

Teaching Sciences and Biology for deaf individuals: investigating the context of teaching practice in regular classrooms of a municipality in the state of Paraná

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Abstract

The process of school inclusion for people with disabilities is a recent development, especially for the deaf individuals, so the study of how this inclusion process occurs and the teaching of Sciences/Biology for these individuals is still incipient. The objective of this work was to investigate how science/biology teaching takes place for deaf students in the city of Cornélio Procópio-PR and what difficulties are encountered by the students, teachers, and sign language interpreters in the scenario of school inclusion. To reach this goal, we interviewed teachers and interpreters who work in elementary and middle schools of the public network that attend deaf students in Cornélio Procópio. The results of the interviews demonstrated that all those involved in this process face difficulties, the interpreters indicate language as an obstacle to the interpretation of Sciences and Biology classes, since Brazilian Sign Language presents a deficit of lexicons in relation to the Portuguese Language. On the other hand, the main difficulty for the teachers is the lack of preparation to work in classes which include deaf people, jeopardizing not only their interaction with the students, but also the teaching of Sciences and Biology.

Key-words: Deafness; Teaching Sciences/Biology; Basic Education.

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Ensino de Ciências e Biologia para surdos: investigando o contexto da prática docente em salas de aula regulares de um município do estado do Paraná

Resumo

O processo de inclusão escolar de pessoas com deficiência é recente, principalmente de surdos, portanto o estudo sobre como se dá esse processo de inclusão e o ensino de Ciências/Biologia para essas pessoas ainda é incipiente. Desta maneira, o objetivo deste trabalho é desvendar como acontece o ensino de ciências/biologia para alunos surdos da cidade de Cornélio Procópio-PR e quais são as dificuldades encontradas por alunos, professores e intérpretes de língua de sinais no cenário da inclusão escolar. Para atingir este objetivo, entrevistamos professores e intérpretes que atuam em colégios de ensino fundamental e médio da rede pública de Cornélio Procópio que atendem alunos surdos. Os resultados das entrevistas nos mostram que todos os envolvidos neste processo enfrentam dificuldades, os intérpretes apontam a Língua como um obstáculo para execução da interpretação das aulas de Ciências e Biologia, pois a Língua Brasileira de Sinais apresenta um déficit de léxicos em relação à Língua Portuguesa. Já a principal dificuldade dos professores é a falta de preparo para trabalhar em classes de inclusão de pessoas surdas, o que prejudica não só a sua interação com os alunos, como também o ensino de Ciências e Biologia.

Palavras-chave: Surdez; Ensino de Ciências/Biologia; Educação Básica.

Enseñanza de Ciencias y Biología para sordos: investigando el contexto de la práctica docente dentro de salones de clase de una ciudad del estado de Paraná – Brasil

Resumen

El proceso de inclusión escolar de las personas con discapacidad es reciente, sobre todo de aquellas con discapacidad auditiva, en consecuencia, los estudios sobre procesos de integración y enseñanza de Ciencias / Biología dirigidos a estas personas es aún incipiente. El objetivo de este estudio es investigar sobre la forma como se desarrolla la enseñanza de ciencias / biología en estudiantes sordos de la ciudad de Cornélio Procópio -PR (Brasil) y cuáles son las dificultades encontradas por los estudiantes, profesores e intérpretes de la lengua de señas dentro del panorama de la inclusión escolar. Para alcanzar este objetivo, se entrevistaron profesores e intérpretes que atienden estudiantes sordos en colegios de educación primaria y secundaria de la red pública de la ciudad de Cornélio Procópio. Los resultados de las entrevistas mostraron que todos los involucrados en este proceso enfrentan dificultades; los intérpretes por su parte, señalan que la lengua de señas brasileña es un obstáculo para la correcta interpretación de las clases de ciencias y biología, puesto que la misma carece de ciertos léxicos propios de la lengua portuguesa. Por otro lado, la principal dificultad afrontada por los profesores es la falta de instrucción para trabajar en clases de inclusión de personas sordas, lo que perjudica no solamente su interacción con los alumnos, sino también, la enseñanza de ciencias y biología.

Palabras-clave: La sordera; enseñanza de ciencias / Biología; La educación primaria.



Introduction

The inclusion of students with special needs in Brazil should be undertaken preferably in regular education. With regard to the deaf individuals, municipal, state and federal laws define what measures should be taken to eliminate communication barriers and guarantee those people access to information and education, such as the training of sign language interpreters (Brasil, 1988; Brasil, 1996; Brasil, 2000; Paraná, 1998. Our translation).

Deaf people, due to their hearing loss, present difficulties in language and communication with hearing students and teachers, since most of them do not have enough knowledge or fluency in the Brazilian Sign Language (LIBRAS), used strictly among deaf students and school interpreters. Consequently, the interaction deficit between deaf students and their teachers and other classmates is significant, with a negative impact on their schooling (Lacerda, 2006; Dorziat, 2004; Silva, 2009. Our translation).

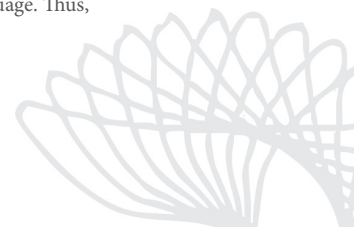
In this context, translators and/or interpreters¹ from LIBRAS become key components in the learning process of deaf students, who interact better, participate and make questions. These professionals, who must be listeners and proficient in LIBRAS, have the role of not only versing the contents of oral language to that of signs, but of engaging in educational practices that favor the learning of the deaf (Marinho, 2007; Lacerda; Silva, 2008. Our Translation).

