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Inclusion strategies for deaf students in physics education: a systematic review of the publications of the Brazilian Ministry of Physics Education (2010-2024)

Inclusion strategies for deaf students in physics teaching: a systematic review of mnpef productions (2010-2024)

Inclusion strategies for poor students in physical education: a systematic review of MNPEF productions (2010-2024)

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Abstract: Deaf education in Brazil has evolved from a clinical-therapeutic paradigm to a socio-anthropological perspective, which recognizes deafness as a linguistic and cultural difference. In physics teaching, a didactic transposition that prioritizes the spatial-visual channel through Libras (Brazilian Sign Language) becomes necessary. This study analyzed inclusion strategies for deaf students in the academic productions of the National Professional Master's Program in Physics Teaching (MNPEF) between 2010 and 2024, through a qualitative systematic review. The results show that assistive technologies, bilingual videos, and tactile-visual experimentation favor learning and reduce cognitive overload. It is concluded that effective inclusion requires visual methodologies and teacher training focused on the democratization of scientific knowledge.

Keywords: Physics Education, Deafness, School Inclusion, MNPEF, Visuality.

Abstract: Deaf education in Brazil has evolved from a clinical-therapeutic paradigm to a socio-anthropological perspective that recognizes deafness as a linguistic and cultural difference. In physics teaching, a didactic transposition that prioritizes the spatial-visual channel through Libras (Brazilian Sign Language) becomes necessary. This study analyzed inclusion strategies for deaf students in the academic productions of the MNPEF (Brazilian National Program for the Promotion of Deaf Education) between 2010 and 2024, through a qualitative systematic review. The results show that assistive technologies, bilingual videos, and tactile-visual experimentation favor learning and reduce cognitive overload. It is concluded that effective inclusion requires visual methodologies and teacher training focused on democratizing scientific knowledge.

Keywords: Physics Education, Deafness, School Inclusion, MNPEF, Visual Abilities.

1. Introduction

1.1 The Historical and Legal Overview: from exclusion to a socio-anthropological perspective

The trajectory of deaf education is characterized by conflicts between approaches that aim to...
normalization of the individual and those that recognize their linguistic particularity. Throughout
For centuries, the clinical-therapeutic perspective prevailed, reaffirmed at the Milan Congress (1880).
which vetoed the use of sign languages on the grounds that the deaf should be incorporated into
society through oral communication and lip reading. This paradigm of disability, which viewed deafness
treated as a pathology to be "cured," it resulted in profound cognitive and educational setbacks for

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generations of students (SKLIAR, 1998).

In Brazil, the paradigm shift began to gain both legal and theoretical traction at the end of the 20th century.
20th century. The transition to a socio-anthropological perspective defines deafness not by the absence of
hearing, but through the presence of a visual experience and a language of its own. This understanding
This was corroborated by Law No. 10.436/2002, which recognized the Brazilian Sign Language (Libras).
as a legal means of communication and expression. This was done even more significantly by
Decree No. 5,626/2005.

This decree is essential for the inclusive education of deaf people, as it establishes the mandatory nature of
teaching Libras (Brazilian Sign Language), training bilingual teachers, and the presence of a Translator and Interpreter of
Brazilian Sign Language (Libras) in the classroom. Currently, the Brazilian Inclusion Law (LBI, 2015) reinforces the right...
to an inclusive education system at all levels, ensuring that the learning of subjects
Complex skills, such as physics, should not be denied to this segment of the population due to barriers.
communicational.

1.2 Teaching Physics in the Context of Deafness

Teaching physics to deaf students presents challenges that go beyond simply translating concepts. Physics,
traditionally based on mathematical models and sound abstractions (as in wave physics),
It needs to be rethought from a visual pedagogy perspective. As recent research indicates...
National Professional Master's Degree in Physics Teaching (MNPEF), the effectiveness of teaching is linked to
The teacher's ability to translate scientific knowledge into language that utilizes...
a spatial-visual channel, valuing experimentation and the use of assistive technologies.

