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ARTICLES

The subject of Libras in teaching undergraduate degree of Chemistry and Biological Sciences: current tendencies and change proposals

A disciplina de Libras em cursos de licenciatura em Química e Ciências Biológicas: tendências atuais e propostas de mudanças

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Abstract

With the recognition of the Libras following the publication of Law No. 10.436/2002 and Decree No. 5,626/2005, Libras became a mandatory curricular subject in all undergraduate courses at Educational Institutions in Brazil. Therefore, this article aims to answer the question: Does the Libras discipline present in the curriculum of undergraduate courses in Chemistry and Biological Sciences address or provide discussions aimed at teacher training from the perspective of inclusive education? For this, the objective is to analyze the contents covered and discussed during the training of undergraduate students, according to the vision of Libras teachers and students of undergraduate courses in Chemistry and Biology. The data was collected from a documentary analysis, interviews with teachers and students, and analyzed according to Bardin's (2016) categorical analysis technique of content analysis. The results highlighted some discrepancies in the content assigned in the syllabi, the teachers' opinions, and what was learned by the students. This may be related to the lack of more detailed information about the role and objective of this discipline in teacher training courses, which are not included in the aforementioned Decree for each HEI to define how the discipline will be offered.

Keywords: Libras discipline, Teacher training, Biological Science and Chemistry teaching

Resumo

Com o reconhecimento da Libras, a partir da publicação da Lei n.º10.436/2002 e do Decreto n.º 5.626/2005, essa passou a se constituir como disciplina curricular obrigatória em todos os cursos de licenciatura das instituições de ensino do Brasil. Este artigo, portanto, pretende responder à seguinte pergunta: a disciplina de Libras, presente na grade curricular dos cursos de licenciatura em Química e Ciência Biológicas, aborda ou proporciona discussões voltadas à formação de professores na perspectiva da educação inclusiva? Para isso, o objetivo desta pesquisa é analisar, segundo a visão de professores de Libras e estudantes dos cursos de licenciatura em Química e Biologia, os conteúdos abordados e discutidos durante a formação dos licenciandos. Os dados foram coletados a partir de análise documental, entrevistas com esses sujeitos e analisados, segundo a análise categorial de conteúdo proposta por Bardin (2016). Os resultados evidenciaram algumas discrepâncias em relação aos conteúdos atribuídos nas ementas, à opinião dos professores e ao que foi aprendido pelos estudantes. Isso pode estar relacionado à falta de informações mais detalhadas sobre o papel e o objetivo dessa disciplina nos cursos de formação docente, que não são contemplados no Decreto, permitindo que cada IES defina, como ela será ofertada.

Palavras-chave: *Disciplina de Libras, Formação de professores, Ensino de Ciências Biológicas e Química*

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Introduction

Nowadays, the education of Deaf[1] people in Brazil has been broadly discussed. Two important documents, which guarantee the accessibility of almost 10 million Deaf people in the country (IBGE, 2012), stand out: the Law n.º 10.436, from April 24, 2002 (Brasil, 2002), that recognized Brazilian Sign Language (*Língua Brasileira de Sinais* – Libras), as a means of communication and expression of the deaf community, and the Decree n.º 5.626, from December 22, 2005 (Brasil, 2005), which raised great advances to the discussions and the research in Deaf education and in the Libras area by foreseen its implementation as a subject in the curriculum of teacher education in middle and higher education, and in the Speech Therapy degree (Brasil, 2005; Costa & Lacerda, 2015; Lodi, 2004).

According to Silva and Banessi (2014), the obligation of the subject in the Teaching degrees "emerges as a new perspective to attend deaf people, providing more access in all societal spheres in which they are inserted, including the educational one" (p. 8). However, the same document does not mention or offer any guidelines regarding how the subject must be offered in the institutions, its format, focus, organization of study load, the content to be taught/and or the methodology.

Despite the lack of clarification and objectives in the legislation, the inclusion of Libras as obligatory in the Teaching degrees and in Speech Therapy, and as an optional course in the other degrees in Brazil is (or should be) an opportunity to train future professionals that are able to understand and value a "visual world" with perceptions and sociocultural experiences that are different from those of a hearing person.

Hence, the present work presents new reflections related to the issue of the subject Libras in the Teaching undergraduate Sciences degrees in public Higher Education Institutions (HEI) in Brazil, mainly in Chemistry and Biological Sciences, based on the analysis of the syllabi and the perception of the students and Libras teachers.

From the theoretical reference that discusses the Libras teaching in teacher education and the data presented by Charallo and Andrade (2022), this work seeks to answer the following

[1] We highlight the term "Deaf" with a capital D in some strategic points of the text as a tool of empowerment, showing the personal view of one of the authors, a professional in the area, as well as the respect and recognition of the identity experienced by the Deaf subjects, their linguistic and social values, and the whole historical-cultural process involving them. Several authors, such as Lane (2008) and Castro Júnior (2011), use this strategy.