However, in the face of the urgent demand for Translators/Interpreters of Sign Language (TISL) in basic education, especially from the recent inclusion policies of deaf people in schools, anyone who knows sign language is considered fit to work in schools, even without higher education and/or specific training in the areas of knowledge in which they work (Lacerda; Gurgel, 2011; Lacerda, 2010. Our translation).

On the other hand, the problems are not only in the skills and competences related to the training of these professionals. The contents of the school subjects related to the natural sciences, for example, have specific terms that do not have equivalents in LIBRAS, which makes the interpretation of these contents a very difficult task for the interpreters. The TISL complain about the lack of bilingual glossaries of LIBRAS-Portuguese and supporting materials that contribute to the interpretation and autonomy of deaf students at study time (Marinho, 2007. Our translation).

Given this, the TISL are required to take some practical steps to solve some of these problems, as conveying signs with the students, even though each class can generate a different sign to the same concept. They also make use of illustrations, indication of the terms on the Blackboard and sign language (representation of the letters of the alphabets of oral languages through the hands). However, the last one pointed presents problems since the speed of typing may make it difficult for the deaf to recognize the word. In addition, many scientific terms are from Greek or Latin origin and, in these cases, the

¹ According to Quadros (2004, p. 7-11), a *sign language interpreter* is a person who “[...] interprets from one sign language to another language, or from any language to a particular sign language”. The *translator* is the one who “[...] translates from one language to another. Technically, translation refers to the process involving at least one written language. Thus, translator is one who translates written text from one language to another”.



interpreter can type incorrect letters for lack of knowledge of their spelling (Marinho, 2007. Our translation).

Therefore, we attempted to investigate through an end-of-course final work of conclusion of course (Biological Sciences Licensing), whose results are presented in this article, the scenario of Sciences and Biology teaching for the deaf of the municipality of Cornélio Procópio-PR, in the scope of Basic Education, in order to highlight the difficulties faced by students, interpreters and teachers in the daily school life of regular classes with deaf students.

Through this investigation, it was possible to verify the difficulties highlighted in the literature for the teaching of deaf people, in the local scope, but with emphasis in the school subjects of sciences and biology, considering that they contribute to a great collection of technical vocabulary, considered by many researchers in the area of sciences education as too excessive (Krasilchik, 2011. Our translation).

As a result of a study of local reality in dialogue with the literature, we offer some ideas to minimize the evidenced difficulties. The following is a historical review of the inclusion of deaf people in regular education, to contextualize the reader in relation to the advances and setbacks of this process.

A historical synthesis of the formal education of the deaf

School education for deaf people is a topic that has generated considerable concern, since even though they attend the same period of time in school benches as hearing students, studies indicate that their performance is enough, denouncing an inadequacy of education systems and suggesting measures to ensure that their full development be achieved (Lacerda, 2006. Our translation).

From antiquity to about AD 476 people who were born deaf were not considered to be competent human beings by listeners of Greco-Roman society, who believed that thought would only develop through speech. Therefore, pondering that without hearing there would be no speech, the deaf were taken as devoid of thought and unable to teach or learn. Those who lost their hearing throughout their lives were not seen that way. Aristotle said that language was what gave the condition of human to the individual. And then, without language, the deaf was considered nonhuman (Moura; Lodi; Harrison, 1997. Our translation).

These preconceptions have had a major impact on the categorization of deaf people to this day. An example of this is the record that the Romans deprived the deaf of their legal rights, for they could not speak about them. This can also be observed in the Brazilian Civil Code that considers the deaf incapable and categorizes them as “[...] the exceptional ones without complete mental development” (Brasil, 2008. Our translation).

In the Middle Ages the deaf continued to be considered non-human, but with a religious vision, for if they could not speak the sacraments, their souls would not be immortal either. However, it was during this period that the first ways of educating the deaf began to emerge. Some preceptors devoted themselves entirely to teaching deaf people to speak, read and write so that they could have the right to family inheritance (Moura; Lodi; Harrison 1997. Our translation).



From the half of the 15th century, with the work of the Spanish monk Pedro Ponce de León (1520-1584), considered to have been the first deaf teacher of history, people with this deficiency began to be recognized as capable, mainly with the demystification of religious, philosophical and medical beliefs (doctors said that the deaf could not learn because they had brain injuries). Leon was able to teach the deaf children of rich and noble families to speak, read and write, including studies of philosophy. (Moura; Lodi; Harrison, 1997. Our translation).

According to Moura, Lodi and Harrison (1997), from this impulse of Leon, some educators played an important role in the oral education of the deaf: Juan Pablo Bonet (1579-1629), who takes up León's work, published a book in 1620 presenting a digital alphabet and the art of teaching the deaf to speak; Jacob Rodrigues Pereire (1715-1780), who also used some signs and a digital alphabet to teach the deaf to speak; Johann Conrad Amman (1669-1724), an important German oralist, wrote a book that was considered the seed for the German institutionalized education model of the deaf; John Walis (1616-1703), was recognized as a founding element of oralism in England, launching the first English book on education of the deaf in an oral line; among others. These three personalities, according to Moura, Lodi and Harrison (1997), are called *The Three Pillars of Oral Education*. Great forerunners of oralist education, even considering speech as the true expression of humanity, they used some signs and digital alphabet in their works, although they did not give these methods the right value.