2. Theoretical Framework / Results

2.1 Historical perspective and the Milan Congress

The understanding of deafness has undergone profound transformations, from a clinical view to a...
socio-anthropological conception. As highlighted by SKLIAR (1998), the clinical-therapeutic model,
Consolidated at the Milan Congress in 1880, it imposed oralism as the only way, disregarding the
The cultural identity of the deaf. However, the current perspective recognizes deafness as a difference.
linguistic and visual. As AGUIAR (2020) points out, Libras is not just an accessory, but a
language of instruction that allows the deaf student to structure their scientific thinking in a way
equivalent to that of the listener.

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2.2 Physics Teaching and Cognitive Load Theory

A central challenge in teaching physics to deaf students is managing divided attention. According to FRANCO (2019), based on Cognitive Load Theory, states that deaf students face a overload when trying to simultaneously follow the experiment, the teacher's explanation, and the... Interpreter signaling. To mitigate this effect, the theoretical framework suggests the use of resources that reduce the need for frequent visual transitions. RODRIGUES (2020) reinforces that the The use of bilingual and subtitled videos functions as an effective assistive technology. allowing the student to process the information at their own pace, connecting the sign language sign directly related to the observed physical phenomenon.

2.3 Visual Aspects and Experimentation in the Teaching of Wave Phenomena and Optics

Given the visual nature of learning for the deaf, physics should be taught through phenomena. perceptible. In the field of acoustics and wave phenomena, CASTRO (2015) and CALDAS (2017) They argue that teaching should focus on the physiological qualities of sound through vibrations. The theoretical framework indicates that the use of oscilloscopes and waveform visualization software allows that the concept of frequency and amplitude be "seen," replacing auditory abstraction. Similarly, PICANÇO (2015) argues that Geometric Optics is one of the most powerful areas for inclusion, as it uses the visual acuity of the deaf person to explain vision problems and the use of Corrective lenses, transforming physics into applied and functional knowledge.

2.4 Rationale and Teaching Practice in the MNPEF

The Brazilian legal framework, comprised of Law No. 10.436/2002 and Decree No. 5. Decree No. 5,626/2005 establishes that the education of deaf people must be bilingual. Within the scope of National Professional Master's Degree in Physics Teaching (MNPEF), this right translates into the creation of Educational Products (EP). According to the studied framework, effective inclusion occurs when the The teaching material is designed from its inception for the spatial-visual channel, ensuring that the The constitutional right to scientific education should be fully realized, in accordance with the Brazilian Inclusion Law (LBI). 2015).

The literature indicates that deaf students are vulnerable to learning disabilities in exact sciences disciplines, due to the historical lack of technical terminology in Libras (Brazilian Sign Language) and the shortage of visual methodologies. According to FRANCO (2019), the teaching-learning process of Physics is

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affected by the phenomenon of divided attention, in which the student needs to manage attention simultaneously.
The observation of the experiment and the interpretation of the signal. According to the results of the study of
FRANCO (2019), cognitive overload manifests itself critically when:

The divided attention effect occurs when students are forced to divide their attention between different sources.
physically separate pieces of information (e.g., text and diagram), both essential to
understanding. If students need to divide their attention, they should use cognitive resources to...
mentally integrating information sources reduces the resources available for...
learning. (FRANCO, 2019, p. 46).

Along the same lines, AGUIAR (2020) emphasizes that the introduction of Kinematics in regular classes
It requires more than just the presence of an interpreter. The data from the research conducted demonstrate that
The use of interactive teaching sequences and sign language videos significantly reduces the
reliance on real-time translation, allowing the deaf student to establish connections
Direct links between the observed motion and the physical quantity represented. According to RODRIGUES (2020),
The effectiveness of teaching Newton's Laws to this audience is contingent upon the "visual" nature of the material.
material, arguing that visual information should be the primary basis and not just a resource.
complementary.

