Green Hydrogen - How to set up a class for students with deafness

https://doi.org/10.56238/sevened2024.015-002

Wellington Marcelino Piropo[1], Aline Varella Rodrigues[2] and Ana Cristina Trindade Cursino[3]

ABSTRACT

This chapter of the book emphasizes the importance of making chemistry content accessible to deaf students. Using hydrogen as a thematic support, the research carried out as an applied methodology aimed to identify the options for adapting a class to meet the needs of deaf students. Given the lack of adaptation in many classes for this audience, the study proposed the application of the methodology of investigative experimentation, with the principles of the Three Pedagogical Moments.

Keywords: Chemistry, Green hydrogen, Deafness, Libras, Inclusion.

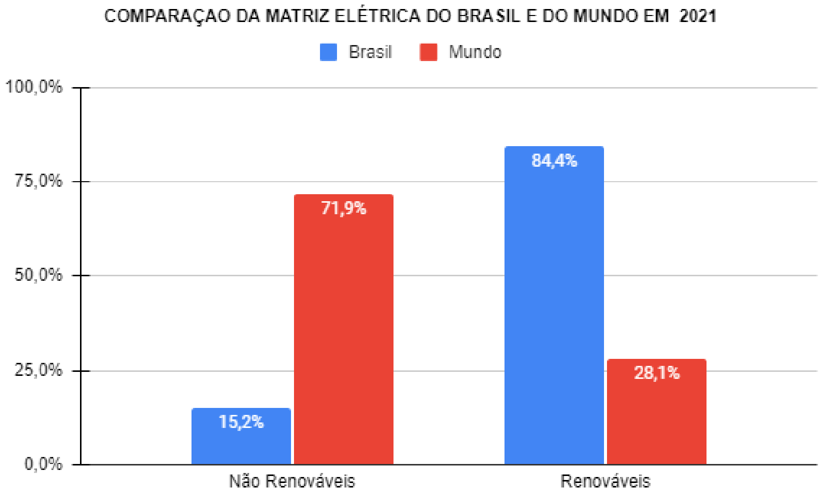
[1] Federal Technological University of Paraná (UTFPR)
[2] São Paulo State University "Júlio de Mesquita Filho" (UNESP)
[3] Federal Technological University of Paraná (UTFPR)

INTRODUCTION

Hydrogen is recognized as the most prevalent chemical element in the universe. Consequently, the importance of "green hydrogen" as a fuel for the future is evident. The applications are diverse, such as in fuels for car, airplane and ship transport. Hydrogen is obtained by water electrolysis, which is the breakdown of hydrogen and oxygen molecules in water (H_2O), through electricity, using renewable energy sources. To produce hydrogen, we often use natural gas or coal. But this process releases carbon dioxide (CO_2^-), the main pollutant responsible for global climate change today. Therefore, the green hydrogen applied would zero the release of carbon dioxide, because, with the use of renewable sources, its production would be without the emission of CO_2 [1,2]. Therefore, its high energy potential together with the need to reduce environmental impacts make green hydrogen the fuel of the future.

Brazil stands out in the world market for already using renewable sources such as hydroelectric, wind, solar and biomass [3]. The different percentages of electricity sources used in Brazil and in the world, sources from renewable and non-renewable resources, can be seen in Figure 1.

Figure 1: Comparison of the electricity matrix of Brazil and the world in 2021.



Source: From the author himself, adapted from [3].

As can be seen, green hydrogen is one of the topics of great discussion. However, it does not reach the scientific academy in its equity. Deaf students in many Brazilian public schools, for example, are unable to follow their studies in such a context due to the precariousness of the educational system itself. Therefore, the educational inclusion of these continues to be a current challenge. Scarcity of accessible resources, lack of bilingual teachers and absence of Libras interpreters in some public institutions are some of the factors that intensify the problem. In addition to the challenges mentioned above, it is also essential to consider the physical issues that impact the presence and performance of deaf students. Many additional challenges arising from these conditions result not only in difficulties in class participation, but also in school delay. The lack of structure and accessibility in educational institutions plays a significant role in this reality, restricting the educational engagement and performance of these students [4].

In this context, the research carried out here explored the concept of green hydrogen with the use of a teacher to assemble an accessible material for a deaf student. In view of the linguistic difference present in the deaf community and the limitations in chemistry teaching methodologies, this work presented a proposal for a didactic resource applicable to a chemistry theme.

METHODOLOGY

To reduce the differences in teaching-learning among deaf students, it was proposed to implement investigative experimentation in the classroom, following the methodology of the Three Pedagogical Moments: Initial Problematization, Organization of Knowledge and Application of Knowledge. The Initial Problematization aims to arouse the interest of students through everyday situations, visually adapted. In Knowledge Organization, students explore concepts, participate in group discussions, and use visual aids to deepen understanding. In the Application of Knowledge, they use learning together with experimentation.