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question: Does the subject Libras in the curricula of the Teaching degrees in Chemistry and Biological Sciences in public HEIs in Brazil, with grade 4 and 5 in Enade, approach and/or allow the discussion of teacher training in the perspective of inclusive education? To do so, our general objective is to analyze the contents approached and discussed during the education of future teachers from the viewpoint of Libras teachers and the students of Chemistry and Biological Sciences Teaching. The specific objectives aim to explain specific aspects of Libras teaching: the concepts about Deaf people, the interpreter role, bilingual education, and the teaching of Chemistry and Biology to these subjects.

The subject Libras in the training of Science teachers

The education of the future teaching in the science areas – Chemistry, Biological Sciences, and Physics – needs to provide discussions that involve teachers' pedagogical actions regarding Science teaching to deaf students, Libras-users, so that they are not only welcomed in school but included and respected in their linguistic singularity.

In light of the works carried out by Brito et al. (2024) and Martins and Lopes (2023), we emphasize that the teachers' role is to overcome the view of Libras as an accessibility form to the students' necessary autonomy so that they can use and participates of all school activities. The science teachers' role is even more important because "through the mediation and dialogue established, the students can re-elaborate their previous concepts and access scientific knowledge" (Charallo, 2022, p. 56).

However, this is not what has been going on in most schools that call themselves inclusive. According to Oliveira and Benite (2015), enrolling a deaf student in a common class and guaranteeing a Libras interpreter for the mediation between teachers and students is not enough for an effective Science education because there are several other obstacles, such as the lack of specific symbology and scientific terms in the area, which do not have equivalence in Sign Language (Sousa & Silveira, 2011). According to Philippsen et al.(2023), this is undoubtedly the main aggravating factor in Deaf people's educational process, as most interpreters do not have specific undergraduate training and need to use other translation methods, such as classifiers. Furthermore, the materials created by the teachers are typically for the hearing, and the Deaf need visual resources. "Science teaching for Deaf students is generally adapted by the

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interpreters, from the material elaborated by hearing people, in written Portuguese" (Marinho, 2007, p.12). Therefore, teachers' lack of preparation to act in inclusive education, mainly regarding the construction of scientific concepts, can lead to these students' exclusion and lack of interest in the classes (Feltrini & Gauche, 2011).

Libras syllabi in Brazilian Teaching undergraduate degrees

The syllabus of a subject is characterized as a short summary in which there is a clear, concise, and objective presentation of what the teacher intends to teach and the procedures to enact. Faced with the obligation of inserting Libras in the curriculum of Teacher undergraduate degrees, Charallo and Andrade (2022) conducted a study aiming to analyze how Libras have been presented in the political and pedagogical projects of 139 chemistry and biological sciences Teaching degrees in Brazilian public HEI, evaluated with the grades 4 and 5 in Enade 2017.

Through a literature review, Charallo and Andrade (2022) identified five thematic and content axes covered in the Libras subject in each of these courses: (1) Conceptions about the Deaf subject; (2) Educational Interpreter; (3) Bilingual Education; (4) Chemistry or biology teaching for Deaf people; (5) Approaches about inclusion in general or conception about special education. Each axis has subdivisions with greater content detailing. Thus, the data was collected through the categorical analysis in which each axis represents a Unit of Context (UC).

Their research showed that the most present themes/contents in the syllabi are related to axis 1 – Conceptions about the Deaf subject – mainly regarding the historical aspects of education for Deaf people, that is, Libras, as a natural language and Deaf culture – and axis 3 – Bilingual Education – mainly the learning of signs and vocabulary. The authors stress that the contexts that appear the most are those focused on showing the importance of students knowing the history of education for the Deaf, loaded with suffering and limitations due to linguistic and prejudice barriers and the use of Sign Language. Such knowledge allowed the in-training teacher to build a concept of deafness differently from common sense.

To make the classes inclusive, other content also needs to be encompassed so that the subject does not rely only on training teachers fluent in sign language. Reuter and Cavalcante (2024) point out that the training should dialogue with diversity so that teachers know how to

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position themselves regarding inclusive proposals, recognize their difficulties, and be aware of the resources and needs to attend to deaf students adequately.

Other contents considered relevant for the education of future teachers, according to Charallo and Andrade (2022), are covered in less than 10% of the syllabi, such as the work of Sign Language interpreters in the school environment; the strategies and methodologies in the teaching/learning process of the Deaf; the specific themes for science education (such as the signs in the chemistry and biology areas); and the methodological strategies for science. Therefore, the work showed that there is still a need for more studies to ground librarians as a meaningful subject in the academic curriculum. According to the author, the reduced study hours of the subject, i.e., 30h and/or 60h, can be one of the reasons why the HEIs opted not to approach other contents.

These results show that there are endless paths, however, more research in the area is needed, considering that Libras has been offered for less than a decade in the HEIs. Hence, theoretical and practical issues abut signs and deaf students' bilingual education need to be developed, as well as increasing the study load of 30h or 60h and create a syllabus with a defined content, according to the area of each course and that, besides the theoretical load, can develop a critical teacher on this theme.