2. Materials and Methods

This study is characterized as a systematic literature review, of a nature...
The systematic review, as per the methodology used, is both qualitative and quantitative, with an exploratory-descriptive character.
defines GIL (2019), allows the synthesis of multiple published studies, providing a
A comprehensive understanding of the state of the art of a specific topic. The time frame.
The established timeframe covers the period from 2010 to 2024, with the aim of capturing the evolution of practices.
inclusive after the consolidation of important legal milestones, such as Decree No. 5,626/2005.
Data collection was carried out through an electronic search in the digital repositories of
National Professional Master's Degree in Physics Teaching (MNPEF), encompassing centers in different locations.
regions of Brazil. The following language descriptors were used to search for productions.
Portuguese, combined with each other: "Physics Teaching", "Deaf People", "Brazilian Sign Language", "Inclusion" and "Education"
"Special." The selection of manuscripts followed rigorous criteria to ensure the accuracy of the...
results were analyzed, including only dissertations and educational products that presented the text.
complete in PDF format and that had as their central focus the teaching of physics to students.
deaf people.

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Thematic analysis was used to organize and analyze the research corpus.

Initially, the titles and abstracts were read to verify their relevance to the topic.

Next, the selected works were subjected to a comprehensive technical review, the data from which was collected.

The data were tabulated in a spreadsheet containing: ID, Author(s), Institution, Year, Physics topic covered (e.g.,

Acoustics, Kinematics, Optics), and the main methodologies applied.

According to the methodological approach of Santos *et al.* (2022), observed in review studies, the

The results were compared and categorized to identify the challenges and potential of...

Teaching strategies focused on visuality in science education.

3. Results and Discussion

An analysis of the productions linked to the National Professional Master's Program in Physics Teaching.

(MNPEF) made it possible to identify that the inclusion of deaf students has progressed through the creation

of Educational Products (EP) that prioritize the visual channel. According to the survey, the

The effectiveness of teaching physics to deaf students does not lie in simplifying the content, but in...

A didactic transposition that considers Libras (Brazilian Sign Language) and visuality as pillars. According to the results

From the study by AGUIAR (2020), the application of interactive teaching sequences in inclusive classrooms

The study of kinematics highlighted that the use of assistive technologies and visual resources is crucial.

for learning.

The author emphasizes that the use of experiments and simulators, when mediated by Libras (Brazilian Sign Language),

It allows the deaf student to stop being a passive spectator and begin to construct concepts of

speed and acceleration with greater autonomy. According to AGUIAR (2020), this approach

The methodological approach favors the appropriation of scientific knowledge, as it reduces barriers.

communicational and allows the student to relate the observed physical phenomena directly to

their reality and their language.

Regarding the analysis of the results, a spreadsheet was created listing the dissertations and products.

Selected educational resources and their data, in order to assist in the synthesis process, including title,

authors, year of publication, objective of the study (TABLE 1) In this sense, it is highlighted that, according to

As discussed by FRANCO (2019), communication barriers and divided attention can generate

This overloads the cognitive load of deaf students, which can lead to fragmented learning.

if the teacher does not use appropriate visual strategies. This study focuses attention on the

Cognitive vulnerability resulting from the language barrier. In this context, the effectiveness of a

The strategy is validated by its ability to reduce translation effort in favor of building the...

physical concept.

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Table 1 – Summary of academic productions analyzed in the MNPEF (2010-2024).

