Inclusive Teaching in Organic Chemistry: A Visual Approach in the Time of COVID-19 for Deaf Students

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Abstract

Before the covid-19 pandemic paradigm, the education sector has been facing several challenges. Especially in the Chemistry area, the subjectivity and complexity conditions are admitted by many students when it is about teaching the content of this science. Furthermore, the promotion of active methodologies for teaching Inclusive Chemistry is deficient, mainly, methodologies which contemplate the particularities of the deaf community. In this context, the purpose of the present work is to offer remote teaching activities that addressed the content of Organic Chemistry in a contextualized way with environmental awareness regarding Urban Waste (RU), involving the principles of Inclusive Education (IE) for a high school class consisting of hearing and deaf students from a public school in Brazil. As for the methodology, the research was based on a qualitative and participatory perspective. Aiming at a methodological proposal which contemplates the students´ educational gaps, especially the deaf population, such as accessibility in Brazilian Sign Language (LIBRAS), the classes were contextualized with support by Digital Information and Communication Technologies (TDICs). Based on the activities carried out in the school environment, it was possible to verify continuous participation of all students, especially, in the activity which involved the water pollution simulator using the "Mozaik Education" software and showing how water pollution occurs upon contact with wastewater in a safe way. Therefore, the teaching resources used in this study were efficient, because they are facilitating agents in the knowledge acquisition process.

Keywords: inclusive chemical education, on-line teaching software, deafness, LIBRAS;

1. Introduction

According to Nogueira and Silva (2020), the disease called covid-19, which is caused by the Sars-cov-2 virus responsible for the pandemic, provoked countless social, economic and educational losses in the world. As a result of this global crisis, schools have been facing several barriers in terms of trying to keep the quality of teaching and the continuity of the school activities, even if remotely; thus, meeting the requirements of social distancing, which, for example, is one of the attitudes to combat the disease progress in the current period (HAGE and SENA, 2021).

In this perspective, the interactions and the relationships between teachers and students were provided with digital means, complying with the legal principles in Ordinance No. 343, dated March 17, 2020, of the Ministry of Education (MEC), which, in short, attributes “exceptional replacement of in-person subjects [...] with classes that use information and communication means and technologies” (BRASIL, 2020, p. 01). In other words, the classes started to take place remotely as emergency, making the

applicability of the didactic methods used by many educators difficult, and consequently, making the aspect of innovation in the teaching practice indispensable.

To what refers to teaching Chemistry, most students admit high abstraction, subjectivity and complexity regarding the content related to the field of this science. Thus, in addition to all adversities pursuant to education in times of pandemic, teachers of the aforementioned discipline face setbacks arising from the students' lack of interest, which appears to be contradictory, considering that the chemical processes are fully present in the daily lives of these individuals. However, the insufficiency of contextualization ends up distancing the students from the scientific knowledge even more, making their civic education more difficult (ALMEIDA et al. 2008).

Associated with the aforementioned issues, the promotion of active methodologies for teaching Chemistry is deficient as well, above all, methodologies that contemplate the particularities of the deaf community, considering that according to Santos and Oliveira (2016), most teachers think that accessibility for the mentioned population is just the presence of the Sign Language Interpreter (TILS) in the classroom, many of these professionals are unaware of the idea that the traditionalist methods used to teach hearing students are structurally different from those planned for teaching deaf students. Thus, it is evident that it is necessary to invest in the qualification of the licentiate for them to be able to work in a really inclusive way (SIQUEIRA, 2016).

In this context, the purpose of the present proposal for pedagogical intervention is to promote remote teaching activities that addressed the content of Organic Chemistry in a contextualized way with environmental awareness regarding Urban Waste (RU), involving the principles of Inclusive Education (IE) for a high school class consisting of hearing students and one deaf students. Such action corroborated to make them more critical and aware citizens.

1.1. Inclusive education

For many decades, education for Persons with Disabilities (PwDs) has been marked by episodes of intolerance and marginalization, once, as Glat and Fernandes (2003) point out, the teaching and learning process of the referred population has been based on a segregated working model.

