 1960s, after their linguistic recognition and because they emerged spontaneously from the inclusion of people who used the language and because signing allows for the expression of any descriptive, emotional, rational, literal, metaphorical concept, whether concrete or abstract (BRITO, 1998).

Libras, like other sign languages, has a grammatical structure based on some parameters that structure its formation at different phonological, syntactic, semantic, morphological and other linguistic levels, initially identified in ASL (*American Sign Language*) by the American linguist William Stokoe in 1960. According to Quadros and Karnopp (2004, p. 48), "Stokoe (1960) carried out an early structural description of ASL, demonstrating that signs could be viewed as compositional rather than holistic." Stokoe created a notation system for American Sign Language, which served as the basis for other proposals for writing for signs later analyzed and compared to Libras.

According to Gesser (2009), the structure of sign language is made up of parameters that combine. The three main and major parameters identified and named by Stokoe as "cheremes"² were: Hand Configuration (HC); Point of Articulation (PA) or Location (L) and Movement (M). Throughout their research, Quadros and Karnopp (2004) describe that the three identified parameters correspond to the "minimal units (phonemes) that constitute sign language morphemes in a way analogous to the phonemes that constitute morphemes in oral languages" (p.49). Thus, the morpheme in sign language is formed by phonemes fitted with the set of parameters, CM, PA and M and do not carry meaning in isolation (GÓES e CAMPOS, 2014, p.74).

Hence, we can see that meaning in Libras can then be created from what Góes and Campos (2014, p. 74) called formational parameters: hand configuration, point of articulation or location, movement, hand orientation and non-manual expressions (facial and body).

While the phonological level is related to the combination of parameters, the syntactic level is related to the construction of phrases and sentences, which obey a structure distinct from the Portuguese language, structured with six possible combinations of subject (S), object (O) and verb (V) (QUADROS, 2004). We therefore see the importance of understanding the grammatical structure of sign language because communication does not happen through isolated signs, but rather through the basic units that make up the structure of the language.

Libras, with all its visual and spatial grammatical characteristics, is the language of instruction used in the social contexts where the Deaf are present, such as associations, events and classrooms, even when these environments are sometimes permeated by oral languages. In the case of school contexts, the Deaf are inserted in a reality characterized by the coexistence of two languages, Portuguese and Libras — known as Bilingualism.

Bilingualism is the educational proposal that considers Libras as the first language of the deaf community and Portuguese as a second language in the written mode. Through the first language the Deaf acquire the second. However, even a putatively bilingual context the privileging of oral languages over Libras can be seen. "[...] the language that circulates all the time in the classroom and the pertinent pedagogical strategies are typical of those who guide from the condition of orality [...]" (BOTELHO, 2010, p.87). This finding may be related to the ignorance of the importance of Libras in the development and learning of Deaf students.

Thus, understanding the grammatical structure of Libras, as well as the recognition of this language as the primary language (L1) of deaf people, is important for the future teacher of science not only with regard to the optimal effectiveness of the signs used to establish communication with deaf students, but mainly in relation to the order of sentences in the written process and visual methodologies that can contribute to the acquisition of knowledge.

LIBRAS AS A CURRICULAR SUBJECT IN INITIAL TEACHER TRAINING

Among the many contributions of the Decree No. 5626/2005, especially in relation to deaf education, the inclusion of Libras as a curricular subject in teacher training courses in higher education in Brazil is of particular note as it served to enrich the initial training of teachers and improve the teaching and learning of the Deaf.

Chapter II of the Decree, which provides for the inclusion of Libras as a curricular subject, establishes in its Article 3 the mandatory inclusion of this subject "[...] in teacher training courses for the exercise of teaching, at secondary and tertiary phases of education, as well as in Speech-Language Pathology and Audiology courses at public and private educational institutions," which includes certification programs in various disciplines. For other higher and professional courses, the recommendation is that Libras be offered on an optional basis.

According to Silva and Banessi (2014), the mandatory nature of the subject in initial teacher training courses, "emerges with a new perspective for serving deaf people in terms of greater access to all areas of society in which they are inserted, including the educational sphere" (p.8). For it contributes to "preparing teachers to receive deaf students in regular classes, in line with the legislation regarding the inclusion of students with special needs" (p.2), in addition to contributing to more effective interaction in the classroom.

Considering that there are no curricular parameters in the normative documents that guide the teaching of this subject, it should be considered that even with the mandatory nature, it is still possible to find gaps in the initial training, which may lead to the exclusion of deaf students. As it is a teacher training subject, it cannot have the same profile as a basic language course, with an objective focused only on communication. Theoretical content and discussions around cultural and educational aspects of the Deaf should be included in syllabus description contents, as well as the role played by the professional interpreter of Libras contributing to the teaching-learning process

of Deaf students. Such attention may ensure more effective classroom integration as any discussion of training of teachers to work with deaf students must include the importance of the educational interpreter (EI) throughout the inclusive process.

Like the teacher, this other professional also plays a fundamental role in the process of inclusion of deaf students, as “(i)n addition to interpreting between two languages, he also assumes the role of educator, committed to student learning” (SANTOS, 2014, p.27).