Dissertation Spreadsheet			
Numbers	Title of the work	Reference	Main Objective
1	A didactic sequence introducing kinematics to deaf and hearing students in a regular classroom.	AGUIAR (2020)	To investigate the impact of experimental screenplays based on in visuality.
2	Cognitive Load Theory: Pre-knowledge and Reduced Divided Attention in the Education of Deaf People in Electrification Processes	FRANCO (2019)	To analyze the interference of visual fragmentation in electrification processes.
3	Bilingual Videos: Teaching Laws of Newton for Deaf Students and Listeners	RODRIGUES (2020)	Develop bilingual audiovisual support for the study of classical mechanics.
4	Experimental acoustics activity for teaching physics: A proposal for the inclusion of deaf people.	CALDAS (2017)	Suggest itineraries that utilize the tactile perception of vibrations. sound effects.
5	Teaching geometric optics through vision problems and corrective lenses: a teaching unit in the context of inclusive education for the deaf	PICANÇO (2015)	Apply UEPS to Teaching lenses in the context of inclusive education.
6	The use of digital games in physics education: An approach using the CC-Connect Circuit game for teaching deaf and hearing students.	ALVES (2019)	To evaluate the educational potential of the CC-Connect Circuits game.
7	Inclusion in physics education: Teaching the physiological qualities of sound to deaf and hearing students.	CASTRO (2015)	To analyze the impact of tactile-visual strategies in teaching acoustics to inclusive classrooms.

Source: Author's own work (2026)

Regarding the qualitative analysis, the results converge on the thesis that visual physics does not It is not merely a palliative measure, but rather a structural necessity. As evidenced by CALDAS (2017), in the context of acoustics, in the teaching and learning process of the deaf student, the

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Communication and visual perception are fundamental factors, so the teacher and the school...
They should seek alternative teaching strategies that promote better quality in the process.
the pedagogical needs of these students. Therefore, it is necessary to use strategies that employ
Visual resources to guide the student to understand a particular physical concept.
(CALDAS, 2017, p. 52).

Thus, the discussion of the data reaffirms that full inclusion requires the teacher to assume the role of mediator of languages, overcoming the exclusive dependence on simultaneous interpretation for to promote direct immersion in the physical phenomenon.

In this sense, convergence is observed between the findings of RODRIGUES (2020) and FRANCO (2019) regarding the need to reduce cognitive load during classes. While RODRIGUES (2020) points out that bilingual videos are essential so that the student does not miss information while The teacher writes on the board, FRANCO (2019) highlights that the fragmentation of attention is the main obstacle in teaching electrification. The discussion of the data reveals that, without material that While the information is visually centralized, the deaf student is often marginalized in the process of... theoretical abstraction.

Regarding the teaching of wave mechanics and acoustics, the dissertations of CASTRO (2015) and CALDAS (2017) They present promising results by using tactile and visual perception. The authors argue that the physics of sound can be fully understood through its physiological qualities. perceived through vibrations and wave visualization software. According to the results de CASTRO (2015), sensory experimentation, in which the student 'sees' the sound wave through a The oscilloscope, or the 'sense' by means of vibrating surfaces, fills the gap left by the absence of hearing. This method transforms Acoustics, previously purely abstract, into a field of tactile-visual exploration, guaranteeing the right of the deaf to access quality scientific information. (CASTRO, 2015, p. 52).

In summary, the results indicate that academic production in the National Professional Master's Program in Teaching Physics (MNPEF) has been successful in proposing methodologies that respect singularity. Linguistics of the deaf. However, the discussion also points to the need for more training. continued support for physics teachers, given the presence of a sign language interpreter, although Essential, it does not replace lesson planning focused on visuality.

Analysis of Graph 1 indicates that academic production on teaching Physics to deaf students in MNPEF is still small, but it has shown significant growth in recent years.

Although the study covers the period from 2010 to 2024, the selected works only emerged from that date. from 2015, with a greater concentration between 2019 and 2020. This shows that, despite inclusion being a An old topic in law, it only began to gain practical and specific materials for physics much later.