However, since the 90s, upon the elaboration and the publication of the Salamanca Statement (1994), the notion and the need for inclusive education, i.e., education which effectively contemplated all people and their “physical, intellectual, social, emotional, linguistic or other” conditions (p. 3) was understood. Thus, the inclusion process should encompass from PwDs to "gifted [...] children, street and working children, children of remote origin or nomadic population, children belonging to linguistic, ethnic or cultural minorities, and children from other disadvantaged or marginalized groups” (SALAMANCA STATEMENT, 1994, p. 3).

In Brazil, according to Mendes and Reis (2021), the discourses on school inclusion began with the enactment of the Law on National Education Guidelines and Bases (LDB) No. 9394/1996, so that this legal document pointed to the urgency in the development of adaptation of the Brazilian teaching institutions for them to be able to assist all students satisfactorily. Accordingly, over the years, other records and laws related to inclusion have been created and/or improved in the country, as well as one of the documents of the Ministry of Education (MEC) issued in 2008, which classified the movement in search of global student

inclusion as a political, cultural, social and pedagogical action which considers education for all as implementation of the constitutional norms:

Inclusive education is an educational paradigm based on the concept of human rights, which combines equality and difference as inseparable values, and which progresses in relation to the idea of formal equity by contextualizing the historical circumstances of the exclusion production in and out of school (MEC, 2008, p. 5).

Recently, another legal framework related to social inclusion in Brazil was the enactment of the Brazilian Law on Inclusion of Persons with Disabilities (LBI), also known as Law No. 13,146 dated 2015, or the Statute of Persons with Disabilities (Brazil, 2015), considering that this legislation has been issued to guarantee and promote equitably the use of the right to inclusion and citizenship for the referred population (Machado, 2021). Thus, it is possible to consider LBI as exceptionally significant progress for the education sector, bringing guidelines on the right to full, qualified and accessible education for PwDs to the country:

Education is a right of the persons with disabilities, assuring an inclusive educational system at all levels and learning throughout the entire life, in order to achieve the maximum possible development of their physical, sensory, intellectual and social talents and abilities, according to their learning characteristics, interests and needs (BRAZIL, 2015).

The aforementioned educational modality, as pointed out by Rodrigues (2006), understands that the "difference" factor shall not be seen as a negative attribute of some individuals, but as an aspect of human nature, because for the author, Inclusive Education was created to address the "different", i.e., all students. Thus, it is evident that it is the role of the educator, with the help of the pedagogical team, to promote diversified methodologies for the students' learning to be based on an equitable process. In this condition, it is essential such paradigm to be implemented in the first grades of the regular education, because, as Carneiro (2012) discussed, spaces where the differences are welcome teach the children to value and respect the society in a natural way.

Therefore, as a recent survey carried out in Bangladesh points out, the foundations of Inclusive Education have to be presented and encouraged to the teaching professionals since the initial period of qualification, aiming to overcome the different challenges of the inclusive schooling (AMBIA and RAHMAN, 2021). Undergraduates and graduates are also responsible to question the aspect of insufficiency in EI-related issues in the construction of their academic curricula, given that the applicability of the described model shall be considered as something beneficial for all participants in the educational process (GONÇALVES et al., 2013).

Thus, the understanding of inclusion can be acquired by the teachers "such knowledge may be acquired by participation in projects, pedagogical workshops, congresses, seminars, meetings, study groups, among other actions that provide opportunities to think, reflect and practice, including pedagogical actions" (Gomes et al., 2021, p. 29). According to Fachinetti, Spinazola and Carneiro (2021), such understandings are emerging, especially in the current period, in which the need to offer quality public good accessible to all has been intensified, because, as they pointed out, covid-19 impacted all sectors, and mainly, the social universe.

1.2. Education of deaf people: historical process and the use of images

When referring to the history of the educational process of deaf people, Perlin and Strobel (2006) highlight an educational principle that caused big polemic, starting from year 1880 with the Milan Congress, Oralism. In this bias, such period was supported by numerous educational changes that resulted in intensive impacts on the deaf subjects´ lives. According to Baalbaki and Caldas (2011), one of the main assumptions resulting from the Milan Congress was that the deaf did not have physiological difficulties in relation to the phonatory system and the voice emission, i.e., "speaking" would not be a problem for them.