From 1750 on, work began with signs, when the French abbot Charles Michael L'Épée (1712-1789) decided to dedicate himself to the deaf, educating them by means of "methodical signs" that combined the Sign Language with flagged French. He founded the first public school for the deaf in the world, the National Institute for the Deaf-Mute in Paris. In this institute, the deaf had the opportunity to learn various contents using their own language. However, L'Épée considered this language without grammar or utility, adding signs for words and terminations of the French language that were not represented in the Sign Language (Methodical Signs) (Moura; Lodi; Harrison, 1997. Our translation).

In the contemporary age, in the United States, from the beginning of the nineteenth century, teaching deaf people aroused interest starting with Professor Thomas Gallaudet (1787-1851), who, interested in the ideas of the abbot L'Épée, went to Europe to seek teaching methods for deaf people, later creating the Public School for the Deaf in the USA. In Europe, after some refusals, he carried out an internship, made observations and began to learn L'Épée's System of Signals. He had as instructor the deaf Laurent Clerc (1785-1869), who he contracted and took him to the United States to found the school in 1817 (Prince, 2011; Moura; Lodi; Harrison, 1997. Our translation).

At the USA Public School for the Deaf, students learned written English from him, many other subjects like astronomy, geography, history, math, literature, and religion. The contracted teachers learned the French Sign Language, which was being modified by the students, used and disseminated by the deaf from other places until the American Sign Language was consolidated, the culture and community of the deaf.

As a result, schools for the deaf were founded in a network so that by 1869 there were about thirty of them by the United States. Before that, in 1864, the American Congress



had already authorized the first college for the deaf, Gallaudet University in Washington, founded by the son of Thomas Gallaudet, Edward (1837-1917) (Moura; Lodi; Harrison, 1997. Our translation).

However, the American Sign Language began to suffer negative pressure, being rejected and forced to give way to oral English due to a nationalist wave established after the Civil War. In this process of eliminating sign language, Horace Mann and Samuel Howe had great influence, after Mann visited schools in Prussia, Saxony and Holland, to know his oralist line and amaze himself with deaf people speaking.

The criticism made now at days is that Mann could not assess the language of the deaf, for he had never seen a deaf before and he did not even know the ways of working with these people. After Mann's report, the Hatford School founded by Gallaudet sent a representative to Europe who found that despite the efforts and time spent in this oral training, the speech of the deaf was unintelligible (Moura; Lodi; Harrison, 1997. Our translation).

Howe, according to Moura, Lodi and Harrison (1997), insisted that the deaf needed to be oralized. Signal education was yielding excellent results, but Howe had personal interests involved and said that using signals, the deaf would be segregated and should be taught to be equal to the listeners. He set up an oral school even though oralist methods had already failed in the USA, and said that deaf children should be placed in listening families, strictly using oralism. He was also against the marriage between deaf people, as it was said that it would be dangerous to have more children born with this deficiency.

In 1867 he founded the Clark Institution in Northampton, which prohibited any form of manual communication, establishing oralism in the United States. Another advocate of pure oralism and important character at this stage of the development of deaf education was Alexander Graham Bell (1847-1922), even though he was married to a deaf spouse, he had different ideas from Clerc regarding deafness. He advocated that deafness should be treated as a disease that even without healing could be relieved and listeners should help the deaf in denying deafness and deaf culture (Moura; Lodi; Harrison, 1997. Our translation).

In 1880 a congress was held in Milan that brought together 182 people from various countries to discuss the education of the deaf and, among other things, to discuss how the deaf should be taught, whether using oral or sign language. Of these 182 people present, only one of them, Edward Gallaudet, was representative of the opinion of the interested minority, the deaf. He watched the vast majority of listeners decide without considering the opinion of the deaf. Thus, as a result of the deliberation of this group, Congress deliberated on the superiority of oral language over sign language, stating that the oral method should be preferred in the education of the deaf since the words were undoubtedly superior to the gestures (Prince, 2011; Lorenzini, 2004. Our translation).

The decisions taken at that Congress practically banned the Sign Language from schools, causing all of Europe to adopt pure oralism in the instruction of deaf students. This resulted in the massive dismissal of deaf teachers, preventing them from having any power to organize manifestations (Lane, 1989 *apud* Moura; Lodi; Harrison, 1997; Prince, 2011. Our translation).



With oralism established, it was developed in order to transform the deaf into a “listener”, using new techniques of electroacoustics, such as individual or collective sound amplification devices, aphasia rehabilitations and works in speech clinics. All based on the necessity of oralizing the deaf, since the signs were not allowed (Sanches, 1990 *apud* Moura; Lodi; Harrison, 1997. Our translation).

In the oralist approach, the deaf were seen as deficient because deafness was characterized by the absence of speech. In this way, the deaf could only be cured by means of auditory stimulation and oralization. However, the acquisition of speech by the deaf was totally artificial, non-spontaneous and decontextualized, since they do not have the main receptor channel for this type of language. Thus, they were unable to reach levels of abstraction and were unable to master scientific concepts (Goldfeld, 2002 *apud* Prince, 2011. Our translation).