Another point raised by Charallo and Andrade (2022) was the lack of detailed information in the Decree n.º 5.626/2005 (Brasil, 2005) about the objective of the subject Libras for Teaching degrees, which contributed for each HEI to define, according to their perceptions, which themes are more relevant or not. This was evidenced in the research conducted by the authors because some syllabi had a diversity of contents, while others focused only on sign teaching. Though the document does not define how the subject should be conducted by the teacher, it is important because it presents the delineations of the relevant content and evidence what is not considered as essential for the courses. Thus, the researchers finish by indicating that the offer of Libras in the Teaching degrees do not allow or aim to form bilingual teachers but to provide support so that future teachers can understand the different linguistic conditions of deaf and hearing students, preparing them to develop assertive strategies, providing opportunities for different symbolic spheres to be used to build a new knowledge from the understanding of Sign Language, deafness, and linguistic-cultural community.

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Methodology

The methodological procedure for this study is grounded by the principles of the qualitative approach, which, according to Bogdan and Biklen (1994), can be pursued in several investigation contexts when the data collected are rich in the description of the respondents' profile, that is, the investigator seeks to know them to record all that is presented about them.

Therefore, based on the study by Charallo and Andrade (2022), we conducted this research with Libras teachers and students in the Teaching undergraduate degrees in Chemistry and Biological Science. The first participated in interviews, while the latter answered a questionnaire.

The semistructured (Gerhardt & Silveira, 2009) was composed of 23 questions on the initial education of the participant teachers and their perceptions about the contents and approaches during the subject Libras with hearing students. In this phase, five teachers participated, two hearing and three Deaf, who gave their interviews in sign language, with a Libras interpreter's help. Teachers were identified by the letter T, followed by a number (T1 to T5).

Regarding the undergraduate students, there were 59 students, 38 from the Biological Science courses, in the 10th semester of the course, and 21 from Chemistry, in the 8th semester, all of them had already studied the subject in the previous semester and were identified during the data analysis with the letter S, followed by a number (S1 to S59). The subjects' study load is the same in the three participant institutions, however, the offer and distribution differ: at HEI-1, it is offered in a semester, with a 60 hour load, equivalent to almost five months of theoretical and practical studies, with 4-hour weekly encounters. HEI-2 and HEI-3 divide it per year, 30 hours per semester, with two weekly hours.

Students answered a printed questionnaire with 12 open questions to identify the reception of Libras classes, their contribution to their educational process, and the relevance of the content approached.

As previously mentioned, the data collected was analyzed, according to Bardin's (2016) category technique of content analysis because it presents a process that starts from the exploration of the material, creating thematic categories, that is, identifying the most recurrent themes found in the materials and statements of research participant subjects (Valle & Ferreira, 2024), as well as in the UC (Units of Contexts) and UR (Units of Records) specifications, mentioned by Charallo and Andrade (2022). By reading the students' answers, we identified the

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need to create Units of Record for UC4, as well as the UR e4.3, e4.4, e4.5, and e4.6 are emerging units, as shown in Figure 1.

Figure 1

Units of Context, Units of Records presented by Charallo and Andrade (2022) and emerging UR

UC	Definition	UR
1) Conceptions about the deaf subject	Contents that identified (or not) discussions regarding Deaf people's historical and philosophical aspects	1.1 – Deafness historical aspects 1.2 - Libras as a natural language 1.3 – Vocabulary 1.4 – Deaf culture and identity 1.5 - Legislations and educational policies
2) Educational interpreter	Contents that identified (or not) discussions about the Libras' interpreter, as the professional that mediates communication, and their attributions in the process of school inclusion with the hearing teacher	2.1 – Understanding the interpreter's role as a communication mediator 2.2 – Attributions of the teacher and the interpreter 2.3 – Interpretation techniques Libras/Portuguese and Portuguese/Libras
3) Bilingual education	Contents that approached the bilingual education model in the education for the Deaf	3.1 – Portuguese as a second language (L2) and Language acquisition L1 and L2 3.2 – Visual pedagogy or strategies and methodologies for the teaching-learning process of deaf people. Production of didactic materials.
4) Chemistry and Biology teaching for Deaf people	Approach/discussion about themes in the area of science teaching, in this case chemistry or biology teaching, for deaf students	4.1 – Specific signs from the areas of chemistry and/or biology 4.2 – Methodological strategies specific to science e4.3 – Lack of interpreter's knowledge e4.4 – Difficulty to teach sciences due to the lack of signs in Libras e.4.5 – Presentation of a class in Libras e.4.6 – Were not approached
5) Approaches about inclusion in general or conceptions about special education	Besides Libras, general or specific discussions about special education and/or inclusion and Libras as a subject in teacher education;	5.1 – Present general discussions about inclusion 5.2 – Do not present general discussions about inclusion 5.3 - Libras in teacher education

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Results and discussion

So that the discussion proposed here is more consistent, we will also present the syllabi already published in the study by Charallo and Andrade (2022) in the data presentation of each UC. Thus, in the following figures, the data on the columns "Teachers" and "Students" (collected from interviews and questionnaires applied by this research authors) are original, while the column "Syllabi" refer to the authors' study.