The interpreter of Libras and the educational interpreter perform a similar job, because they interpret from Libras to Portuguese and vice versa. However, the educational interpreter acts specifically in the school environment and therefore must be able to deal with the different challenges presented in the classroom, which go beyond the communicative function (GILKE, 2018, p.22)

When the teacher allows for this relationship of partnership and collaboration — if successful and negotiated — it can only benefit the educational process, especially in relation to the teaching of science, since this area presents a major obstacle both for the understanding of the Deaf student (due to the complexity of scientific knowledge), and for the EI.

Despite this, it is noted that although adherence to the curricular component by teachers alone is still insufficient to acquire fluency in Sign Language, but it contributes to demystify misconceptions about deafness, covering the Deaf subject as a political and social being, with its own culture and community (MARQUES, 2016). According to Pedroso et al. (2010); Marques (2016) and Louzada et al. (2017), the mastery of Libras by teachers is not enough. It is also necessary to have a preparation that is focused on discussions related to linguistic and sociocultural differences of the deaf community and know how to use the tools in the context of science education for the Deaf in order to minimize other existing barriers beyond the linguistic one. For example, the lack of school resources, specialized educational care in schools, the absence of an EI; the lack of specific terminologies in the area of Science in Libras and the ignorance of the use of resources and visual materials in the evaluation processes o (FERNANDES; REIS, 2019), demonstrate that challenges do not cease to exist in the educational process only by investing in teacher training to teach Science to the deaf (SILVEIRA; SOUSA, 2008).

According to Schuindt (2017), the unpreparedness of teachers and interpreters for teaching and learning chemistry for the deaf can lead to scientific and technological illiteracy of these students, contributing to their exclusion, increasing this already high rate.

Given this context, it is important that the teacher responsible for Libras courses, as well as those responsible for preparing the curriculum of undergraduate teacher certification programs, be careful about the choice of content and the preparation of the syllabus in order to consider the discipline in which the future teachers will work. It is therefore not desirable to use the same program for all undergraduate courses of the Higher Education Institution (HEI); each discipline must consider its specific teaching for the Deaf. Therefore, in this work, we seek to verify which contents are included in

the syllabus of the Libras course in two programs focused on the area of Science: the teaching certification program in Chemistry and its counterpart in Biological Sciences.

METHODS

The data analyzed in this study refer to the menus of Libras subjects of undergraduate certification courses in Chemistry and Biological Sciences of public HEIs receiving scores of 4 and 5 (the highest) in the last National Examination of Student Performance (Enade), with results published in 2017. The present study is characterized as qualitative documentary research, with data analysis based on the methodological assumptions of the Content Analysis proposed by Bardin (2011).

For Fonseca (2002), documentary research is every analysis and study that is made of a document, highlighting the forms of writing, contextualization, and intellectual forms that compose it, thus schematizing all the information and ideas that one aims to extract from a given document. In this case, the main document is the syllabus.

The purpose of the syllabus is to "present a summary of the content and practical applications of a subject or course" (PERSE, 2011, p.69), i.e., the syllabus should describe a parameter for the teacher to organize what content will be worked on during the year, semester or four-month period, in a particular subject. Therefore, we understand the syllabus to be an essential part of the teaching plan, which directs the course of the class in an institution and that is why we decided to analyze the syllabi of Libras courses offered in the programs of the mentioned areas.

The decoding of data required in Content Analysis consists of three stages, which in the research were as follows: pre-analysis, search for the program courses and initial readings; exploration of the material in which the units of context and registration were built based on the research framework and; treatment of the results in which the results of the analysis of the syllabi were contrasted with the literature and enabled interpretations.

DATA COLLECTION

The process of collecting the documents began with the search for the results of the 2017 Enade, released by Inep (Brazilian National Institute of Research and Studies) in October 2018. The choice for this exam is because until the completion of this research, Inep had not released the result in the last Enade (government assessment exercise), held in November 2021.

The purpose of this search was to identify the HEIs that had undergraduate teaching certification programs in Chemistry and Biological Sciences awarded scores of 4 and 5 (the maximum), because they are more established courses and, with over twenty years of existence, it is expected that their Libras courses are better structured.

Thus, sixty HEIs of undergraduate teaching certification courses in Biological Sciences were identified with a score of 4, and sixteen HEIs awarded a 5, totaling seventy-six public HEIs, encompassing fifty-three at the federal level, twenty state, three municipal. As for the undergraduate teaching certification programs in Chemistry, a total of seventy-five institutions were found, sixty of which were of the federal category, twelve state and three municipal. Of the total seventy-five HEIs found, fifty-nine had a score of 4, and sixteen had a score of 5, according to the Enade government assessment exercise. After collecting these data, the HEIs were coded according to each course analyzed, HEI -B, to represent the undergraduate teaching certification programs in Biological Sciences, and HEI -Q to denote the undergraduate programs in Chemistry, Shown in the model presented in Table 1.

Table 1 - Example of the coding of the programs in each HEI

Coding	HEI	Abbr eviation	Campus	Administrative Category	Mode of instruction
HEI-B-01	Federal University of Sergipe	UFS	São Cristóvão , SE	Federal	In-person

Source: The authors (2022).