EXPERIMENTAL

MATERIALS AND REAGENTS

To carry out the experiment, the following materials were required: 100 mL Erlenmeyer (04), a small amount of chopped aluminum foil, match (01), bladder (04), funnel (01) and a solution of caustic soda (sodium hydroxide) with a concentration of 0.5 mol. L-1.

EXPERIMENTAL PROCEDURE

Sodium hydroxide 0.5 mol. L-1 is corrosive and toxic. Therefore, this product has been handled with great care. Masks and goggles were used. The package was hermetically sealed. 1 mL of sodium hydroxide was added to the Erlenmeyer Sintra Millimeter, using a funnel for easy handling. Then, the chopped aluminum foil was placed inside the erlenmeyer. The beginning of the reaction was observed by the dissolution of the aluminum foil, and the flask was carefully removed from the erlenmeyer when it was filled. The balloon was tied with a knot so that the gas could escape. Notes about what happened during the process were made by the students. Stretching out his arm, one student held the balloon while another popped the balloon with the match. The procedure was observed by the students, who took note of what happened. The same procedure was repeated for the other erlenmeyers.

RESULTS AND DISCUSSIONS

The first phase of learning consisted of the theoretical exploration of the approach and the pertinent chemical concepts. Initially, a dialogued survey was conducted so that the students' previous knowledge could be evaluated with the following question: 'When thinking about hydrogen, what comes to mind?'.

Soon after the survey, there was an exhibition of what would be the concept of hydrogen, as a historical part with the help of visual resources, as well as and in the following problem situation: 'In recent months, Brazil has experienced remarkable climate changes, characterized by an increase in rainfall and high temperatures'. These climate extremes have generated a series of challenges in several regions of the country, directly impacting security, local properties and the infrastructure of the places themselves. What could the population do to reduce these climate issues? And what other means could be used as a renewable source of energy?'. Based, therefore, on previous knowledge and information developed so far, the students were guided to create hypotheses for the solution of the problem.

In the third stage, the focus was on the theme of green hydrogen, addressing definitions, applications and related environmental issues. This exploration provided students with information so that they could elaborate more informed answers to the problem-question presented above.

The closing stage involved the participation of students in a practical experiment with hydrogen gas. Here, the students were separated into four pairs to carry out the experiment. When mixing sodium hydroxide and aluminum, the students observed the following reaction:

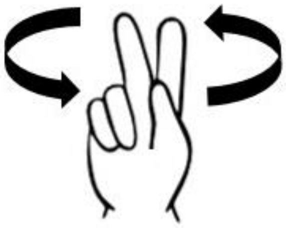
$$1\ NaOH + 2\ Al + 2H_2O \rightarrow 2\ NaAlO_2 + 3\ H_2$$

By adding sodium hydroxide, an exothermic reaction occurred, releasing a lot of heat. At this time when hydrogen was produced, all care was taken [5].

The sodium hydroxide reacted with the aluminum foil, generating sodium aluminate ($NaAlO_2$) and hydrogen gas, which filled the bladder. The bladder, containing enough hydrogen gas, can then rise, since it is lighter than the gases that make up the air. Hydrogen is highly flammable and can go into a combustion state when it comes into contact with a heat source, often a spark or flame.

In addition to experimentation, the teacher can use other resources that already existed, so that he could help students during class in an accessible way in Libras such as the periodic table. For this, it was necessary to have a teacher with skills in Libras so that communication with deaf students was effective. An example of the symbology of the hydrogen element for Libras can be seen in Figure 2.