For the UC1, entitled **Conceptions about the deaf subject,** six questions were analyzed, four from the interview with teachers and two from the questionnaire with students; they are: Which contents do you work within the subject Libras?; Do you approach themes about the interpreter's role?; In your opinion, what do students need to know about Libras and the education of deaf people at the end of the subject?; Which contents were approached in your subject?; Which one(s) do you consider more relevant?. The results can be seen in Figure 2.

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Figure 2

Data of the UR referring to UC 1 – Conceptions about the deaf subject

UR	Records and examples		
	Syllabi	**Teachers**	**Students**
1.1	107 records	3 records	13 records
Deafness historical aspects related to sign language	"Brief study on deafness and hearing impairment; the dead person and their historical aspects." (HEI-B-57[2])	*"History of deaf education, as it was in the past, the deaf, their history until nowadays."* (T3)	*"History of the deaf people and the recognition of Libras as a language."* (S7)
1.2	120 records	4 records	8 records
Libras as a natural language (grammar aspects)	"Parameters in Libras; linguistic notions of Libras; transcription system; types of phrases in Libras; incorporation of denial and grammar in Libras (HEI-C-56)	*"Basic questions of the grammar in sign language to understand the comparison with Portuguese, in what they are similar and different."* – (T1) "*I show what Libras is and use this time to talk about the parameters and how the signs are created.*" (T2)	*"Libras gramar/phrase formulation."* (S51)
1.3	111 records	4 records	49 records
Signs and Vocabulary	"Hand sign alphabet. Non-manual expressions. Use of the space. Classifiers. Libras vocabulary in different contexts. Dialogues in Sign Language" (HEI – B-31)	*"Basic vocabulary of Brazilian sign language."* (T1)	*"Basic conversation vocabulary".* (S35)
1.4	76 records	5 records	2 records
Deaf culture/ Identity	"Deaf identities and deaf culture." (HEI-C-57)	*"Deaf culture and identity."* (T4) *"The main content is deaf culture, because people need to know how the deaf community is"* (T5)	*"Musicalization in Libras."* (S41)
1.5	43 records	1 records	4 records
Educacional Legislation and Policies	"Bilingualism and deaf education: legal and political-pedagogical." (HEI-B-67)	*"I work with the inclusion of deaf students."* (T2)	*"Legislation on the inclusion of deaf people in schools."* (S20)

[2] The syllabi were organized with the following acronyms: HEI-C (which represents the course, in this case, Chemistry) and the number of the syllabus. The same was done for the syllabi in Biological Sciences – HEI-B-number.

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According to the data presented in this Figure, each axis (syllabi, teachers, and students) had a UR that stood out, however, we observed that the most mentioned content did not correspond to the most cited among the teaching/learning process stakeholders. From the perspective of the teachers interviewed, UR 1.4 is the most mentioned, as the students stressed that the most approached content during the subject, the one they remember the most, refers to teaching sign language and vocabulary in Libras, whose records were concentrated on UR 1.3. The results indicate a certain incompatibility with the studies of Charallo and Andrade (2022), who identified UR 1.2 – Libras as a natural language (grammar aspects) as the most evident.

From a general perspective of the collected data, though teachers consider the content about deaf culture and identity as relevant, the students do not seem to remember this content, or it was not approached in the classes. Therefore, there is a discrepancy in the approach of the three analyzed axes because each stands out in a specific unit.

When analyzing individually each UR and its respective data, it is possible to outline a panorama of the main content of the concept of deaf subjects (UC1). Thus, three of the five analyzed stand out by presenting the greater number of records in the three axes, however, in a different classification order, as Figure 2 indicates. UR 1.2 and UR 1.3 had the same number of mentions when analyzing the results of teachers' interviews.

The most present in the syllabi were respectively: UR 1.2 – Libras as a natural language (grammar aspects); UR 1.3 – Signs and Vocabulary, and UR 1.1 – Deafness historical aspects related to sign language.

In the analyses of teachers' U, we can also find the same units, however in a different classification order. In the teachers' axis, UR 1.4 – Deaf culture/Identity stands out, followed by UR 1.2 – Libras as a natural language (grammar aspects), UR 1.3 – Signs and Vocabulary, and UR 1.1 – Historical aspects of deafness related to sign languages. The last two have the same position (2nd and 3rd places) in the syllabi and in teachers' analyses.

Except UR 1.4 – Culture/Identity, which had the highest amount of records only in teachers' testimonies, we observe that the most mentioned contents by students were related to UR 1.3 - Signs and Vocabulary; UR 1.1 – Historical aspects of deafness related to sign languages, and UR 1.2 – Libras as a natural language (grammar aspects) respectively).

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UR 1.2 contemplates data about teaching and the discussion of grammar aspects of Sign Language. As previously mentioned, this was the content most found in the syllabi researched here and the second most cited by teachers, except T3, who declared prioritizing the teaching of practical contents, due to the reduced study load of the subject. Practical content was also the third most cited by the students, despite the small number of records: only eight in 59 students cited it, indicating that it might not have the same relevance highlighted by teachers.