After conducting a survey of the Brazilian public HEIs that offer undergraduate teaching certification programs in Biological Sciences and Chemistry, given scores 4 and 5 (the highest possible) by the government, we began the search for the syllabi of the Libras courses offered by these programs. The search for these data took place using the internet, on the websites of the HEIs, on program-specific pages and via e-mail and/or telephone contact with administrators and departments. However, some programs did not have publicly-available syllabi, and even when requested via e-mail or telephone, we sometimes did not receive a response. It is for this reason that we had to exclude the undergraduate Biological Sciences certification programs of UNESPAR, UFBA and UFRRJ, and the Chemistry degree counterparts at UERJ, UFRRJ and IFPI.

Once the one hundred and forty-five syllabi were identified — seventy-three of which referred to the Biological Sciences courses and seventy-two to Chemistry — we initiated the process of reading and categorization. While counting the documents it was observed that some HEIs offer the same syllabus for both programs (Chemistry and Biological Sciences) analyzed, as in the case of UFAM, UFS and UNESP — which also present the same syllabus across all *eight campuses*. We therefore treated each case with individual attention.

It was also observed that some syllabi did not present the full profile of the class, but rather simply the course aim, while others brought a very brief explanation of what the subject would be, which made it impossible for us to analyze the scope of contents covered. The syllabi HEI-B-06, HEU-Q-42, HEI-Q-48, HEI-Q-50, HEU-Q-64, were discarded, altering the total amount of data from one hundred and forty-five to one hundred and thirty-nine analyzed syllabi, seventy-one of which refer to undergraduate teacher certification programs in Biological Sciences and sixty-eight refer to undergraduate courses

in Chemistry. The HEIs whose syllabi were ultimately included in the analysis were as follows: UFS, UFAM, UFPI, UFOP, UFSCAR, UFV, UEL, FURG, UFU, UECE, UNICAMP, UNESP, UEM, FURB, UFSJ, UFMA, UFAC, UEMA, UFPA, UFRN, UFPR, UFES, UFSM, UFG, UFSC, UFRJ, UFRPE, UTFPR, UNIOESTE, UFPEL, UESB, UNIRIO, UFMS, UNEMAT, IFFluminense, UNICENTRO, IFCE, IFSP, UFCG, IFTM, UFT, UFABC, UFB, UFC, UENP, UFOB, UNB, UFRRJ, UNESPAR, UFV, UFF, UFMG, UFJF, UNITAU, UFOP, UFBA, UFMT, FURG, UESC, UNEB, UDESC, UFSJ, UFRN, UFES, UFPE, UFRGS, UFLA, UNIFAL, UNIFEI, IFBA, UEFS, IFGoiano, IFPE, IFRJ, IFFarroupilha, IFB and IFMS.

It is important to clarify that our objective with the syllabi was not to analyze the scope and sequence or the basic references of the course, since this information is included in the individual class syllabi, to which we had no access. Thus, after the open reading of the one hundred and thirty-nine syllabi, the Context Units (CUs) and the Units of Record (UR) were established. It is worth clarifying that some programs had two class levels of Libras (Libras I and Libras II); in this case, both were counted and the contents were analyzed according to CU and UR. Moreover, when necessary, the syllabi were divided and accounted for in more than one UR. In the next item, we will present the result of the organization and analysis of the reading of the syllabi.

DATA ANALYSIS AND DISCUSSION

The analysis of the syllabi resulted in five Context Units and their respective Units of Record with themes presented in the descriptions of the courses analyzed.

The first context unit - **Conceptions of the Deaf** brings the records related to the contents covered in the descriptions that identify (or not) discussions in relation to historical and philosophical aspects of the Deaf people through four URs, as presented in the following table.

Table 2 - Number of RU records and examples referring to UC1 data

UR	Records and examples
1.1	107 records
Historical aspects of deafness related to sign languages	"Brief study on deafness and hearing impairment; the deaf person and related historical issues" - HEI-B-57
1.2	120 records
Libras as a natural language (grammatical aspects)	"Parameters in Libras; linguistic notions of Libras; transcription system; sentence types in Libras; incorporation of negation and grammar of Libras" - HEI-Q-56
1.3	76 records
Deaf Culture/ Identity	"Deaf Identities and Deaf Culture" - HEI-Q-57
1.4	43 records
Educational Legislation and Policies	"Bilingualism and deaf education: legal and political-pedagogical guidelines" - HEI-B-67

Source: The authors (2022).

As shown in Table 2, the content concerning the historical aspects of deafness is present in approximately 77% of the syllabi analyzed, which means that discussions about the Deaf, including historical and philosophical characteristics of deaf education as well as the emergence of sign languages, are topics that provide another perspective in future teachers in relation to these people.

UR 1.2 sought to compile the contents related to the linguistic aspect of Libras as a natural language and its grammatical characteristics, identified in more than 80% of the analyzed syllabi. Therefore, we see that the courses consider the linguistic aspects of Libras an important subject to be covered during teacher training because it enables students to know and understand that Libras is not a reproduction of oral languages, and that communication does not happen through isolated signs, but through the basic units that make up the structure of the language. The signs arise through the combination of the parameters, providing a complete and effective communication.

