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VOICES THAT COME OUT OF THE HANDS: ASTRONOMY FOR THE DEAF

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ABSTRACT

Astronomy learning for deaf is currently a remote possibility in Brazil, something that hardly happens or, when it happens, it is usually very limited. In order to improve astronomy education for deaf children and the school-aged youth, it is necessary to expand the resources of the Brazilian Sign Language (Libras, acronym in brazilian portuguese), to strengthen the preparation of teachers, to develop teaching resources more aligned with sensory experience of the deaf and even of rethinking organizational aspects in classroom settings. Astronomy is very important for the educational background of the deaf and has a significant role in its introduction of the fundamentals of science and to motivate students for scientific knowledge.

RESUMEN

El aprendizaje de astronomía para personas sordas es actualmente una posibilidad remota en Brasil, algo que casi no pasa o que, cuando ocurre, suele ser muy limitado. Con el fin de mejorar la educación astronómica para niños sordos y los jóvenes en edad escolar, es necesario ampliar los recursos del Lenguaje de Señales Brasileño (Libras, siglas en portugués brasileño), para fortalecer la preparación de los docentes, para desarrollar recursos didácticos más alineados con los sentidos experiencia de los sordos e incluso de repensar aspectos organizativos en ajustes del aula. La astronomía es muy importante para la formación educativa de los sordos y tiene un papel importante en la introducción de los fundamentos de la ciencia y para motivar a los estudiantes en el conocimiento científico.

Key Words: deaf — inclusive science — science education

1. INTRODUCTION

A person born with deafness does not apprehend the world in the same way as a hearing person. Sound is not part of their perceptual reality, which alters their relationship with oral and written language, in addition to inducing a very strong sensory focus on the other senses, especially vision.

The teaching of Astronomy to the deaf is currently a remote possibility in Brazil, something that practically does not happen or, when it does happen, it is generally very limited. In this sense, teaching for the deaf is a challenge because it faces a clear limitation of the Brazilian Sign Language - Libras, in which the lack of signs related to Science in general (and Astronomy in particular) is notorious.

After an analysis, on the website of the Brazilian Signs Dictionary and the Three Books of the Sign Language Dictionary of Brazil: The Sign Language in your hands, it is observed that Libras incorporates only a small number of signals about the vast field of phenomena in the universe. And even so, there are more basic things like the Sun, Moon, Planets, Telescope and Stars - all more familiar to the common sense and insufficient for a broader understanding of Astronomy or for an effective teaching of the subject, involving a description of characteristics of objects or narratives. of phenomena.

A solution to improve astronomy education for the deaf consists of two points that would positively impact learning: expanding the signs of Libras and developing didactic visual resources to support teaching. The sense of sight is undoubtedly an important compensatory resource for the deaf. The teaching of Astronomy can then explore a pedagogical and didactically more appropriate curriculum for this strong point of the deaf, in order to provide methodologies that better take advantage of their cognitive advantage in vision (Xavier 2019).

2. SIGN LANGUAGE - LIBRAS

The Brazilian Sign Language - Libras is the natural language of deaf communities in Brazil. It is fully articulated through signs, having its own structure and rules. It is characterized by a set of conventional gestural forms used by the deaf to communicate with

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each other, or with hearing people initiated in this code. Linguistically, the expression resources of the deaf have a fundamental difference: while the language of hearing people is oral-auditory and based on phonemes that are emitted to form words, the language of the deaf (Libras) is visual-spatial. Libras uses hand movements and points of articulation, which are places on the body itself or in space, where signs are made and also facial and body expressions, thus configuring a linguistic system for transmitting ideas, facts and emotions (Fig. 1). According to Quadros & Karnopp (2004), the parameters of Libras are:

- configuration of hands
- point of articulation
- movements
- hand orientation
- facial and/or body expression

3. LACK OF SIGNS

The teaching of Astronomy for the deaf has a basic limitation in its language, in which words or concepts such as Emission Nebula, Pluto and Constellation, among many others, do not have a corresponding sign. So, in these situations, the use of typewriting arises, a manual alphabet in which each letter of the written language has a specific corresponding sign (Fig. 2), as if the words were typed letter by letter by hand signals. Deaf people use typewriting to write names of people, streets, objects and a multitude of words not included in Libras. There is a lack of scientific scope in Libras, and to improve the effectiveness of teaching for the deaf it is necessary to develop new signs.

In Brazil, the teaching of the deaf astronomy is in the absence of astronomical signals. For example, there are no signs for Pluto, Supernova, Stellar Agglomerate, Exoplanet, Radiation, Nuclear Fusion and numerous other objects, phenomena or fundamental concepts within the study of stars. The deaf community, the sign language ended only incorporating a small number of signs - like Sun, Moon, Planets, Comet, Eclipse, Telescope and Stars - which refer to more familiar aspects for people's daily life and are insufficient to deepen Learning and knowledge of the characteristics of the universe. That is, lack of scientific comprehensiveness of astronomy in the sign language.

Therefore, it is important to develop new signs to improve astronomy education by deaf in Brazil.

Fig. 1. The importance of communication in Libras in the lives of deaf people is an interaction process in which messages, ideas, emotions and feelings are shared (Libras Academy 2022).