In the 1960s, the negative results obtained with the oral method led to the development of a new educational philosophy, called Total Communication (TC), which aimed to promote the communication between the deaf, listeners and other deaf people. In this philosophy, orality was no longer considered the main focus, but a feature that could be used along with other resources such as signs and lip reading (Lacerda, 1998; Lodi, 2005 *apud* Prince, 2011. Our translation).

This new approach resulted in significant improvements in the understanding and communication of the deaf, although abstract ideas and concepts were still out of date. The TC privileged the use of artificial languages in the education of the deaf (gestures, drawings and signs) that only met a momentary need in the representation of oral language (Prince, 2011. Our translation).

Over time, the Sign Language begins to be seen as essential for the cognitive development of the deaf (Lacerda, 1998. Our translation). In that interim, Bilingualism assumes that the mother tongue, that is, that which is natural for the deaf, the Sign Language, is the first to be developed in the deaf child. Subsequently, they should learn oral language in written form as a second language (Lodi, 2005. Our translation).

The oral language as a second language, for the deaf person, differs from a foreign language because it is seen mostly in a school context, while it is used daily in everyday life because it is the language of the group in which one is inserted. Only through the first language it will be possible to develop abstract thinking and contextualize the community, culture and values. It is therefore imperative for the deaf to use their first language (Sign Language) to express their feelings and develop their cognitive ability (Jokinen, 2009 *apud* Prince, 2011. Our translation).

From the 1990s on there has been a worldwide furor since the Declaration of Salamanca² which decided on the policy of inclusion of children with special educational needs, understanding that all students should be in the regular teaching rooms, regardless of their social, ethnic and linguistic background, including the deaf and proposing greater respect and socialization to these people. During this period there was a move-

² The Salamanca Declaration on Principles, Policy and Practice in the area of Special Educational Needs (1994) is a document produced at a world conference attended by several government representatives, in addition to UNESCO.



ment to encourage inclusion practices and a disrepute to special education programs (Lacerda, 2006. Our translation).

Finally, inclusion policies have recently sought to ensure that all students have the same opportunities. Inclusion is based on solidarity and respect for individual differences. It suggests that society learn to live with differences. However, the inclusive proposal has not proved satisfactory since for its implementation, many problems are found. The care for children with special needs demands training, individualized care and curricular revisions that depend on a work of discussion and training that has been little accomplished (Lacerda, 2006. Our translation).

The education of the deaf in Brazil

Of all Brazilians, at least 5.7 million have some hearing impairment, according to IBGE (2000). Therefore, Brazilian legislation has adapted over time to this community that demands very specific linguistic experiences, using another language, in a space-visual modality called the Brazilian Sign Language (LIBRAS). This language has been developing since the mid-nineteenth century with the creation of the National Institute of Education of the Deaf, INES, in Rio de Janeiro, and the arrival of deaf French scholars such as Professor Ernest Huet (late 1857) who brought the French alphabet and some signs to Brazil (Marinho, 2007. Our translation).

The deaf people from other states who studied at INES and who used the French Language of Signals and the Brazilian Sign Language were important for the dissemination of LIBRAS throughout Brazil and for the creation of the first associations of the deaf. Currently, Brazil has a Confederation, eight Federations and ninety-five Deaf Associations spread throughout the states. The National Federation of Education and Integration of the Deaf (FENEIS) and the Brazilian Confederation of Deaf (CBS) are entities that are concerned with the integration of the deaf and are widely represented (Lorenzini, 2004. Our translation).

In April 2002, the Law 10.436 was approved, which recognizes LIBRAS as a legal means of communication and expression, and also decrees that the public power must guarantee the support, use and diffusion of the Brazilian Sign Language as a means of communication of the deaf communities and that this language should be taught at the middle and higher levels courses in special education, speech therapy and teaching. This law was regulated by Decree No. 5.626 of December 22, 2005, which also regulated art. 18 of the Law 10.098 of December 19, 2000, known as the Accessibility Law, which ensured the training of professional writers in Braille, sign language and guide-interpreters.

Decree No. 5.626 regulated the policy of inclusion of the deaf in regular schools, from Early Childhood Education, Primary and Secondary Education to Higher Education, with the right to use LIBRAS as a language of instruction at all levels, as well as having a professional Sign language translator/interpreter. In view of this legislation, it became necessary to create positions for professional interpreters of LIBRAS to act in the classrooms, next to the teachers regents, with the students.

Finally, in the context of the state of Paraná, the Brazilian Sign Language was already recognized four years before the Federal Law, by State Law No. 12.095 of March 11, 1998.



Such law already included LIBRAS in the curriculum of the public school system and in higher education courses in the areas of education, health and humanities. It ensures, through public administration, sign language interpreters in education from early childhood education to the highest levels.

Teaching of sciences and biology for deaf

In Brazilian Bilingual Education the basis for the learning of any school content is the Sign Language. Therefore, if the deaf does not master the Brazilian Sign Language, they will find it difficult to form concepts, since they require certain levels of abstraction achieved only through the natural language (Trevisan, 2008. Our translation).

For the formation of scientific concepts, which are not spontaneous, the child must have a consciousness that allows him to transfer them from the plane of action to the plane of language, to express himself in words. The scientific concept must be constructed by the student with the teacher's mediation and this must be a conscious act, through language, different from spontaneous concepts that are acquired naturally and without effort. However, these two types of concepts, even though they differ, must be related in the learning of sciences (Vygotsky, 1999 *apud* Prince, 2011. Our translation).