UR 1.3 - Deaf Culture/Identity appear in smaller quantities, compared to the UR presented so far. About 54% of the syllabi point to discussions around deaf culture and identity as it is not desirable to study a language without evoking the identity and culture of the people that use it to communicate, and since "language and culture are intimately and mutually related" Marconi (2009, p. 288).

When discussing deaf culture, the Libras course instructor also makes room for discussions about history, laws, literature, cultural artifacts, and finally, the language. As we already saw in the quote from Pedrosa et al. (2010), teaching focused on the communicative aspects of language is important, but should go further to offer knowledge about culture and identity, enabling teachers to discuss and reflect on who this student is and make them understand that Deaf people are built by multiple identities related to linguistic and sociocultural differences in deaf communities. These differences need to be present within the school so that the education of these students includes what the legislation addresses regarding the bilingual model of education, however, not all courses present this content in their syllabi. UR 1.4 - Legislation and Educational Policies carries contents that appear in smaller quantities in the syllabi compared to the others, that is, 31%.

With these data, we can see that there are few discussions involving more theoretical content related to what the legislation proposes regarding bilingual education, as well as the rights of the Deaf in regular schooling. Thus, it is possible to show in Table 2 that most of the syllabi analyzed in this CU incorporate more discussions focused on the conceptions about the Deaf in terms of the historical, cultural and linguistic aspects of Libras, making up more than half of the course content.

CU2 - Educational Interpreter presents the records referring to the contents covered in the syllabi that identify (or not) discussions about the development, profession and performance of educational interpreters (EIs) vis-à-vis inclusion of the deaf student in inclusive classrooms, as well as the role assignments of the teacher and the IE in the deaf teaching-learning process,

and the interpretation and translation techniques used in the Portuguese-Libras and Libras-Portuguese communication process.

Table 3 - Number of RU records and examples referring to UC2 data

Context Unit 2 (CU2) - Educational Interpreter	
UR	Records and examples
2.1	12 records
Understanding the role of the interpreter as a mediator of communication	"Understanding the role of the educational translator/interpreter" - HEI-B-29
2.2	4 records
Duties of the teacher and EI	"Knowledge of the nomenclature and of professionals involved in the education of deaf subjects" – HEI-Q-68
2.3	7 records
Libras/Portuguese and Portuguese/Libras Interpretation techniques	"Theory of translation and interpretation. Introduction to Libras/Portuguese translation techniques. Introduction to Portuguese/Libras translation techniques" - HEI-B-07

Source: The authors (2022).

The educational interpreter of Sign Language is closely involved in the teaching-learning process of the deaf student, being expected of him a certain posture and actions that are consistent with that of an educator and classroom in these conditions. "The educational interpreter working in the educational arena must be able to mediate the relationships between teachers and students, as well as between deaf and hearing colleagues" (QUADROS, 2007, p. 60) and it is in the possession of such qualities that the EI for Sign Language has become to be noted as special. However, there is still little recognition and understanding about EI in the education of Deaf students, since their work is not (only) one of a technical nature, but can also be considered a pedagogical endeavor. Therefore, knowing this professional, as well as her or his role in the educational inclusion of Deaf students in regular schooling is an important discussion in initial teacher training courses. However, only 8% of the syllabi address this theme.

Some HEIs that offer both courses present the same course descriptions, as is the case of the Federal University of ABC (UFABC), Federal University of Santa Maria (UFSM) and State University of Londrina (UEL) and the excerpts included in the analyzed documents are similar: "**the role of the interpreter in deaf education**", "**understanding the role of the educational translator/interpreter**" and "**the role of the interpreter**," respectively. In addition, the corpus of analysis related to undergraduate courses in Chemistry also includes the syllabi from the Federal University of Viçosa (UFV) - "**role of the translator and interpreter of Libras/Portuguese Language**", Federal University of São José Del Rei (UFSJ) - "**role of translators - educational interpreters of Libras - Portuguese**" and the Federal University of Pernambuco (UFPE), which is already mentioned in Table 3.

UR 2.2 - brings the records of the syllabi that address discussions or content about the attributions of the EI and the teacher, present in the same educational environment. We found that few documents bring this theme, as presented in the previous table. Only the Federal Institute of São Paulo (IFSP) of the city of Sertãozinho presented what seems to include this theme, because by citing "**knowledge of the nomenclature of professionals involved in the education of deaf people,**" we imagine that this excerpt contains approaches about knowing not only the EI, but also other professionals involved in this context, such as the regular classroom teacher, special needs teacher, the bilingual teacher, the teacher of Libras, etc. Considering a team effort that includes the teaching-learning process of Deaf students.

Although we identified that only 3% of the syllabi address this topic, as shown in Table 3, we emphasize the relevance of the discussion regarding the duties of each one in the school environment because it enables the future teacher of Chemistry or Biological Sciences to see the IE as a support in the teaching and learning process of deaf students and not assign functions that are their responsibility to this professional.