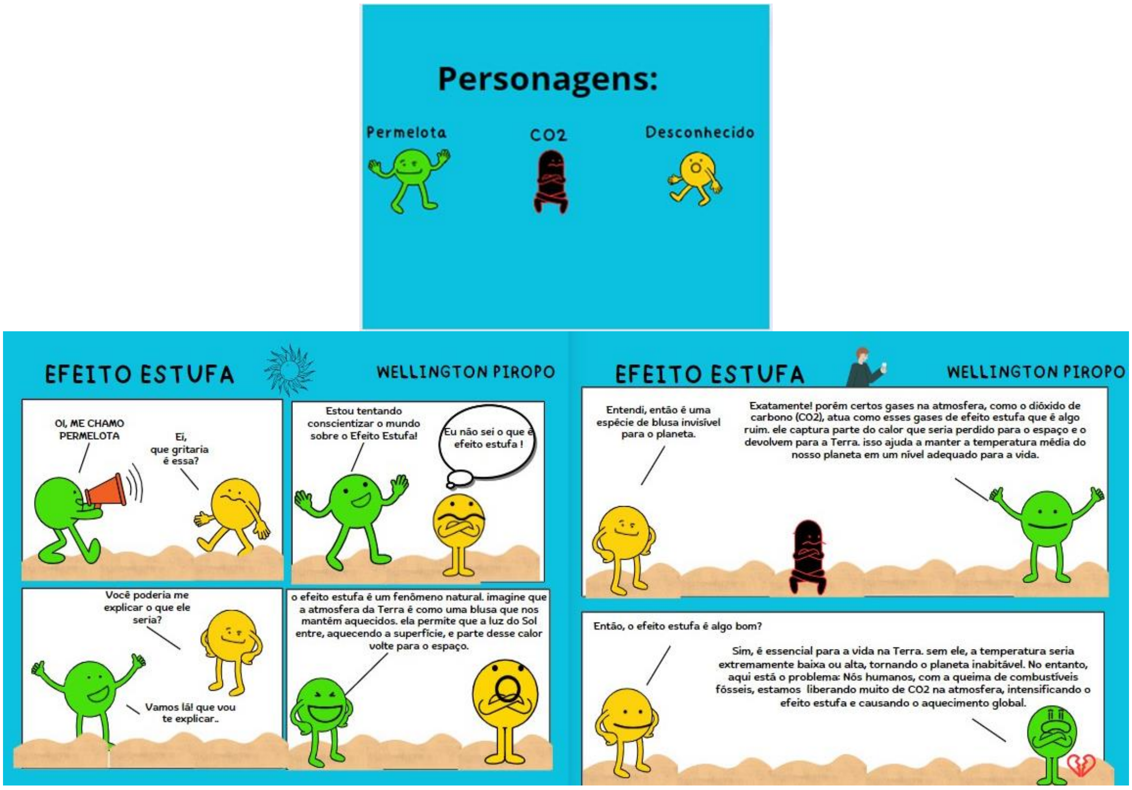
Figure 2: Symbology of the element hydrogen from the periodic table for pounds.