Language is defined as a set of rules and abstract signs, conditioned or not to speech and signs, as is the case of Libras and, therefore, essential to the social practices of a linguistic community. Therefore, teaching practical content is important, as T3 points out, because it is a special-visual language composed of phonological, morphological, syntactic, semantic, and pragmatic rules needed for its execution. That said, the subject should encompass language teaching as a whole and in several ways through discursive resources, such as hand configuration, movements, grammatical facial expressions, locations, body movements, signaling space, and classifiers, beyond an isolated vocabulary or sign.

As pointed out, UR 1.3 had the highest amount of meaningful records in the present analysis. This allows us to infer that a large number of teachers and syllabi have content focused on the teaching of signs and basic vocabulary, but the students' data stand out because they indicate a higher number of content classifications. Even though the subject does not aim for fluency in the language but a more conscious formation on the singularities of deaf students, learning signs and vocabulary is essential for the future teacher to acquire knowledge and communicate with deaf students. After all, only learning the language is not enough to guarantee its inclusion in the regular education system, as it is vital to understand all other contents proposed by the UCs of this work.

UR 1.4 – Culture/Deaf Identity was the most mentioned in teacher interviews. However, these data do not coincide with the other analyzed axes, as in the syllabi the number of mentions about his content appeared in only 76 of them, out of 139, thus, in the fourth position.

The analysis of the questionnaire data answered by the students shows even smaller numbers because only two people mentioned having this content during the subject, placing this UR in the fifth and last position in the general classification, after the syllabi (fourth place). Considering that this UR encompasses a fundamental question in the teaching of Sign Language

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– call upon a people's identity, culture, and customs –, as language and culture are intimately and mutually related, there are two possible hypotheses: either the teachers seek to bring these discussions to the classroom and the students do not effectively grasp this proposal or they do not assimilate what the teachers say they approach.

Finally, UR 1.5, refers to the contents related to the Legislation and Education Policies, such as the Law Libras n.º 10.436/2022 and the Decree n.º 5.626/2005 (which recognizes Libras as the instruction and communication language of Brazilian Deaf people and establish the rights of these subjects in society, specifically in the educational area, proposing a bilingual education (in which Libras is considered a first language and Portuguese the second one) was the unit of analysis that presented the smaller number of citations in the three analyzed axes. During the interviews with the teachers, only one of them mentioned approaching the *"inclusion of Deaf people in inclusive regular school"* (T3). In the data collected with students, just four cited they had some discussion about the theme. Thus, if neither the teachers nor the students present this content as relevant in the practice, we can infer that the public policies about the deaf/Libras are not effectively approached in the Libras classes in the Biology and Chemistry degrees in these three HEI.

UC2 – Educational Interpreter was specifically created to accommodate the records referring to the Libras Interpreter, one of the professionals who directly works with deaf students in the classroom. These data are summarized in Figure 3.

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Figure 3

UR data referring to UC 2 – Educational interpreter

UR	Records and examples		
	Syllabi	**Teachers**	**Students**
2.1	12 records	4 records	0 records
Understanding the interpreter's role as a communication mediator	"Understand the role of translators and the educational interpreter." (HEI-B-29)	"*I also approach the role of the Libras interpreter.*" (T2)	
2.2	4 records	0 records	0 records
Attributions of the teachers and attribution of the interpreter	"Knowledge of nomenclature and the professionals involved in the subjects' education." (HEI -C-68)		
2.3	7 records	0 records	0 records
Interpretation techniques Libras/Portuguese and Portuguese/Libras	"Translation and interpretation theory. Introduction to translation techniques in Libras/Portuguese. Introduction of translation techniques Portuguese/Libras." (HEI -B-07)		

Considering these results, the syllabi column was the only one with mentions in all URs (2.1; 2.2; and 2.3), even if in small numbers, as was the case of UR 2.2 - Attributions of the teachers and attribution of the interpreter – which had only four records. On the other hand, the students' column did not have any. UR 2.1 – Understanding the interpreter's role as a communication mediator – stood out because it was mentioned in 12 out of the 139 syllabi analyzed. The content was also cited by four teachers who affirmed they briefly approached this theme during the subject. However, no student stated they studied this content during classes.

UR 2.2 – Attributions of the teachers and attribution of the interpreter – and the UR 2.3 – Interpretation techniques Libras/Portuguese and Portuguese/Libras – do not have any record in the teachers' and students' columns, which shows that they did not think it was relevant to discuss the role played by the main teacher and the interpreter in the teaching and learning process of the deaf student. The last UR, 2.3, which was also not mentioned, focuses on the translation and interpretation techniques used by the interpreter during the interaction

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with the deaf student. Besides knowing the interpreter and the role he/she plays, it is equally important to know the techniques involved in translating oral language for sign language and vice versa. During the classes, the interpreter experiences different translation moments, sometimes signing what the teacher is saying in oral language, going from Portuguese to Libras, and other times translating what is communicated in Libras to Portuguese, i.e., the interpreter is the Deaf person's voice in different moments (work presentation, content doubts, activities, evaluations, and even in the interaction with the teachers and classmates).