For Santos (2010), teachers, for lack of understanding, delegate to the EI all the responsibility for deaf students, including the wrong use of the term "their students" when the deaf are actually students at the school. From this perspective, Lacerda (2015) clarifies that the teacher is responsible for planning the classes, for deciding which are the appropriate contents and the assessment of students. However, the EI is the professional who knows the deaf student, as well as their difficulties and their deafness and can collaborate with the teacher by suggesting activities and working in partnership aiming at a more harmonious inclusion of deaf students.

In addition to these units, during the reading of the syllabi we identified that approximately 5% of the texts had excerpts about the translation and interpretation techniques between languages, i.e. Libras and Portuguese. Therefore, we decided to add this UR 2.3 to the others because it is a theme related to the role of the EI.

It is noted that few courses incorporate discussions about the translation and interpretation techniques that are used by EIs in the school environment. When discussed, this theme identified in seven of the syllabi may provide the future teacher insight into certain moments of the class in which the EI will translate simultaneously from Portuguese to Libras. On other occasions, for example, during a moment of questioning, comment or presentation of papers, the deaf student will sign (through Libras) and the EI will take over the student's speech, translating from Libras to Portuguese and this translation may happen in the first person, and consecutively: "(T)he receiver following the interpretation builds the notion that this speech is not the interpreter's but who has the floor at that time" (ALBRES, 2012, p.50). The adoption of techniques used during interpretation depends on the type of utterance to be interpreted.

However, we can conclude that discussions about the EI and the hearing teacher in the inclusive classroom do not feature prominently in the syllabi

analyzed. Few courses present specific content on the duties, functions and involvement of these two professionals vis-à-vis the learning of deaf students.

CU3 - Bilingual Education, includes all the content found in the syllabi that address the theme of the bilingual education model in deaf education. This unit is subdivided into three URs. In UR 3.1 – where the descriptions carrying content related to the process of language acquisition in the primary language L1 – Libras and secondary language L2 – Portuguese are presented, as well as the writing of Portuguese as a second language by deaf students. UR 3.2 – brings approaches regarding methodological strategies for teaching both languages based on Visual Pedagogy and production of teaching materials. And last but not least, UR 3.3 - includes the records about the practical teaching of the language focused on signs and vocabularies.

Table 4 - Number of records and examples of the UR referring to the data of CU3

Context Unit 3 (CU3) - Bilingual Education	
UR	Biological Sciences/ Chemistry
3.1	31 records
Portuguese as an L2 and Language Acquisition (L1 and L2)	"Process of acquisition of Sign Language observing the similar differences existing between it and the Portuguese Language" - HEI-Q-13
3.2	9 records
Visual Pedagogy or strategies and methodologies for the teaching learning process of the deaf. Production of teaching materials.	"Introduction to methodological strategies for teaching deaf students. Production of pedagogical teaching material for the inclusion of the deaf student in the context of the classroom" – HEI-Q-28
3.3	111 records
Signs/Vocabulary	"The typing alphabet. Non-manual expressions. Use of space. Classifiers. Libras vocabulary in different contexts. Dialogues in Sign Language" – HEI-B-31

Source: The authors (2022).

The process of acquisition of Portuguese by Deaf students does not occur naturally, that is, in frequent contact with native speakers, but formally in the school environment. Thus, the educational proposal of Bilingual Education is the most appropriate, given that it considers Libras as the natural language of the deaf and is based on this assumption for the teaching of written Portuguese (QUADROS, 1997).

Salles and collaborators (2004b, p. 34) point out that one of the difficulties encountered by deaf students with the Portuguese language concerns the "connection between words, segments, sentences, periods and paragraphs," that is, the sequential organization of thought in cohesive chains in written Portuguese. This is due to the fact that oral and sign languages have structural differences that make syntactic relationships occur in different ways.

Bernardino (2000) specifies that it is common to find such features as short sentences, sentences without verbs, lack of coherence in the

organization of sentences, gaps in parts of texts, writing words that do not exist (among others) in the writing of deaf students due to the linguistic difference between the visual spatial language (Libras) and auditory oral language (Portuguese).

These findings presented by the authors, when discussed in a teacher training course, enable those responsible for education, at different levels of education, to know the linguistic peculiarities and issues involving their development/learning; that teaching practices designed for this community should be continuously outlined and reflected on because, according to Lodi (2004, p.36), "the writing of deaf students will always be that of a 'foreigner' user of the Portuguese language".

It is for this reason that Decree 5626/2005 deems that "mechanisms of evaluation consistent with the learning of the second language, in the correction of written tests valuing the semantic aspect and recognizing the linguistic singularity manifested in the formal aspect of the Portuguese language" (BRASIL, 2005) be adopted for the Deaf.

In addition to the offer of education in their first language, guaranteed under Decree No. 5.626/2005, the use of visual resources as support for such acquisition, currently called visual pedagogy (Lacerda, 2014) has presented itself as a pedagogical practice that aims to ensure meaningful learning for this portion of society. Kelman (2011) refers us to the fact that in addition to the use of oral language and sign language in the teaching/learning processes, the use of varied visual resources can contribute significantly to the learning of deaf children, stressing the need for these resources to be included in the pedagogical strategies aimed at these students.

However, we observe in table 4 that the number of records found is modest as only 6% of the documents analyzed present this theme. These data are in line with the conceptions presented by Silva and Gaia (2012, p. 12), when they state that during undergraduate studies, few pedagogical and general training subjects address visual pedagogy.