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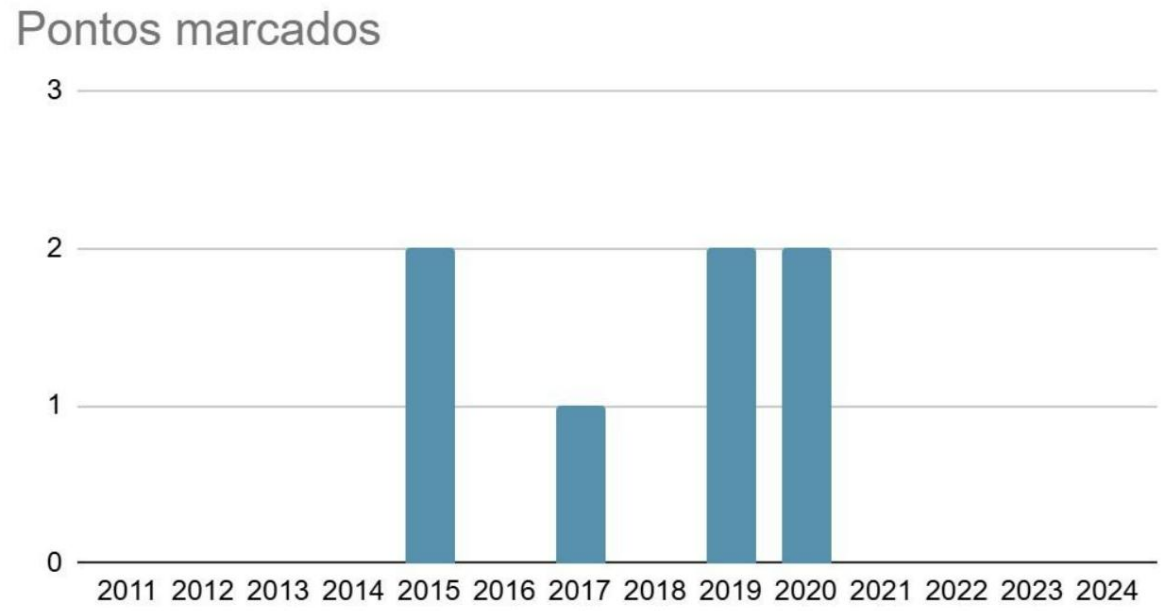
recently. Having only 7 jobs in 14 years reinforces the idea that teachers in the classroom

Teachers still need guides and educational products to help them in their daily work with students.

Deaf people and deaf culture.

Figure 1 - Chronological Distribution of MNPEF Dissertations (2010-2024).



Source: own authorship (2026).

Upon examining the content of these dissertations, we identified three fundamental points that

These summarize successful strategies for inclusion:

The Primacy of the Spatio-Visual Channel and Assistive Technology: How the deaf student perceives the world.

Primarily due to visual considerations, the most commonly used strategy is the use of bilingual videos (Brazilian Sign Language and...).

Portuguese), digital simulators and photographs. The idea is for the student to understand the physical concept.

Before attempting to understand the theory in writing. Mitigation of Divided Attention and Organization

Cognitive: A frequently cited point is that the deaf student cannot look.

simultaneously for the sign language interpreter and for the experiment. Therefore, the studies suggest

Materials that allow the student to focus on one piece of information at a time, avoiding mental fatigue.

and the loss of information. Adapted Tactile-Visual Experimentation Practices: The use of practical kits.

that involve touch and sight, such as feeling the vibration of sound or observing the behavior of light.

Through lenses, it helps to make abstract physics concepts more concrete and understandable.

In summary, the data indicate that, to include deaf students, it is not enough to have an interpreter in the classroom;

It is necessary for the physics teacher to adapt their material to make it completely visual and practical.

The seven dissertations analyzed serve as an excellent starting point, showing that, with the use

With the right technology and visual aids, it is possible to teach any physics concept in a way that...

efficient for the deaf community.