Thus, the school spaces started to adopt the Oralism method, so that, upon imposition of such approach, professionals from other areas were integrated into the educational sector, such as speech therapists and otolaryngologists, all this with the purpose to "normalize" the deaf people, because at that time, it was believed that these individuals were disabled (VIEIRA and MOLINA, 2018). Many bibliographic studies about Oralism point out that this was an extensive process which resulted in considerable damage in many people´s lives, Perlin and Strobel (2006) describe such events well:

No other event in the history of deaf people has had a higher impact on the education of deaf people like this one, which caused serious turbulence in education for over a hundred years, when the deaf subjects were forced to listening practices, having to abandon their culture, their deaf identity and submit to "hearing ethnocentrism", having to imitate them (PERLIN and STROBEL, 2006, p. 11).

Then, another important educational principle that marked the educational and historical continuity of the deaf community was Bilingualism. According to Garrutti-Lourenço (2017), this method is based on the use of two languages: Sign language (first language) and Oral (second language). This approach is known for dividing opinions, as it has been discussed a lot whether its functionality is effective or not. Reis and Morais (2020) inform that Bilingual Education is essential for the development of the deaf people; however, in Brazil, the Brazilian Sign Language (LIBRAS) is still marginalized in relation to the bilingual encouragement. Vieira and Molina (2018) collaborate with this notion, showing that most deaf people do not have access or encouragement to LIBRAS since childhood.

Currently, in Brazil, the processes developed for the educational sectors aim to assist all students fully within the convictions of Inclusive Education. About deaf students, Valsechi and Martins Filho (2020) argue that these students live in schools which pretend to be inclusive; however, they fail in several factors, among which, the absence of Sign Language Interpreting Translators stands out first, which is worrying, considering that Mendes, Chahini and Silva (2020) point out the relevance of these professionals to the "social, educational, and professional inclusion of the deaf, as well as in the mediation of communication between deaf and hearing people" (p. 337).

Another aspect is the lack of encouragement and use of the first language of the deaf people in the schools. Trevisan (2019) states that this occurs because most educational institutions do not consider the needs of structural adaptation of the school and the didactic resources to serve the students effectively. Pointing out that the context of the education of deaf people is more "integration" than an inclusive procedure. This indicates that there is a great need to create and/or improve policies for inclusive education with partnership of the school and the people responsible for the students in order to create management that supports the progress of IE. (MWIRICHIA, KATHURI and MARIENE, 2020).

One of the most discussed circumstances regarding the process of training deaf subjects today is the

exploration of the visuality aspects of these individuals, because work using images instead of textual elements "has been proven to contribute to the deaf student teaching and learning process due to the potential of the visual sense" (SOFIATO, 2016, p. 789). For Campello (2008), the applicability of this inclusive approach is called Visual Pedagogy, which is a structure that collaborates in the formulation of methodologies adequate for the deaf people´s needs, "valuing visuality and seeking new ways to present the worked content" (GOMES and SOUZA, 2020, p. 102-103).

Moda and Rodrigues (2015) reaffirm these understandings, stating that the communication channel of the aforementioned population is predominantly through vision, "once the characteristic of the deaf people is the visual experience, developed since their first social contact" (Moda and Rodrigues, 2015, p. 12) The applicability of such resources enables the teachers to assist in the process of conceptual development of deaf students effectively (VIEIRA, MOLINA, 2018; BIRINCI, SARIÇOBAN, 2021). Thus, it is understood that the teaching work is not disconnected from social inclusion, because the teacher's role is to mediate the learning of all students.

1.3. Importance of the contextualizing the Organic Chemistry teaching in the perspectives of Inclusive Education

According to Almeida et al. (2008), the didactic aspects related to contextualization are result of the reform of the high school education with LDB-No 9394/1996, guiding and motivating the correlation between the content understanding and its daily application. As a consequence thereof, there are many debates alluding to contextualization, especially for teaching Chemistry; however, significant progress is still necessary for the teaching community, because, as presented by Santos (2007), many teachers understand contextualization only as a mention of daily events.

The aforementioned author presents his conclusions on this problem, showing that the traditionalist methods are still impasses for the teaching process:

> [...] does the mere mention of physical, chemical and biological processes in the daily life makes the teaching of these sciences more relevant for the student? Will the student learn science more easily with such teaching? Often, this apparent contextualization is placed only as a background to cover up the excessive abstraction of purely conceptual, encyclopedic teaching of almanac culture. In this view, more and more content is added to the curriculum, as if isolated knowledge alone were the condition to prepare students for social life (SANTOS, 2007, p. 4).