In the context of deafness, the biology teacher, recognizing the importance of language for the construction of abstract and scientific thinking, should bear in mind that the Sign Language mediated by the Interpreter of Libras is not only for classroom communication, but it is through which deaf students will attribute meaning to the content. The Brazilian Sign Language is the basis for the construction of concepts learned at school and also in everyday life (Feltrini, 2006 *apud* Prince, 2011. Our translation).

In view of the whole history of deaf education presented earlier, one understands why there is a scarcity of signs for scientific terms. For a long period of time Sign Language was banned, which meant that the creation and documentation of scientific signals were impaired. Other areas, where the Brazilian Sign Language is more exploited today, such as linguistics, present specific and documented signals, but in order to create a signal, the concept must first be understood and assimilated by the deaf community, what is still to happen in sciences field (Prince, 2011. Our translation).

According to Witches (2010), the need for lexical amplification in the Brazilian Language of Signals related to biological termination is perceived in sciences and biology teaching. The New Illustrated Trilingual Encyclopedic Dictionary of the Brazilian Sign Language (DEIT-LIBRAS), which is a national reference, does not present a signal for the smallest morpho functional unit of living beings: the cell, even though it has 9.828 signs corresponding to 14.000 words in the Portuguese language.

Thus, a strategy used by biology interpreters and teachers who teach for the deaf is to agree signals to the students inside the classrooms and to use the datiological alphabet to refer to terms that do not have sign language equivalents. However, these strategies often do not succeed in learning for the deaf (Witches, 2010. Our translation).



Procedimentos metodológicos

The present work is configured as a qualitative research. This type of approach involves a set of different interpretive techniques that aim to translate and express the meaning of the social world phenomena. This approach is multi-methodological in its focus, considering naturalistic interpretations, that is, the researcher studies things in their natural environment, trying to make sense or interpret phenomena according to the meaning that people attribute to them (Denzin; Lincoln, 1994 *apud* Campos, 2000. Our translation).

For the initial development of the research, a bibliographical survey was carried out that took into account studies on the topic addressed, according to the following keywords: Deaf Education, Inclusive Education, Deafness, Sciences Teaching/Biology for the Deaf, LIBRAS, Inclusion, Bilingualism, Interpreter of LIBRAS. We searched for printed and online scientific articles, theses, dissertations, books and conclusion works. These sources were analyzed, selected and presented in the theoretical-methodological basis of the present paper.

As regards the instrumental equipment used for data collection, Lüdke and André (1986) indicate the interview as an instrument that enables the establishment of an interactive relationship between the researcher and the researched, providing a great flexibility in the elaboration of what is wanted to ask/investigate. It was decided, therefore, to use interviews with a semi-structured script that supported the improvisations of the researcher during the interviews and allowed the respondents to express themselves freely.

In all, two teachers from the state school system of Cornélio Procópio-PR, both trained in Natural Sciences, with experience of approximately thirty years in teaching, working in both Elementary and High School, including deaf students, as well as two sign language interpreters who have been working for more than five years in state education, in regular classrooms.

The interviews were conducted in December of 2015 in two state colleges in the municipality of Cornélio Procópio-PR and audio-taped, whose prior questionnaire is in Table 01.

Table 01 – Semi structured questionnaire for interview questions

Questions for interviewing interpreters	Questions for interviewing teachers
How long have you been working with included deaf students	Have you ever worked with included deaf students? Justify it.
In your opinion, what are the difficulties that deaf students face when included in regular classes?	Do you find difficulties in teaching a deaf student in a regular class? If so, which difficulties?
Does the presence of the interpreter minimize these difficulties? Explain it.	Do you have any specific or adapted material to teach Biology contents for deaf students? If so, which ones?
Do you, as an interpreter, experience difficulties in working with these students? Which ones?	How do you communicate with deaf students?
And in Biology classes, would you highlight difficulties? If so, which ones?	Can you give any special attention to the deaf student during your classes? Explain it.
During the Biology classes can you transmit all information the same way the teacher does? Justify it.	Do the deaf students participate in your classes? Explain it.
Are there any Biology content that you have/had difficulties interpreting? If so, which ones?	According to your experience, do the deaf students present the same learning performance as the listeners? Justify it.
Are there signs (LIBRAS) for all concepts covered in Biology classes? Explain it.	What are the main difficulties for the deaf students in your subject (Biology)?
If the answer to the previous question was negative, for instance, in the absence of a corresponding sign in LIBRAS, how do you interpret the concepts?	How does the evaluation process take place in your classes?

Source: the authors.



In order to maintain the ethical secrecy of the identities of the interviewees, they were coded as follows: I1 (Interpreter 1), I2 (Interpreter 2), T1 (Teacher 1), and T2 (Teacher 2). Each of the interviewees signed a free and informed consent form, claiming knowledge of the research objectives and authorizing the use of their answers (research data) in scientific publications. These terms are filed with the authors of this article.

After the interviews, the recordings were transcribed, generating a *corpus* of analysis. This *corpus* was analyzed in the light of Discursive Textual Analysis, proposed by Moraes and Galiuzzi (2006). In the following section the interviews and their interpretations are presented.

Data analysis

In the analysis it was possible to verify the existence of six categories of mixed character, that is, some were predicted a priori and others were established a posteriori. In addition to these categories, subcategories and units were also constituted, as presented below.