Even though they are little discussed in the syllabi analyzed and/or not present in teachers' and students' discourse, these content are extremely relevant because they allow undergraduates to understand that the interpreters' role is not to substitute the teacher or to be the "deaf student's teacher" but to help him in the process of school and linguistic inclusion. According to Lacerda (2015) and Antia and Kreimeyer (2001), the teacher is responsible for planning the classes, the content, and the adequate methodology. However, the interpreter is the professional that knows the Deaf, deafness, and masters the language, thus, able to work together to fully develop this subject.

UC3 – Bilingual Education – contemplates all contents found in the syllabi and the teachers' and students' words about the theme of bilingual education in the education of the Deaf. This unit is subdivided in three: UR 3.1 – primary language acquisition process (L1 – Libras and second language L2 – Portuguese), as well as the writing of Portuguese as a second language by deaf students; UR 3.2 – approaches regarding the methodological strategies to teach both languages based on Visual Pedagogy and the production of didactic materials, the results are summarized on Figure 4.

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Figure 4

Data of the UR referring to UC 3 – Bilingual Education

UR	Records and examples		
	Syllabi	**Teachers**	**Students**
3.1	31 records	1 record	0 records
Portuguese as a L2 and Language acquisition L1 and L2	"Sign Language acquisition process observing the similarities and differences between this language and Portuguese." (HEI-C-13)	*"I also talk about the difficulties that deaf students have with Portuguese"* (T2)	
3.2	9 records	1 record	0 records
Visual pedagogy or strategies and methodologies for the teaching-learning process of deaf students. Production of didactic material.	"Know methodological strategies to teach deaf students. Produce didactic material for the inclusion of deaf students in the classroom context." (HEI-C-28)	*"The second content I approach, after deaf culture, is about the different methodologies that can help teachers adapt their classes for deaf students."* (T5)	

Considering that bilingual education refers to the use of two languages, in the case of deaf people L1(Sign language) and L2 (the country's official language), for Brazilian deaf people, Libras is the L1 and should be acquired naturally through the socialization with other Deaf people and, after, acquire the L2, in the case of the Portuguese Language. Structurally speaking, L1 and L2 are different because the first refers to spontaneous and essential acquisition in a natural environment, while the second is apprehended in a formal environment. Summing up, the acquisition process of Portuguese by the deaf student should not occur naturally, that is, not in frequent contact with native speakers but formally in the school environment. Hence, the educational proposal of Bilingual Education is the most adequate, as it considers "Libras as the natural language of Deaf people and starts from this assumption for the teaching of written Portuguese" (Quadros & Karnopp, 2004, p. 25). When learning to read and write Portuguese, Deaf people do not follow the same paths and processes as hearing people, which is one of the greatest challenges for their education. For the Deaf, reading the world passes by their natural

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language, i.e., Sign, which allows them to build meanings and formulate a notion of the world interactively through interventions that can give life to meanings.

Therefore, when these aspects are discussed in a teaching training course it allows teachers, at different educational levels, to know the linguistic particularities and the issues that involve Deaf people's development/learning, as well as the teaching practices that should be taught, delineated, and constantly reflected because, as Lodi (2004) highlights, "the writing production of Deaf students is always one of a 'foreign' user of Portuguese" (p. 36).

Besides using oral language and Sign Language in the teaching and learning process, varied visual resources can significantly contribute to Deaf people's learning, as long as they are inserted in pedagogical strategies targeting students.

Despite the relevance of visual resources in the literature and, consequently, in the training of the future teacher of a deaf student, we have observed that UC 3 – Bilingual Education also had few or no records in the three analyses. The syllabi column in Figure 4 shows that the content related to Language Acquisition and Portuguese as a written L@, according to UR 3.1 – Portuguese as a L2 and Language acquisition L1 and L2, is approached only 32 times in a total of 139. Despite this number, this UR had the most data when compared to the two other analytical axes – teachers and students. The data regarding teachers show that this discussion is rarely covered in the subject because, out of the 5 teachers, only T2 talked about it and no undergraduate student mentioned it.

UR 3.2 compiles the records found in the syllabi and the teachers' and students' discourses regarding the discussions and/or presentation of Visual Pedagogy contents or methodologies and strategies that can be used by the teacher in the classroom. Thus, we could see the importance of discussing visually adapted materials in the learning process of deaf students in nine syllabi. However, it was only mentioned by T5, who considers it important knowledge for training future teachers, and, once again, no student raised the topic.

The penultimate analytical unit, UC4 – Chemistry and Biology teaching for Deaf people, is specific and would need to be identified in the syllabi and the teachers' and students' records, as it refers to the themes and contents discussed on the area of Chemistry and Biology teaching for deaf students, as seen on Figure 5.