In this context, it is possible to highlight one of the main specialties, which entered the structural plan of the Chemistry subject around 1850, the Organic Chemistry sub-area (OQ) (Roque and Silva, 2008); basically, this branch dedicates its studies and research to the structural formation of the carbon compounds and their properties. The analysis of the OQ's content enables understanding of numberless substances, which are indispensable to comprehend the maintenance of the living beings´ life, food, clothing, medicines, among many others (FERREIRA and DEL PINO, 2009).

However, teaching of OQ, as well as Chemistry in general, ends up being viewed negatively by the students, because many of them don´t know such notions. Rocha and Vasconcelos (2016) corroborate this perception, demonstrating that high school students cannot identify the existing relationships between the content of Chemistry and their lives out of school. Evidencing again the urgency of applicability of the contextualization in the teaching of the concepts of this subject. But knowing that in times of pandemic, as

already reported, education has been undergoing several challenges, how can teachers unite Organic Chemistry and the current pandemic context effectively, and above all, include deaf students?

For this purpose, it is indispensable the teachers from the area to understand that the covid-19 prevention actions involve the need of studies aimed at care for the environment (Conjo et al., 2021) and its chemical processes, once, as demonstrated by Santos et al. (2021), the generation of waste, including organic waste, has been considerably higher during the pandemic, contributing to the aggravation of the environmental impacts and human health. Thus, the combination of Organic Chemistry with the convictions of Environmental Education (EE) would be an efficient didactic approach, which, when placed within the principles of Inclusive Education for deaf people, as in the example of Visual Pedagogy and the use of illustrative images, would really help in the educational process of these students.

2. Methodology

It shall be pointed out that, as regulated by Resolution No. 466 dated December 12, 2012, of the National Health Council (CNS), research involving human beings must meet ethical and scientific fundamentals and be submitted and appreciated by a Research Ethics Committee (CEP) for its implementation (BRASIL, 2012). That said, this research project has been appreciated and approved under Certificate of Ethical Appraisal Presentation - CAEE: 50914521.8.0000.5185, by the Research Ethics Committee (CEP) of the Federal Institute of Paraíba (IFPB).

The research was carried out in 2021, in a federal public education establishment, the Federal Institute of Paraíba Campus João Pessoa, Brazil, with an inclusive class of the Environmental Control Technical Course composed of one deaf student and eight hearing students. The application and development team consisted of two students from the Licentiate Degree in Chemistry at the mentioned Campus and three professors from three different campuses of the mentioned Institution, namely: João Pessoa, Sousa and Cabedelo. The work was also supported by two Sign Language Interpreter from Campus João Pessoa, which were extremely important for the development of the action.

The application procedure was performed in four methodological development phases (Table 1). Due to the availability of time of the involved people, it was performed once a week for two hours, totally 8 hours of application divided into four meetings followed in order. The topic of the work adopted for the research was Organic Chemistry, as this was the content the students were studying at the time. It was focused on the introductory part of Organic Chemistry and its importance for the attention to environmental care, mainly aimed at the hazard of contamination of the affluent water due to the decomposition process of non-natural organic matter in the affluents, coming from Urban Waste.

The stages of the project application can be seen in Table 1:

Table 1: Project application stages	
Phase 1: Application of the Informed Consent Form (TCLE) and the Informed Agreement Form (TALE), both bilingual (written Portuguese and LIBRAS).	To support the participation of deaf and hearing students, assuring student confidentiality.
Phase 2: Performance of two classes contextualized using Information and Communication Technologies (TDICs).	Paying attention to the localization of the interpreter's window in the provided material, aiming at a more accessible and closer approach to the students' reality.
Phase 3: Exposure of classes with practices relevant to the covered content and the professional environment of the course (carried out VIRTUAL due to the limitations caused by the Covid-19 pandemic).	In addition to the use of ludicity as a tool to approach the students, using the virtual simulation artifact, the free software: "*Mozaik Education*" (MOZAWEB, 2021).
Phase 4: A Final Questionnaire (QF) was applied.	In order to observe the development of the class before the research.

Table 1: The project application stages.

It shall be pointed out that the work was done totally remotely, due to the aforementioned pandemic, and all stages of the work application were recorded with permission from all participating students, as well as their guardians, aiming to record the student comments.