Table 02 – Prior category of difficulties

Category	Difficulties: in this category were included all excerpts that dealt with the general and specific difficulties of Biology teaching, experienced by both the interpreters and the teachers.	
General Difficulties	Experienced by the interpreters	Difficulty with the Portuguese Language So the difficulties that I live with have to do with Portuguese language, which the deaf have a lot of difficulty with, right? That depending also on the life history of each one, it is a level of ... that they have knowledge about Portuguese [...] (I1)
		Lack of contact with regular teachers and their planning There is a lack of time, you know, to have a relationship with the teachers. Because the interpreter has no hour-activity, so, what happens: he does not know what the teacher will work with, he has no conditions before thinking about what way he could better translate the lesson, in what way it could be adapted. (I2)
		Non-inclusion of the deaf in the regular class Difficulties ... In relating to the other students in the class, and especially in the case of the student I interpret to, she does not ... there is not this inclusion, she does not relate to the other students, so in fact the inclusion ... does not exist. Because there is no relationship between her and the other students because of the language, right? (I2)
	Experienced by the teachers	Interpreting To work in a room with deaf students really presents difficulties in interpretation, but with the presence of the interpreter it is much easier, we can establish a learning relationship with the student. (T1)
		Non-understanding of verbally explicated concepts In this case, the greatest difficulty is not understanding certain concepts that must be, in this case, verbally explicated. (T1)
		Lack of adequate training to deal with the deaf students [...]the teachers do not know ... they are not aware of LIBRAS, they do not ... they do not work with adapted material, right? As much as ... let's face it, or the interpreter is guiding the teachers but they are not ... they still insist on preparing the lessons especially for the listeners, not for the deaf, so they have this barrier too, the barrier of communication with others ... the other students, right, there are even teachers who don't... most teachers do not ask how to work with these students, how to facilitate a little, communication, access to information (I1) I am not prepared for this, unless I have an interpreter as in the case of Sueli, then it is alright, the doubts I have I ask her... Even to communicate that the student is coming, right Sueli, She comes and talk to me and I can't understand, then I look at Sueli and she tells me what is happening. (T2, the black stripe refers to the name of the interpreter)



Specific Difficulties of Biology teaching	<p>Exact transmission of information Not all, because the teacher is there, teaching a content, explaining and so, we go through what has to be faithful to the interpretation but there it gets a little vague because the deaf, he is visual, he will try to imagine in his way, and the way the interpreter is showing it is often ... it doesn't stick to it, right, there are things that do not work, neither with classifier nor with LIBRAS you can not show it if you do not have an image to be clearer. (I1)</p> <p>Sometimes not, because what happens is: sometimes we do not have all the signs of biology, much is missing. Today I was even searching ... I read some time ago and I know of researches that have developed signs in the area of biology, but it still lacks. That's why it gets complicated, because when you type, you know the deaf do not understand. That's why I spoke of practical examples ... when the teacher, he ... he gives examples, then the deaf understands, but when he stays in that scientific, scientific terminology ... the deaf is lost in class. (I2)</p>
	<p>Practical class or with visual material vs Theoretical class The difficulty is that, there are many concepts, many details that do not have ... teachers also do not prepare with visual material, right, because for the listener it is already difficult, to understand for example the operation of a cell, all those scientific names that have. It is difficult for the listener to understand, hence the deaf one, right, if he has no image. Then the interpreter has to go through this, the interpreter has to have a prior knowledge, to be passing it through LIBRAS [...]. (I1)</p> <p>So what I notice in Biology classes: when the teacher, she gives examples of real situations, when she focuses on the image, when she does practical classes the deaf loves it, he understands the lesson. Now when the class ... it gets more in the book, more theoretical, it gets complicated, Imagine how I feel ... mainly because of the scientific terminologies, and everything ... Hence he has more difficulty understanding the class. (I2)</p>
	<p>Specific or adapted material to teach No. At the moment we do not have any material at the moment. (T1)</p> <p>Material? No. The material that I have is ... I work with videos, book, pictures, right, with them, but not specific material. This is the difficulty that we have. (T2)</p>
	<p>Absence of signs for Biology All of them... There's no sign for everything, right? [...] As there is no sign, there in that moment of the lesson, while the teacher is explaining and the interpreter is there with the deaf, you can create a signal for that moment, right, for that lesson, not that it will be that conventional signal, right, conventional. But you can create a signal from that image that the teacher ... if the teacher brings an image, you can create a signal there at the time of the information to make it easier to pass the class. (I1)</p> <p>We sometimes "manage it all on our own" for the deaf to understand what's being said. In fact, what we do: we are ... when we do not type, the deaf, for example the deaf I interpret, she is very critical. So she sometimes asks, for example, the teacher on the board, a very simple example: if you are talking about carbohydrates and suddenly she did not understand this concept of carbohydrate, she asks, then I ask the teacher and explain again to her. So when I have these scientific terminologies and she does not understand I ask the teacher and the teacher explains it in a simpler language so she can understand. (I2)</p> <p>When you have a word, a too scientific word, I think they have a bit of trouble. (T2)</p>

Source: the authors.