With the expansion of the signs of astronomy and more appropriate for the perception of the deaf, the teaching of discipline can be more effective because the performance of the teachers and the learning performance of the students tend to be more effective.

4. DIDACTIC VISUAL RESOURCES

Expository classes with an abundant use of didactic visual resources and practical activities would be very useful. In other words, using different forms of communication (visual and lucid) in class, trying to establish a more effective connection with the deaf, who concentrate greater cognitive ability in the sense of sight.

Teaching for deaf people is still challenging, (...), as it is centered on "seeing" or "looking", and the teacher must carry out teaching strategies based on the visual (Quadros & Perlin 2007).

The use of images, simulations, a blackboard (to describe how things work) and styrofoam balls give a practical perception of the movement of the stars and serve to reinforce the students' learning performance, considering their deafness peculiarity.

Other possibilities of these resources, for example are: the use of a basketball and a tennis ball, both representing in scale, respectively, the Earth and the Moon (Fig. 3). Holding the tennis ball at a point and moving the basketball approximately 6.5 m away from it, an accurate idea (in scale) is created about the real distance between these two celestial bodies (on average 384,421 km).

Another resource: a string helps to explain to students the frequency and wavelength in the electromagnetic spectrum; with two participants holding the ends of the string and both applying movements to it, it is shown that the higher the frequency, the shorter the wavelength (Fig. 4).

An example of this adaptation to the sensorial reality of the deaf is in the content of the portal

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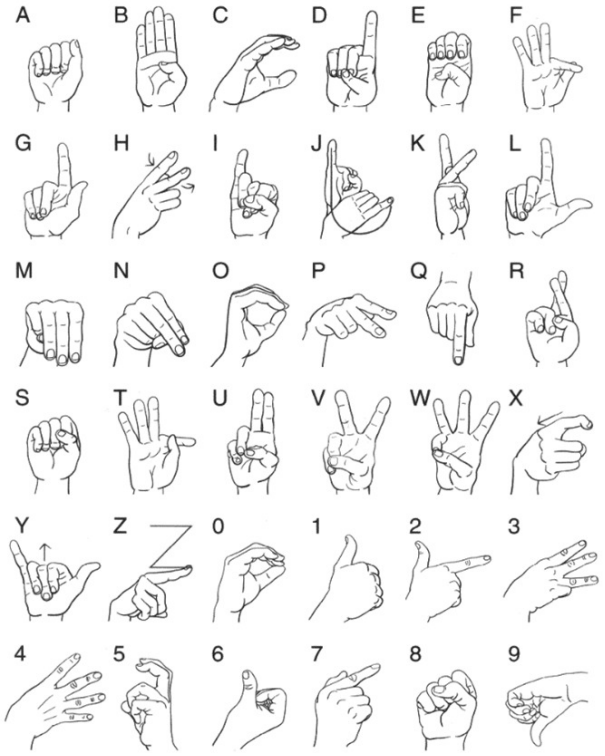

Fig. 2. Typing is the spelling of words (Karoline, Fernandes & Moreira 2015).

Fig. 3. Practical activity developed by the physics and astronomy professor Scott Hodkinson, from the Magnolia West High School, to explain the distance between the Earth and the Moon (Hodkinson 2017).

Astronomia em Libras (Figs. 5 and 6), created by one of the authors of this article who is deaf. The portal already has 190 videos with information about phenomena in the universe (Xavier 2017a,b).

Sign language is a language that uses visual resources. But didactic visual resources constitute another sphere of communication, describing how stars phenomena work as a whole. An example is in Figure 5, on the inclined axis of the earth's rotation. In this case, the visual didactic resource also has a potential to explain the movement of Earth's precession. This is the didactic visual feature. In this way, visual resources are sets of narratives for general simulations with objects. Anyway, they are essential tools for teaching astronomy by deaf, as best involve the feeling of vision and significantly compensate for the limitations of the deaf person, capturing better attention and facilitating learning about astronomical phenomena.

Fig. 4. British physicist Brian Cox (center), from the University of Manchester, demonstrating the relationship between frequency and electromagnetic wavelength. Source: BBC, Prof. Brian Cox - A night with the stars, (Cox 2011).

Fig. 5. Author Xavier describing how things work and relate to astronomical phenomena. Source: Astronomy channel in Libras, Facebook (Xavier 2017a).

Fig. 6. Author Xavier describing how things work and relate to astronomical phenomena. Source: Astronomy channel in Libras, Facebook (Xavier 2017b).

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These didactic and practical visual resources are important for a deaf student to understand better, as they present our teaching objective in a very visual way and in situations with their direct participation (Dominique et al. 2010). The sense of sight is undoubtedly fundamental and compensatory for the deaf.

In Brazil, in the 1960s, Prof. Dr. Rodolfo Caniato (Caniato 2017), dean of astronomers and physicists in the country, has already carried out numerous didactic experiments for the most varied audiences, with positive learning results (Caniato 1978, 1982, 2007, 2010).

5. CONCLUSION

The teaching of Astronomy for the deaf is still incipient, although its contribution to their education is quite relevant, mainly for their better insertion in the context of science. Libras has a deficit of astronomy signs and teaching resources suitable for the deaf are scarce. With solutions to these gaps, we can take a step forward in the learning of deaf people, including motivating their interest in Science in general (Xavier 2019).

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