The content aimed at teaching basic signs and vocabularies, which corresponds to UR 3.3, appears frequently in the analyzed syllabi, comprising 80% of them. Vocabulary teaching is essential and fundamental to acquire knowledge of the language and use it to communicate with Deaf people. Leite (2001) describes how common it is in Libras classes for listeners to learn first the vocabularies to only then build sentences and dialogues.

The penultimate unit created, **CU4 - Teaching Chemistry or Biology to the Deaf**, was specifically designed to identify the relevant themes regarding teaching these subjects to Deaf students. Two units of record emerged, one involving the specific signs in these disciplines, and the other focused on strategies and methodologies for Science Teaching. The number of documents found with this theme will be presented below, as well as an example of a syllabus for each program.

Table 5 - Number of RU records and examples referring to CU4 data

Context unit 4 (CU4) - Teaching chemistry or biology to the Deaf	
UR	Biological Sciences Chemistry
4.1	9 records
Signs specific to the disciplines of Chemistry and/or Biology	"Basic Libras Vocabularies: General and Specific Contents of the Chemistry Teaching Context" – HEI-Q-54
4.2	1 record
Methodological strategies specific to science	"Methodologies for teaching science and biology to the deaf. Presentation of in-school activities aimed at teaching the deaf in the disciplines of science and biology" - IES-B-23

Source: The authors (2022).

Regarding Science Teaching for Deaf students, it is quite common to find works and studies pointing to the inexistence and scarcity of technical or scientific terms that do not have an equivalent match in Libras.

Freitas (2001) and Quadros and Karnopp (2004) reveal that there is a lack of scientific terminology in Libras, which may interfere with the negotiation of meaning of scientific concepts by teachers, students and interpreters, thus hindering the teaching and learning of science.

Marinho (2007) also reports that in addition to the lack of sufficient signs to carry out interpretations in the field of Biological Sciences, the texts full of biology terms are presented in language that is not easily accessible by deaf students.

Therefore, it is necessary that the regular classroom teacher, responsible for these subjects, plan, design and develop lessons with methodologies based on visual elements (drawings, maps, graphs, photographs, etc.), which provoke debate, bringing up concepts and opinions that can be deepened towards the objectives intended by the teacher (SIMÕES et. al. 2011).

Despite the lack of terms in the area of Science, it is possible to find some sign-related materials, including vocabulary and glossaries, with signs created within scientific research and available in digital format. However, future teachers seem to be unaware of the existence of such materials, as only three of the syllabi (Table 5) in all seventy-one Biological Science programs analyzed, and six of the sixty-eight undergraduate courses in Chemistry, featured this theme in the text. Regarding the specific methodological strategies for the teaching of science, this result was even lower, with only the Federal University of Pará (UFPA) including this content in the description of its undergraduate teacher certification program in Biological Sciences.

Approaches to inclusion in general or conceptions about special education is the last context unit - **CU5**. This aimed to identify in the themes presented in the syllabi addressing (in addition to Libras) general or specific discussions about special education and/or inclusion and Libras as a course in teacher training.

Table 6 - Number of RU records and examples referring to CU5 data

Context Unit 5 (UC5) - Approaches to Inclusion in general	
UR	Biological Sciences Chemistry
5.1	20 records
Present general discussions around inclusion	"Proposes a reflection on the National Policy for Special Education from the perspective of inclusive education and the national guidelines for Special Education in Basic Education" - HEI-B-45
5.2	120 records
Do not present general discussions around inclusion	"The Brazilian Sign Language (Libras): concepts and parameters. Visual description and linguistic/topographical signage space. Presentation of basic vocabulary for understanding the structures and regularities in Libras" – HEI-Q-44
5.3	11 records
Libras in teacher training	"Education of the deaf in teacher training, school reality and otherness" – HEI-B-20

Source: The authors (2022).

As shown in Table 6, almost 90% of the syllabi do not include general discussions on the theme of inclusion in regular education. Most discuss issues specifically involving deafness and deaf education while others address Libras as a training subject.

Faced with the reality of an inclusive school, open to all, and with the responsibility and commitment to teaching and learning for all, the regular classroom teacher, who encounters a diversity of children on a daily basis, including some considered target audiences of Special Education, having consistent training is very important (TOLOI, 2015). Not only does the special education teacher need preparation and professional development (OLIVEIRA, 2004), but also the common education teacher. The training of the head teacher of a classroom from the perspective of inclusiveness assumes relevance for the construction of a school responsible for the teaching of and learning among students, favoring the right of all to education.

The vast majority of undergraduate teacher certification programs do not include courses focused on Special Education or Inclusive Education, which restricts students from understanding and discussing this reality. The Libras subject, in most cases, is the only one in the program focused on the area of special education. However, due to the limited number of course hours devoted to it, it does not allow the teacher to address more general discussions about the mastery of basic knowledge regarding pedagogical procedures that promote educational inclusion based on a solid curriculum that includes diversity and inclusion as content and subject of study.