Table 03 – Emerging category of communication between teacher and deaf students

Category	Communication between teachers and deaf students: in this category the means of communication between teachers and deaf students are identified
In writing	Through written material. Since a dialogue ... becomes difficult because one does not know how to treat the student, then the only way is the writing itself. (T1)
Through interpreters	Through the interpreter. (T2)



Table 04 – Emerging category of special attention from teachers to deaf students

Category	Special attention from teachers to deaf students during classes: in this category the means of communication between teachers and deaf students are identified
It is possible <i>Yes, I can. For knowing his difficulty in understanding certain parts of the content, it has to deserve special attention. (T1)</i>	
It is difficult <i>Look ... It's difficult. It's kind of complicated, it depends a lot on the class, if the class has fewer students, then you can even give a little attention, but everything depends a lot on the interpreter, in my case I'm not prepared, I did not take course to work with them, so I feel a lot of difficulty, so sometimes I even try but I can not, so I depend heavily on the interpreter. (T2)</i>	

Source: the authors.

Table 05 – Emerging category of deaf students' performance

Category	Performance of the deaf: in this category it is presented the manifestations of the teachers regarding the participation and the occurrence of learning on the part of the deaf students.
Participation <i>They participate. With certain difficulty in terms of how to express themselves, but usually through writing they can manifest themselves. (T1)</i>	
Learning <i>[...]when he is very keen to learn, then it depends on each student, since deafness is not a limit ... it is not a factor that will make learning difficult. (T1)</i> <i>Ah, I believe so. I believe so. (T2)</i>	

Source: the authors.

Table 06 – Emerging category of evaluative procedures

Category	Evaluative Procedure: in this category, teachers manifest themselves in relation to how the assessment procedures are performed for deaf students
Differentiated <i>The evaluation process is done in a different way leading to the correction of certain concepts, where they need to be written according to the verbal part with the written part, so I take the condition of writing rather than the verbal part. (T1)</i>	
Normal <i>Evaluation process? Normal, normal, right, with the interpreter. In the different case it is only in the case of the visual that the letters have to be written bigger, that makes a little difference, but in the case of the deaf student it does not. (T2)</i> <i>Then through the exams too, right, so you give the evaluations, then you see the results of the evaluations, but on a daily basis so I depend more on the interpreter to know how it is happening. (T2)</i>	

Source: the authors.

Table 07 – Emergent category concerning the role of the interpreter

Category	Role of the interpreter: in this category the role of the interpreter as a minimizer of problems in the relation between the deaf and the others is present and how much the interpreter is essential for the deaf students in the school environment
Minimizer of problems <i>It minimizes because the interpreter, he will do this ... this intermediation between teacher-student, student-student, student-school community. But it does not solve all the problems, right. He minimizes because the interpreter, he is prepared, most of the interpreters are prepared, to pass these concepts, and give this guidance with the teachers, right. (I1)</i> <i>The teacher is the one who has to teach, the interpreter will only transmit what the teacher is teaching, then it ends up that the interpreter takes some for himself, right, he ends up explaining, doing the teacher's role, but we can't take it all. (I1)</i> <i>Oh, from what I see, when they understand if they have an interpreter they will communicate and understand, then I ask the interpreter: Is that okay? are you understanding? Right, then she is the one who transmits to me: she understands. Because actually, I do not know. (T2)</i>	
Essential for deaf students in the school environment <i>Yes. Yes, because if there was no interpreter, that relationship would be even more impaired, right? Because when she needs to say something to someone, when she needs to address someone, she always resorts to the interpreter, if she did not have that person, those relationships between people would be more harmed. (I2)</i> <i>[...]in the day by day so I depend more on the interpreter to know how it is happening. (T2)</i>	

Source: the authors.



Taking into account the structured analysis, in summary it can be considered that when working in a regular classroom where there are deaf students, there are several difficulties pointed out by both the interpreters and the teachers. Regarding the difficulties that the interpreters face, according to I1, they involve the Portuguese Language: the deaf present great difficulty, depending on their life history and their identity in the community. This factor influences the school life of each student, which in turn presents different levels of reading. This is reflected in the work of the interpreter also in Biology classes, for example, because there are many concepts and scientific names that, if not accompanied by visual material, make learning difficult through the Sign Language.

The interpreters have another great difficulty with joint planning with the regent teachers, since they can not get in touch with them outside the classroom to discuss the matter to be worked. There is a lack of time to prepare for the interpretation.

Regarding the process of inclusion of deaf students, it is noted in this research that there are problems. I2, who has been working as an interpreter in regular schools for three years, realizes that deaf students, called included, are not experiencing true inclusion because of the difference between the languages used, the listening students do not relate to the deaf and vice versa. However, this relationship is not further impaired by the presence of the interpreter, who bridges the two linguistic groups.

It is possible to perceive, according to the interpreters, that language itself is an obstacle to the teaching of the included deaf students, both in situations of social interaction in the classroom and in moments of teaching. Deaf students find it difficult to relate to other hearing students and teachers because they use different languages. The deaf do not understand oral Portuguese nor its written form, in most cases, neither do teachers have knowledge of the Sign Language. In this way, both always depend on the interpreter for these relations to be established effectively.

In a consensus with Lacerda (2006), it is questioned whether the inclusive proposal has been really satisfactory, since the care of the child with special needs demands training, individualized care and curricular revisions that depend on a discussion and training work, which has been little accomplished.

Although the interpretation must remain true to the knowledge taught, by the world-perception characteristics of the deaf (visual perception), I1 asserts that there are contents that become vague to the deaf, since they can not be taught through the Sign Language and their classifiers in the absence of images.