3. Results and Discussion

During the first phase of the application, at the end of the presentation of the bilingual TCLE and TALE, there was free acceptance by the students of the Environmental Control Technical Course, as well as permission by the students' parents, who realized the importance and the richness of knowing what the experience provides.

To prepare the visual resources used in the second application phase, due attention was paid to how the deaf student would enjoy the class. This fact caused the first difficulty to be overcome, asking the following question "*How to make the deaf student enjoy the visual resource, together with the provided explanation?*". Figure 1 exemplifies the methodology commonly used by teachers for the deaf student to be able to observe the visual resource and TILS, which causes a serious problem, considering that this was

to be part of the means of communication of the deaf, concomitantly with the enunciation in LIBRAS. By not providing opportunity for visualization of the sign language at the same time as the visual didactic materials, many deaf people lose factors relevant for the learning (DA HORA CORREIA and COELHO NEVES, 2019).

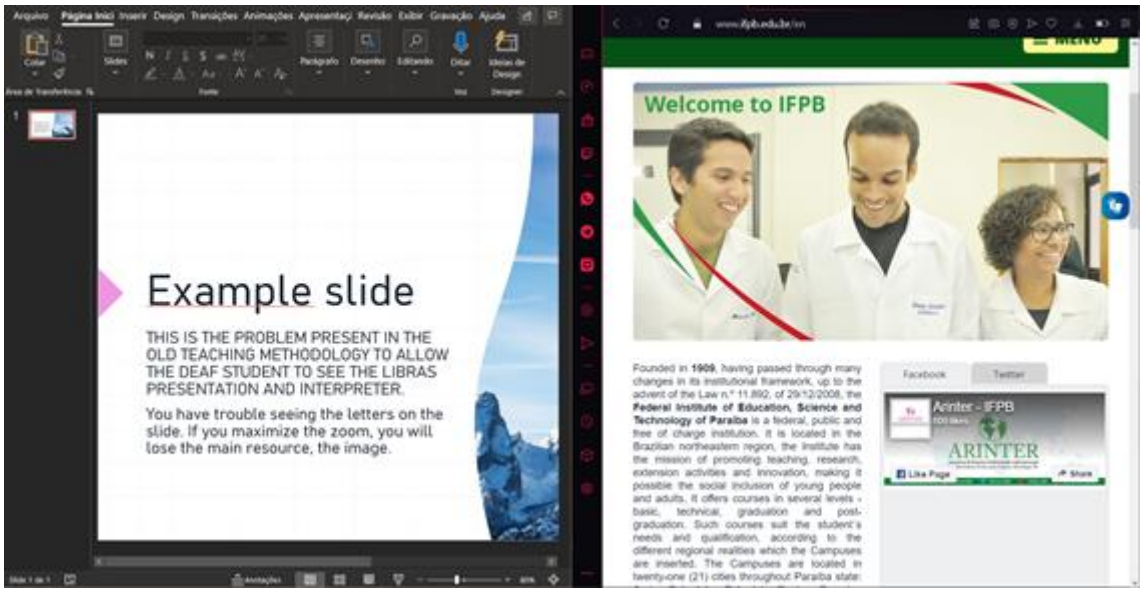


Figure 1. An example of the 'failure' in the method commonly used by teachers. Source: Own.

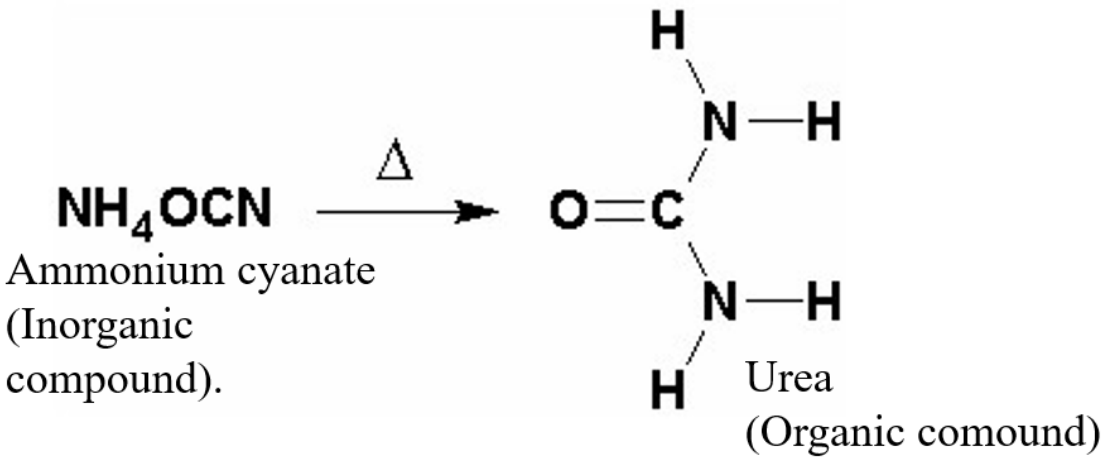
After several tests to solve the mentioned problem, a free software called “OnTopReplica” (ONTOPREPLICA, 2017) was found, which replicates a selected part of the screen or window simultaneously with the slide show, for example, by running in the background. Thus, it was possible to solve this difficulty, providing a space dedicated to TILS in the presentation window, in parallel with the reproduction of TDICS, as it can be seen in Figure 2.