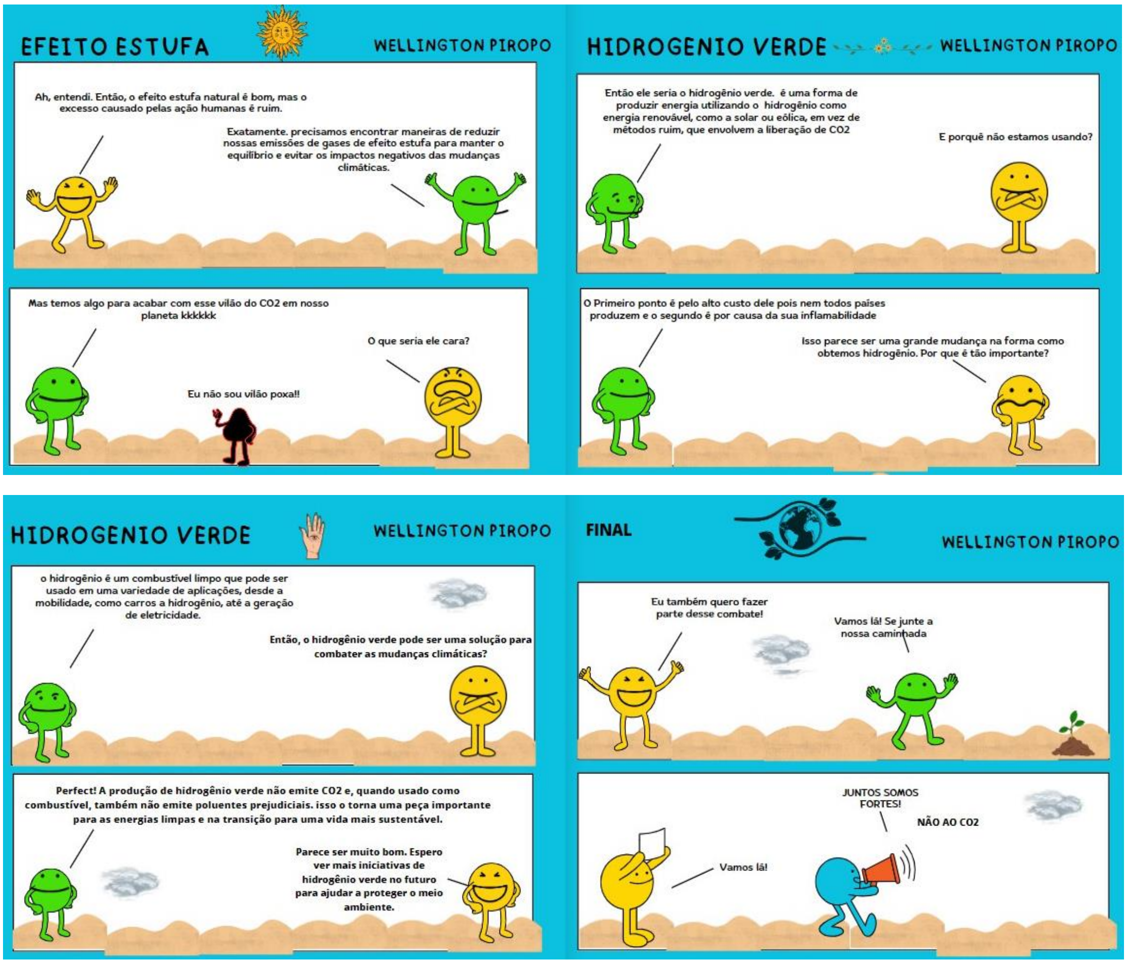


Source: From the author himself, adapted from [6,7].

Another way to address the topic of green hydrogen was through a brief comic book, which can be used as a review of the subject. An example is shown in Figure 3, highlighting the importance of green hydrogen in the emission of carbon dioxide and its consequences, such as the greenhouse effect.

Figure 3: Comic book about the role of green hydrogen in carbon dioxide emissions and its consequences, such as the greenhouse effect.





Source: The author.

CONCLUSION

By adapting the theme of green hydrogen to cater to deaf students, teachers have played an important role in building more accessible classes. The application of the methodology of the Three Pedagogical Moments, with an emphasis on experimentation, was not limited only to the understanding of the content. It also promotes more meaningful interaction between deaf and hearing students. This interaction contributed to the creation of a more welcoming educational environment, where the exchange of experiences between groups is fundamental. In addition, this approach allows deaf students to explore their previous knowledge on the subject and establish practical connections between the theory presented in the classroom and their daily lives.

ACKNOWLEDGMENT

I am immensely grateful to Dr. Prof. Ana Cristina Trindade Cursino for providing this job opportunity, which took me out of my comfort zone and provided a unique view of the degree. My thanks also to Dr. Prof. Aline Varella Rodrigues for accepting to participate in this article and for the guidance, support that were fundamental for my learning.

REFERENCES

1. ________. (2021). O que é Hidrogênio Verde? Disponível em: <https://www.h2verdebrasil.com.br/o-que-e-hidrogenio-verde/>. Acesso em: 14 jul. 2024.

2. Boscolo, M. (2023). Quais são os benefícios e os danos do dióxido de carbono? Disponível em: <https://www.nationalgeographicbrasil.com/meio-ambiente/2023/01/quais-sao-os-beneficios-e-os-danos-do-dioxido-de-carbono>. Acesso em: 14 jul. 2024.

3. Empresa de Pesquisa Energética. Matriz energética. Disponível em: <https://www.epe.gov.br/pt/abcdenergia/matriz-energetica-e-eletrica>. Acesso em: 15 jul. 2024.

4. Gomes, I. (2012). Pessoas com deficiência têm menor acesso à educação, ao trabalho e à renda. Disponível em: <https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/37317-pessoas-com-deficiencia-tem-menor-acesso-a-educacao-ao-trabalho-e-a-renda>. Acesso em: 14 jul. 2024.

5. ________. (2016). Produzindo gás hidrogênio – o gato experimenta #8. Disponível em <https://ogatodacaixa.wordpress.com/2016/11/03/produzindo-gas-hidrogenio-o-gato-experimenta-8/>. Acesso em: 14 jul. 2024.

6. dos Santos, A. E. (2020). Tabela periódica inclusiva. Disponível em <https://www.ifmg.edu.br/portal/noticias/professora-do-campus-bambui-desenvolve-tabela-periodica-em-libras/tabela-periodica-inclusiva-profa-alda-ernestina.pdf>. Acesso em 14 jul. 2024.

7. Medeiros, A. R. N., Soares, V. C., Chiquitto, A. G., Mourão, F. P., & dos Santos, A. E. (2021). Tabela periódica inclusiva: desenvolvimento de um software para auxiliar professores no ensino de química para alunos surdos. Disponível em <https://www.ifmg.edu.br/sic/edicoes-anteriores/resumos-2021/ciencias-exatas-e-da-terra/tabela-periodica-inclusiva-desenvolvimento-de-um-software-para-auxiliar-professores-no-ensino-de-quimica-para-alunos-surdos.pdf>. Acesso em 14 jul. 2024.