From the analysis of the syllabi, one can see that the Libras courses present in the curricula of undergraduate teaching certification programs in Chemistry and Biological Sciences, planned as presented, propose a diversity of content in relation to different themes that can contribute to the end of prejudice and fear of having a deaf student in the classroom.

As we have observed, the most common aspects in the syllabi chiefly concern the historical and linguistic aspects of the education of the deaf,

focusing on the teaching and learning of the language, teaching signs/vocabularies. The history of education of the Deaf is important as Deaf people have suffered several limitations due to linguistic barriers and prejudice in the use of sign languages. Such knowledge allows the student to construct the concept of deafness in a way that is distinct from what is observed in common conceptions.

When thinking about the training of Biological Sciences and Chemistry teachers who will work in inclusive classrooms, which will possibly have the presence of deaf students, other content also needs to be covered so that the subject does not fall on the training of teachers fluent in sign language, but on professionals who need to know how to position themselves within the inclusive proposals, recognizing their difficulties, but aware of the resources and needs for adequate attention to deaf students (CAETANO & LACERDA, 2014).

In view of this and reflecting on the analysis carried out, we can see that many contents that are considered relevant for the training of the future teacher are only included in very few syllabi — less than 10%. Such contents would include the performance of Sign Language, the EI in the school environment, strategies and methodologies for the teaching-learning process of the deaf, and specific topics for science teaching, such as signs in the areas of Chemistry and Biological Sciences, and methodological strategies for Science, as shown in Table 6.

The limited time allotted for such courses (30 and 60 semester hours), may be one of the reasons why these contents are not covered. However, it is necessary to include discussions on this theme, even if in a single class, or due to the relevance for teacher training.

One suggestion that could assist in this process is to provide discussions about the role of EIs and their participation in educational spaces, inviting an EI to share a few words in relation to their experience in Chemistry and Biology classes, including how the lack of specific signs interferes with their work and how the teacher, as an educator, can assist them. At the time of the class, the EI needs to feel free to negotiate content with the teacher, reveal their doubts, the learner's questions and mediate the relationship with the student, so that the desired knowledge is built.

The lack in Libras of specific lexicon in the area of Science is an obstacle to be overcome not only by the HEI, which offers Libras as a class, but by the whole system that involves working with deaf people. Although there are a number of studies in this area, the amount of existing signs and published materials is still insufficient, aside from a paucity of sharing, for example, national documents with scientific signs. For this reason, the Libras subject, especially in science courses, needs to involve discussions about this gap. Libras classes should also present existing terms, glossaries and signs to students/future teachers, coming from academic research, as well as methodological strategies that can be used to fill this gap.

With the absence of a specific lexicon, both the Chemistry and Biological Sciences teacher and the EI of Sign Language need to resort to educational strategies that can assist them in explaining the content of the area, getting

the deaf student to understand abstract scientific content. The course may provide undergraduate teacher certification students with activities that simulate a classroom situation, in which supposedly there are deaf students, for example, asking them to make a lesson plan from the use of various visual resources, such as models, data-show, experiments, etc., as suggested by Visual Pedagogy. At this stage, the activity with teachers in training can address the different roles of the EI — who often has training in “Letras” (language studies) and Libras — and the science teacher, who is the professional responsible for the organization and presentation of scientific content.

As shown in Table 6, only twenty syllabi included mention of special education and/or inclusiveness along with the teaching of Libras. Despite considering the theme of special education one that should cut across disciplines, we agree that not only the Libras should incorporate discussions or content focused on the area of special and inclusive education, but also other courses of the program, such as educational policies, didactics, etc., or even, when possible, that the programs offer specific classes focused on this theme.

These courses provide reflections that enable the teacher to realize what the specificities and affordances of students are, in order to offer them the necessary tools for constructing new knowledge (TOLEDO and MARTINS, 2009). It can thus be asserted that the teacher in training, as well as her or his understanding of classroom diversity, will necessarily influence the way in which they acquit themselves with their students.

CONCLUSION

The teaching of Libras to future teachers is a topic that enthralled us upon taking on this research. Since the publication of Decree 5.626/2005, Libras has been included as a mandatory curricular component in all undergraduate teaching certification programs in Brazilian public HEIs. Sixteen years on, how this course is taught is still quite worrying since the decree mentioned above document does not contain specific guidelines or norms defining how the class should be incorporated, nor its objectives, workload, scope, and training needs of students.

Although our analysis has shown that there are numerous possibilities of offering the subject, further research in this area is still necessary, since so far there are many limitations, such as the short period that the subject is offered annually or biannually, which does not allow ample knowledge about the theoretical and practical issues related to the signs and bilingual education of deaf students to be transferred. According to the data surveyed here, more than a term-long total course load of 30 or 60 hours is needed to understand a whole language. Therefore, given the importance we assign to this subject, an alternative would be to teach this course from the very beginning of the program, either annually or each semester, with content defined by teachers according to discipline and in addition to theoretical content mentioned here that provide students with discussions and exchanges associated with the other classes — in complement to moments of reflection throughout the process of their training as a person and future teacher.