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Figure 5

Data of UR referring to UC 4 – Chemistry and Biology teaching for Deaf people

UR	Records and examples		
	Syllabi	**Teachers**	**Students**
4.1	9 records	1 record	6 records
Specific signs in Chemistry and Biology areas	"Libras basic vocabulary: general and specific contents in the Chemistry teaching context." (HEI-C-54)	*"I only teach specific signs for the course."* (T5)	*"Yes, some biology terms are approached but many of them do not have signs."* (S21)
4.2	1 record	0 records	0 records
Specific methodological strategies for science	"Methodologies to teach Sciences and Biology for deaf people. Presentation of school activities to teach deaf people in Science and Biology." (HEI-B-23)		

According to Quadros and Karnopp (2024), discussing science teaching for the Deaf is important because some barriers within the school space have been observed that could hinder the knowledge acquisition of Deaf people, such as the absence of communication through signs in the school space, as well as the lack of scientific terms in Libras, which can interfere in the negotiation of scientific concepts meanings among teachers, students, and interpreters; a lack of qualification of the teacher working with deaf students; the use of methodologies not compatible with the visual channel; and texts full of terms in the area, presented in a language not very accessible to deaf students.

Under this perspective, Philippsen et al. (2023) highlight that, regarding deaf students, the visual and time aspects, specific to deafness, should be considered, including how the teaching and learning processes take place, as a way to guarantee an effective, inclusive, and conceptual education in the scope of Science teaching.

In light of these concerns, it is important to understand that the presence of Deaf people in regular education requires a bilingual education adjusted to the subjects' conditions, as Martins and Lopes (2023) state. Teachers and/or interpreters in the classroom have to think, plan, and develop classes with methodologies based on image elements that raise debates, concepts, and opinions that can be deepened toward well-defined objectives.

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However, the data presented in Figure 4 indicate that UR 4.1 – Specific signs in Chemistry and Biology areas –shows that only nine syllabi presented contents on specific area signs. Only one teacher mentioned teaching specific signs from the area and only six students cited having learning some Biology signs. UR 4.2 – Specific methodological strategies for science –had almost no records in the three analyzed axes, and only one syllabus, out of 139, presents this topic.

Therefore, the inexistence of discussion on the issues above contributes to future teacher graduating without knowing specific Libras signs in their areas and not knowing the strategies and methodologies that can help during their Chemistry and/or Biology classes. Faced with these results, the research participants were also questioned about the approach of specific contents in these courses ("*Did the class address specific contents or discussion about Biology or Chemistry teaching for deaf people? How was it?*). The answers are summarised in Figure 6.

Figure 6

Number of records and examples of emerging URs in student data of UC4)

Emerging UR	**Records and examples** **Students**
e4.3 Interpreter's lack of knowledge	2 records
	"Yes, we commented about the lack of interpreters to work in these teaching areas." (S33)
e4.4 Difficulty in teaching sciences due to the lack of signs in Libras	4 records
	"Yes, we perceived that because it presents many complex terms, it is difficult to show the deaf student what is being said." (S66)
e4.5 Presentation of a class in Libras	17 records
	"Yes, one of the evaluations of the course was to plan a biology class, having in mind that there would be a deaf student in the regular classroom, and we had to use specific signs in the class." (S36)
e4.6 Were not approached	33 records
	"This was not approached during the subject, it was more Libras in general, basic. It was so basic that, in my opinion, I would like to make a course to learn Libras better and teach a deaf student more respectfully" (S53)

The answers confirm what had already been seeing in previous analysis, that is, more than half of the students indicated that, during the subject Libras, there were no discussion on the content of Chemistry and/or Biology teaching for deaf students, representing the highest amount of records from UR 4.6. The UR 4.5 – Presentation of a class in Libras – was created because 17 students answered that the only moment in which they discussed the theme was

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during an assessment task proposed by the teacher, which aimed to plan a class and present it in Libras. Because of this task, many specific signs needed to be researched. For UR 4.3 – Interpreter's lack of knowledge – and UR4.4 – Difficulty to teach sciences –due to the lack of signs, the number of records found was very low, only two and four, respectively.

In fact, the lack of specific signs in the biology and chemistry degrees is one of the main factors that hinder the teaching and the understanding of contents for deaf students. The lack of signs also impacts the interpreters' work, considering that they often do not have a specific formation in the area and do not find sufficient signs or terms to help them translate and interpret content.

The lack of visual didactic material that can help deaf students is another problem faced by many students. Several of them could help in the teaching and learning processes regarding understanding scientific concepts in the classroom. However, "many teachers only used the board and a marker" (Aragão & Costa, 2017, p. 8). Hence, it is important to fund alternatives that seek to solve such deficiencies, such as creating books translated into Libras and materials for visual projects with technological resources, videos, experiences, and others.

Until now, we presented the data analysis on the content that should be approached during the subject Libras in the undergraduate degrees of biology and chemistry in three public HEI. To do so, when analyzing a teacher education for an inclusive school environment, we must consider other themes, such as the discussion about the inclusion of deaf students at this educational level and even Libras itself as a formation subject.

These themes were also questioned during the research conducted with teachers and students. The data were organized into three URs from UC5, called "Approaches for inclusion in general or conceptions about special education ."The results can be seen in Figure 7.