Figure 2. Exemplification of the method adopted for application. Source: Own.

During the entire application of the class, high interaction of the students was noticed, especially,

in ludic moments, such as the image in Figure 2. Normally, in Brazil, charcoal is used for burning, smoking, among other purposes, i.e., wood, organic compost; this information was given to the students referring to the image of charcoal, which appear to be of vegetable origin, but are of mineral origin and not considered organic. The information on screen, as well as the way it was told (told in a ludic way, with the intention to be "icebreaker"), was a feature to stimulate the students´ interest and expectations.

In certain moment during the class, example of the urea synthesis (CH_4N_2O) by means of ammonium cyanate (CH_4N_2O), done by Friedrich Wöhler, was given. This proved the possibility for synthesizing of an organic compound from another inorganic compound, which invalidated the Vital Force Theory strengthened by the chemist Jöns Jacob Berzelius, which is based on the affirmation that organic compounds can be originates only from organic compounds (ATKINS, 2006). The demonstration of the reaction of the aforementioned experiment can be seen in Reaction 1:



Reaction 1: Urea synthesis reaction: Source: Own.

Figure 3 illustrates the approach to the historical context of Organic Chemistry, in which the contributions of Friedrich August Kekulé were playfully reported. This researcher proposed institution of three postulates: tetravalency of carbon, the equality of the carbon valences and the formation of carbon chains through carbon bonds. The focused figure demonstrates the resumption of expectation, when certain distancing of the students is noticed, a new "icebreaker" is introduced, sound anecdotes which, when placed at the correct time, are a ludicity tool, as shown in the analyzed figure, the fish Gary was inserted, so that the deaf student could memorize the figure of the chemist Friedrich August Kekulé in a simpler way and assimilate the concepts of the postulates of Organic Chemistry. To what refers to ludicity, Almeida (1995) states "[...] Ludic education always appears as a transactional form towards some knowledge, which redefines itself in the constant elaboration of individual thinking in constant permutations with collective thinking [...]" (ALMEIDA, 1995, p. 11).