Regarding the syllabi, the lack of more detailed information about the purpose of the Libras course in teacher training courses in Decree No. 5.626/2005 makes each university define that purpose according to their perceptions of which themes may be relevant or not. This was very clear in our analysis since some descriptions presented a good deal of diversity in their content, while others were focused only on the teaching of signs. While we know that the syllabi alone do not define the subject as a whole, they nonetheless delimit what should be addressed and allow us to perceive what is considered essential (or not) for the programs concerned.

It has yet to be the objective of this study to provide an exhaustive list of themes that Libras courses should cover, given that such an undertaking can result in fossilized and decontextualized recommendations. However, considering what is shown in the literature and what has already been evidenced by the data in this paper, the importance becomes clear of further research into the training of science teachers and the teaching of the Deaf beyond the vision of Libras as a class that should merely focus on knowledge of basic signing. Although outside the main scope of the present paper, we see the training of Libras teachers who work in teaching courses to be of great relevance and importance because these professionals play an essential role in transforming the policies that guide teaching in the various programs into effective actions to train future teachers capable of understanding the Deaf and enabling the learning of science.

Due to the limited time available, offering Libras in undergraduate teacher certification programs does not permit and does not aim to train bilingual teachers (fluent in both Libras and Portuguese). Still, it should support future teachers to understand the different linguistic conditions between deaf and hearing students, the awareness of which can be conducive to developing proactive strategies, providing the opportunity for the various symbolic spheres to be used for the construction of new knowledge from Libras. In addition, the future teacher must understand that a visual experience characterizes deafness and that deaf people are part of a specific linguistic-cultural community and must therefore grow to know how to communicate in Libras with their deaf students and be able to prepare suitable classes – ones that are visually rich, clear and that facilitate the performance of the EI and the understanding of the deaf student.

The doctoral work from which the present paper is derived also investigates the vision of Libras teachers and students of undergraduate teacher certification programs in Biological Sciences and Chemistry with regard to the Libras in these programs. The units of analysis of this article are also the focus of investigation with the participants. They will be presented in future articles enabling a more comprehensive view of the impact of the subject of Libras on the training of undergraduate Science teacher certification programs.

Panorama dos conteúdos abordados nas disciplinas de libras em cursos de formação de professores de ciências: análise de ementas de cursos de licenciatura em ciências biológicas e em química

RESUMO

O contexto para inserção da pessoa Surda na sociedade é marcado por diversos conflitos históricos e filosóficos até que os Surdos conquistassem seu direito pleno de cidadania. Entre as principais conquistas da comunidade surda temos: a Lei nº 10.436/2002 (BRASIL, 2002), que reconhece a Língua Brasileira de Sinais (Libras) como língua oficial do povo Surdo; e, o Decreto nº 5.626/2005 (BRASIL, 2005), que regulamenta a Libras como primeira língua (L1) e a língua portuguesa escrita como segunda língua (L2), além de determinar a inserção da disciplina de Libras nos cursos de Fonoaudiologia, Pedagogia e demais licenciaturas. Essa é, de fato, uma grande conquista no que diz respeito à educação dos Surdos, já que o preparo adequado de professores pode favorecer uma educação de qualidade aos alunos Surdos em situação de inclusão (ANDRADE, 2013). Diante disso o presente artigo teve como objetivo analisar como a disciplina de Libras é organizada em relação aos conteúdos para cursos de Licenciatura em Química e licenciatura em Ciências Biológicas a partir de uma análise documental de ementas. Essa pesquisa de cunho qualitativo teve suas fontes dos dados o quantitativo de 139 ementas de Libras dos cursos de Licenciatura em Química e Ciências Biológicas de Instituições de Ensino Superior (IES), públicas avaliadas segundo o Enade de 2017 com nota 4 e 5. Por meio da análise de conteúdo foram estabelecidas cinco Unidades de Contexto (UC) que contribuíram para que identificássemos quais os conteúdos são pensados e contemplados durante a disciplina de Libras. As UC para a análise das ementas abordavam conteúdos relacionados a: Concepções sobre o sujeito surdo; Intérprete Educacional (IE); Educação Bilíngue; O ensino de Química ou Ciências Biológicas para Surdos e Abordagens sobre a inclusão de maneira geral ou concepções sobre a educação especial. Embora a análise tenha nos mostrado que há inúmeras possibilidades de se ofertar a disciplina e que conteúdos como os aspectos sobre o sujeito surdo é um dos conteúdos mais presentes, é necessário mais pesquisas nessa área, visto que até o presente momento existem muitas limitações, principalmente em relação a pouca carga horária destinada a disciplina, e que não possibilita amplo conhecimento quanto às questões teóricas e práticas voltadas aos sinais e a educação bilíngue dos Surdos principalmente no que tange o ensino de Ciências.

PALAVRAS-CHAVE: Libras. Formação docente. Ensino de Ciências.

NOTES

1 The term Deaf "with a capital D" in various strategic points in this text is highlighted as a form of empowerment, showing the personal view of the first author and as a professional in the area, as one of respect and recognition of the identity experienced by Deaf individuals, including their linguistic and social values, as well as the entire historical and cultural process that involves them. Several authors use this same strategy, such as Lane (2008. p. 284) and Castro Júnior (2011, p.12).

2 Also "cheireme" from the Greek χείρ ("hand") - smaller units of the hands

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