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Figure 7

UR data about UC 5 - Approaches for inclusion in general or conceptions about special education

UR	Registros e exemplos		
	Syllabi	**Teachers**	**Students**
5.1	20 records	0 records	45 records
Present general discussions about inclusion	"Proposes a reflection about the National Policy of Special Education in the perspective of inclusive education and the national guidelines for Special Education in K-12 Education." (HEI-B-45)		"We studied the inclusion not only of deaf students but in companies and other [spaces]. We studied the difficulties and the laws that support this." (S48)
5.2	120 records	0 records	12 records
Do not present discussions	" Brazilian Sign Language (Libras): concepts and parameters. Visual description and space of linguistic and topographic signaling. Presentation of a basic vocabulary to understand Libras structures and regularities." (HEI-C-44)		*"The classes were more focused on learning Libras, a "discussion" would be the presentation of a seminar."* (S11)
5.3	11 records	0 records	0 records
Libras in teacher education	"Education of the deaf in teacher education, school reality and alterity." (HEI-B-20)		

The data points out that 120 syllabi did not raise the discussion of having content on inclusion, be it in school, social, or of other nature, as observed in the UR 5.2 – Do not present discussion. However, it is also possible to find records of general discussions on the topic, such as in UR 5.1, with 20 records. In the data axis from students, we observed the contrary as most, around 45 records, pointed out they held general discussions about the theme (UR 5.1), though 12 of them did not seem to remember or did not have contact with this content.

Finally, UR 5.3, which includes records of Libras as a curriculum subject in teacher education, encompasses records only in the syllabi because teachers and students did not cite

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this content during the course. However, even though teachers did not cite approaching the content or discussing inclusion, they occurred in the class because the students did notice it.

Talking about inclusion in a subject or a teacher training course is fundamental for hearing undergraduates to understand the diversity in the school space. Faced with the reality of an inclusive school, with the responsibility and commitment of teaching and learning for all, teachers must have a consistent training that addresses the particularities and singularities of each students, be them Deaf or with another handicap, as well as health and socioeconomic factors that can also interfere in this process.

Reuter and Cavalcante (2024) situate teachers in their formation process faced with a diversity of contexts they experience in school as the opportunity to be learning protagonists. Thus, stimulating autonomy contributes to future teachers acting conscious of their own potential and assuming responsibility for the challenges emerging in teaching science to Deaf people.

However, the data shows another reality because most Teaching degrees do not offer subjects about Special Education and Inclusive Education, which restricts the discussions and the understanding of pre-service teacher about this reality. In this context, Libras is often the only subject of the course focused on this issue. However, the small number of hours does not allow teachers to approach more general discussions about mastering basic knowledge nor the pedagogical procedures that can indeed promote the inclusion of deaf students in any educational level.

Final remarks

The present work sought to analyze, through different aspects (syllabi, teachers, and students), the contents approached and discussed in the subject of Libras in the Teaching Undergraduate degrees in chemistry and biology in three public HEIs in the state of Paraná, Brazil. The syllabi were analyzed under Charallo and Andrade's (2022) perspective, whose studies aimed to check what contents were studied during the classes from the perspective of Libras teachers and students. Thus, the most present ones were Libras as a natural language/grammar, signs and vocabulary, historical aspects of deafness, and, lastly, deaf culture and identity. However, it is important to stress that they are also indicated in the teachers' words,

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though in another order of priority: 1.º) deaf culture and identity, 2.º) signs/vocabulary, 3.º) Libras as a natural language/grammar, and 4.º) historical aspects of deafness. Out of these four, we highlight the second and fourth as the most relevant ones, according to what teachers, students, and syllabi indicate.

Furthermore, contents such as: interpreters' work; visual methodological strategies that contribute to the teaching and learning process; specific vocabulary in the areas of chemistry and biology; and the lack of scientific terminologies in Libras had little or no record in the syllabi and in the research with teachers and students. Thus, we can perceive teacher trainers' lack of understanding of the importance of approaching the role of Libras interpreter in the classroom with the chemistry and biology teacher, even though this professional is key in the teaching and learning process of deaf students.

The data point out that undergraduates finish the Libras subject not knowing the real educational needs of deaf students, as well as having difficulties in establishing pedagogical practices and specific strategies to teach some scientific contents and terms to welcome the educational needs of deaf and hearing students simultaneously. Therefore, we perceive the need for training that helps future teachers to communicate in Libras, understand different linguistic conditions, and that are able to create visually clear classes that help the interpreters' work and the deaf students' understanding.

However, the proposals presented in this article involve much deeper changes than only the syllabi. Professional teacher education, more specifically in Biological Sciences and Chemistry, does not prepare teachers to deal with deaf students, mainly regarding the construction of scientific concepts. Moreover, only teaching Libras is not enough to fill teacher education gaps. Hence, there is the need to broaden and unify the signs for Deaf people in these areas; reformulate curricula that point out towards inclusion as a necessary point for the education of all teachers; articulate universities and schools to enable practices with Deaf students in teachers' pre-service education; conduct studies that ground regulations, contents, and current themes on this topic.

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