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Final Considerations

This systematic review concluded that academic production at the Master's level...
The National Professional Association for Physics Teaching (MNPEF) has played a leading role in building a more equitable and accessible physics education for the deaf community. The analysis of The documentary evidence showed that the effectiveness of the inclusion process transcends mere presence. of the Sign Language Translator and Interpreter (TILS), fundamentally requiring a pedagogical architecture planned from a visual perspective. It was found that traditionally abstract areas, such as Acoustics, Kinematics, and Geometric Optics, have high inclusive potential when mediated.
through resources that convert auditory phenomena into tactile and visual perceptions.
The results obtained reiterate the imperative need to combat the fragmentation of attention and Cognitive load overload — challenges that permeate the daily school life of deaf students.
It has been demonstrated that didactic transposition, based on assistive technologies, such as Bilingual videos and digital games are not merely a temporary solution, but a real tool.
informational learning that guarantees the deaf person the right to autonomy in the construction of complex scientific concepts
As a practical implication, this study points out that the continuing education of physics teachers It must be restructured to incorporate the domain of bilingual teaching strategies and the Development of original educational products. It is emphasized that full inclusion is a process.
continuous process that demands overcoming the ethnocentric model and developing a pedagogy that It differentiates and recognizes the linguistic uniqueness of the student.
Finally, this research does not intend to be exhaustive on the subject, but rather to serve as a reference for future studies.
research aimed at consolidating inclusive methodologies at all levels of education.
Basic. It is hoped that the evidence presented here will contribute to the teaching of Physics in Brazil needs to evolve from a purely normative inclusion to an effectively pedagogical inclusion.
where science is understood in its entirety, regardless of sensory barriers.

References

AGUIAR, Alysson Duarte de. **A didactic sequence introducing kinematics to deaf and hearing students in a regular classroom.** 2020. 164 p. Dissertation (Professional Master's in Physics Teaching) – Federal Institute of Espírito Santo, Cariacica, 2020.

ALVES, Ticiano Rodrigues Moraes. **The use of digital games in physics teaching:** an approach using the CC-Connect Circuits game for teaching deaf and hearing students. 2019. 116 p.

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Dissertation (Professional Master's Degree in Physics Teaching) – State University of Ceará, Quixadá, 2019.

BRAZIL. **Law No. 10,436, of April 24, 2002.** Provides for the Brazilian Sign Language (Libras). and provides other measures. Brasília, DF: Official Gazette of the Union, 2002.

BRAZIL. **Decree No. 5,626, of December 22, 2005.** Regulates Law No. 10,436, of April 24, 2002. Brasília, DF: Official Gazette of the Union, 2005.

CALDAS, Gracilene Gaia. **Experimental acoustics activities for physics teaching:** a proposal for the inclusion of deaf students. 2017. 119 p. Dissertation (Professional Master's in Physics Teaching) – Federal University of Pará, Belém, 2017.

CASTRO, Jederson Willian Pereira de. **Inclusion in physics teaching:** teaching the properties Physiological aspects of sound for deaf and hearing students. 2015. 114 p. Dissertation (Professional Master's in Physics Teaching) – Federal University of Lavras, Lavras, 2015.

FRANCO, Esdras da Silva. **The theory of cognitive load:** pre-knowledge and reduction of divided attention in the teaching of deaf people in electrification processes. 2019. 131 p. Dissertation (Professional Master's in Physics Teaching) – Federal University of Pará, Belém, 2019. GIL, Antonio Carlos. **How to elaborate research projects.** 6th ed. São Paulo: Atlas, 2019.

PICANÇO, Lucas Teixeira. **The teaching of geometric optics through vision and vision problems. Corrective lenses:** a teaching unit in the context of inclusive education for the deaf. 2015. 69 p. Educational Product (MNPEF) – UFAM/IFAM, Manaus, 2015.

RODRIGUES, Sabrina Farias. **Bilingual Videos:** Teaching Newton's Laws to Deaf and Hearing Students. 2020. 128 p. Dissertation (Professional Master's Degree in Physics Teaching) – Federal University of Rio Grande do Sul, Tramandaí, 2020.
SKLIAR, Carlos. **Deafness:** a look at the differences. Porto Alegre: Mediação, 1998.

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