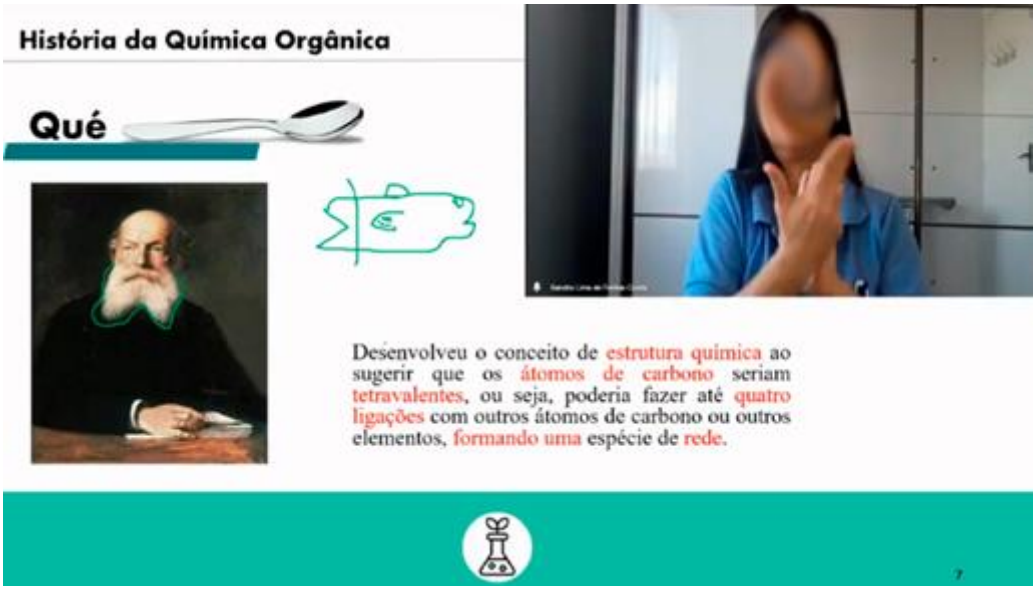


Figure 3. Ludic method used for teaching. Source: Own.

Then, the third phase took place with application of the free simulation software "Mozaik Education" (MOZAWEB, 2021), simultaneously with the translation into LIBRAS (Figure 4), to contextualize organic chemistry to the environmental issue, considering its high weight nowadays, pointing out the incorrect disposal of Organic Urban Waste (RUO) as a common problem. When RUO is incorrectly disposed of, it can pollute the soil, changing the physical, chemical and biological characteristics, resulting in a problem of aesthetic aspect, and the most aggravating, a serious threat to public health (MARQUES, 2011).

Figure 4. Use of the simulation software. Source: Own.

When mentioning the importance of contextualization with the environmental scenario, Oliveira et al. (2016) affirm:

The approach to the environmental issue in high school chemistry classes contributes to the development of values, behaviors and attitudes in the students, favoring the critical sense, increasing the awareness of how their actions impact their lives and the

life of the entire society today and in the future. (OLIVEIRA *et al*, 2016, p. 915)

The application of the simulator was a milestone in the entire application process, in which there were several interactions, such as a student who told in the chat: *"It is very important to know this"*, another student exclaimed: "*This makes perfect sense*", the deaf student also interacted during the entire class, mainly stating: *"I understand everything now."*

A comment made by the class marked the application of the simulators during the finalization process, when the impact of the excess of organic matter in a river area was explained, one student exclaimed: *"When this excessive deposit happens, the river becomes very polluted, that is, there is big presence of organic matter, and the eutrophication process occurs, which ends up reducing the level of oxygen in the river, causing the death of the beings and the proliferation of anaerobic bacteria, which, when they degrade the matter, end up forming hydrogen sulfide, also causing changes in pH, odor, color and taste of the water".* This student was praised for his observation extremely relevant to the taught content, emphasizing that learning is exchange of experience.

The experimentation, although carried out through a simulator, is important, mainly, when observing the pedagogical function to help the student understand chemical phenomena and concepts and due to the current pandemic scenario. Thus, Salesse (2015) points out that:

The function of the experiment is to make the theory come true, we could think that, as an educational activity, this could be done at several levels depending on the content, the adopted methodology or the goals intended with the activity (SALESSE, p 45, 2015).

Thus, making experiments helps to bring classroom Chemistry closer to the students´ daily lives; thus, making the classes more dynamic, expanding the students' capability to understand the chemical phenomena around them. (SALESSE, 2015).

The fourth and last phase occurred with application of a questionnaire made in "Kahoot", containing five questions about the entire content, also in a ludic way, once the instrument provides possibility for Quiz. Regarding ludicity, Kishimoto (1993) states:

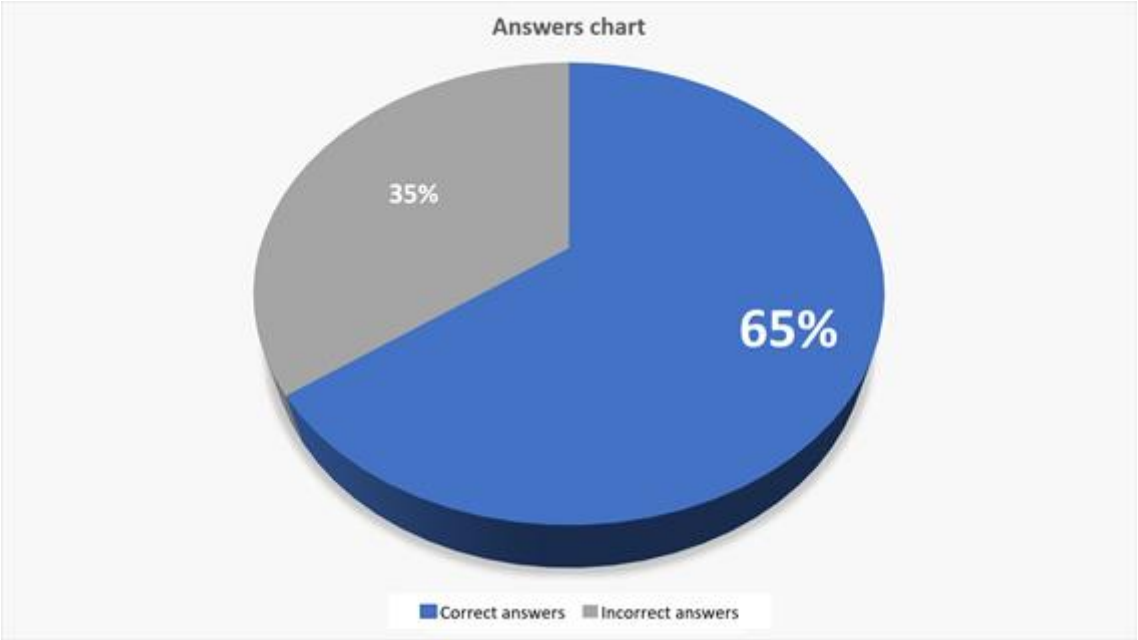
As a free and spontaneous manifestation of the popular culture, the function of the traditional games is to perpetuate the children's culture, developing a way of social interaction and allowing the pleasure of playing". As it belongs to the category of spontaneously transmitted experiences according to the child's internal motivations, the traditional children's play guarantees the presence of the play in the imaginary situation (Kishimoto, 1993, p. 33).

Before the application, a demonstration of how the Quiz worked and how it should be answered was made, as can be seen in Figure 5:

Figure 5. Demonstration of the Quiz. Source: Own.

After the brief explanation, the students started the quiz, the total time available for the game was 20 minutes. The deaf student did not get time privileges, but the total time was previously selected in TILS, aiming at better use due to the time for translation, since Portuguese is this student's second language (the first is LIBRAS). Regarding the content, it was the same for the hearing and the deaf, placing them at a similar level.

Graph 1 illustrates the answers obtained with the Quiz:



Graph 1. Answers of the Quiz resolution. Source: Own.

In Graph 1, it can be seen that the percentage of correct answers is 65%, i.e., it is within a regular range. Paying attention to the 35% incorrect answers, it was seen that some students complained about unforeseen events pursuant to problems with the oscillation of the internet signal during the resolution

process, leading to network outage, a problem which is typical for remote education. At certain point, there was power outage in the deaf student's house, he remained throughout the application process using mobile internet, i.e., the deaf realized the importance of the application, compensating with effort, attention and dedication to complete his participation in the activity.

The results during and after the developed action showed that when the methodology in Chemistry teaching is made adequate by means of adaptation and improvement of the didactic resources, as well as use of contextualization with the student experience and EA, associated with ludicity for the students, mainly, deaf ones, it is possible to reach comprehensibility of the concepts. In addition, the individual knowledge of each student must be taken into account, because thus, there will be development to promote significant learning; therefore, the students´ participation and commitment (mainly, that of the deaf student), as well as the results of the Quiz, delivered enthusiastic results.

4. Conclusions

All citizens have the right to quality Basic Education. However, currently, Chemistry teaching for deaf students has been problematic and needs to be restructured urgently. Thus, the methodology used in this research allowed deaf and hearing people to participate in the pedagogical process actively, building chemical concepts in a critical and cooperative way. Likewise, didactic resources such as TDICs, use of simulation software, contextualization, the suitability of the material for enunciation in LIBRAS, proved to be efficient facilitators in the Chemistry subject, mainly, for deaf. Therefore, the work contributed to the formation of citizens aware of the processes of the world and life, by connecting the scientific and the empirical knowledge, respecting each individual's sensory, linguistic and cognitive differences.

5. Acknowledgments

The authors would like to express their gratitude towards the Federal Institute of Paraiba (IFPB) for their support in making this project possible. This work was supported by Edital 02/2021 (Chamada Interconecta) initiated by IFPB. Further, the authors would like to thank every participant engaged in this academic research.

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