It can be noticed that teachers report not being prepared to receive deaf students in inclusion classes. They do not know how to communicate, interact and explain the contents to these students, making their relation with them to be totally realized through an interpreter. With this limitation, they are not instrumental in perceiving the real difficulties that deaf students face in their subjects so that they can find ways to minimize such difficulties.

This lack of preparation on the part of the teachers implies an inadequate planning of materials, because if the classes were prepared taking into account the implications of the deafness, using images, practical experiences and visual resources to illustrate concepts, classes with included deaf students would be much more helpful to both deaf and hearing.



This consideration reveals that many teachers do not pay attention to the importance of language for the construction of abstract and scientific thinking and do not have in mind that Sign Language, mediated by the interpreter of Libras, is not only useful for classroom communication, but it is through it that the deaf students will attribute meaning to the content, as evidenced by Feltrini (2006 *apud* Prince, 2011. Our translation).

In teaching situations, the greatest difficulty is the lack of signs for scientific terms and concepts, especially in the Biology subject. This fact is pointed out by many studies and has been explained by the history of the education of the deaf that hindered the creation and documentation of scientific signs (Prince, 2011. Our translation).

This makes the interpreters seek alternative strategies to try to convey the class in a faithful way, without loss of information, such as using the datilology, convening signs and even asking for the contents to be explained in a simpler way by the regent teachers. We can see that these strategies are compatible with those presented by other studies on teaching Biology and Sciences for the deaf (Witchs, 2010; Marinho, 2007).

Recognizing the difficulty of the deaf in understanding the biological content, T1 states that they deserve special attention. Despite the presence of the interpreter in the class, T1 alleges ignorance about how to treat a deaf person, he considers that the only form of communication between him and the deaf student is writing. T2 recognizes that his communication with the deaf student occurs through the interpreter.

There is no agreement between teachers regarding the special attention given to deaf students, while T1 states that these students deserve special attention, T2 poses that it is very difficult, but depending on the class it may be possible to give a different care together with the interpreter.

With respect to the performance of the T1 students, the deaf students present the same learning performance as the hearing students, as long as they are very interested in learning, since deafness is not a factor that originally hinders learning.

Through the results of evaluations, which are not different from those of the other listening students, T2 is able to infer the performance of the deaf and maintains that they have the same learning performance as the listeners, but very much depends on the interpreter's opinion of their performance in the day to day. Regarding the evaluations of deaf students, T1 admits that he corrects concepts in their written form, disregarding their verbal form, due to the difficulty of the languages, which shows a differential treatment of this teacher in relation to the deaf students.

It is clear to all the interviewees that the presence of the interpreters minimizes the difficulties of inclusion of deaf students, since this professional, according to I1, is responsible for mediating teacher-student, student-student and school-student interactions and he is prepared to work concepts and guide teachers. He is also responsible for adapting lessons to make them more accessible to the deaf. In this way, this professional becomes indispensable and essential in the school environment.



Final considerations

In view of the scenario of the inclusion of deaf students in regular classes of Basic Education, and the emergence of the professional educational interpreter in these classes, this paper sought to clarify how the process of inclusion and teaching in the subjects of Sciences and Biology, by the perspectives of teachers and interpreters.

The key piece in this process is the Brazilian Sign Language, used by the deaf community to communicate, think, learn and assimilate scientific concepts. In this way, it was necessary to investigate the history of this language and its influence in the teaching of deaf people.

From studies in this area, it was possible to show that this language has gone through many controversies until it was established and legally accepted as a language. It was revealed as an aid for the teaching of the deaf, later rejected in the teaching of the deaf, banned as a form of communication, and today it is encouraged as the best way to teach a deaf person.

So many contradictions resulted today in a suppressed language of society, so that only the deaf community uses it, despite being an official language of Brazil, and so lacking in its own lexicons, that it hinders the work of those who use it precisely to facilitate inclusion of deaf.

To investigate how teachers and interpreters perceived and acted in this process, some of them who work in primary education schools with the inclusion of the deaf in the city of Cornélio Procópio (PR) were interviewed. In front of their speeches some difficulties that participants in the inclusion process face and possible strategies used to try to minimize these difficulties were listed.

Language and communication were pointed out by the interpreters as an obstacle to the deaf students' socialization within the classroom, since they are the only users of Brazilian Sign Language, having to always use the interpreter to communicate with colleagues and with the teacher.

Another difficulty pointed out by interpreters is the non-inclusive way that Biology teachers prepare their classes. The scientific content has many proper terms and concepts that do not find referents in sign language, so the abundant use of images and practical examples is recommended. In an attempt to overcome this linguistic obstacle, interpreters use some strategies that coincide with strategies reported in other studies such as: use of the typology, convene exclusive signs for the class and even ask the teacher for help, to explain in different ways.

Teachers, on the other hand, complain that they do not receive special training to receive these deaf students. They often rely on the interpreter for all teacher-student interactions, as they do not know sign language, deaf culture, and the peculiarities of deaf education.

As a result of this unpreparedness, the teachers set up their classes without taking into account the way of learning of the deaf, thus damaging their access to knowledge. This scenario of limitations and difficulties can be minimized through training for teachers working in deaf inclusion classes, as well as the promotion of studies that generate scientific signals and dissemination to the interpreter community, as well as the encouragement of the diffusion of the Brazilian Language Signals at various levels of education.



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