Praxis of designing an inclusive science curriculum: acoustics within teacher education for and with Peasants and Deaf persons

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Abstract. The growing multicultural and identity diversity of students at the university worldwide requires changing curricula. Our case study aimed to identify inclusive criteria that have emerged in a praxis of designing an Acoustics micro-curriculum carried out in a teacher training course with Peasant students and a Deaf student. Our theoretical-methodological framework comprised the Cultural-Historical Activity Theory, van den Akker's curriculum model and Paulo Freire's pedagogy. We developed a protocol to describe the textbook produced within that praxis. Our findings were five inclusive criteria that have impacted the physics teacher training within the scope of the Acoustics micro-curriculum.

Inclusion in Physics Education

In recent decades, Brazil has promoted inclusive public policies that allow access to higher education for historically excluded groups. As a result, and following a global trend, there is an increasing presence of multicultural and identity diversity among university students, such as Peasant and Deaf students, which requires transforming curricula. Brazilian literature still has few studies on teaching physics to these students (Farias, Sousa & Silva, 2022; Picanço, Neto & Geller, 2021). In order to contribute to decreasing this lack, we carried out a case study about a curriculum design carried out from an inclusive perspective in a teacher training course in Rural Education, which resulted in a textbook (Ribeiro-Gomes et al., 2024). In this work, our research question is: what inclusive criteria have emerged in a praxis of designing Acoustics micro-curriculum carried out in a teacher training course with Peasant students and a Deaf student?

Designing micro-curriculum as a cultural and historical Activity of praxis

We followed a dialectical methodology based on the theoretical-methodological framework of the Cultural Historical Activity Theory (CHAT) (Vygotskii, Luria and Leontiev, 1988), where we expressed the curriculum designing process as an Activity. Once delimited, the Activity is the unit of analysis that encloses processes directed to the Object of Activity. We also created a protocol containing guiding questions that assisted us in delineating inclusive features of the textbook, focusing on Acoustics. Specifically, our focus was on the pitch concept, a physical quality that allows us to categorize sounds into high and low, articulating the physics concepts of frequency and wavelength as associated with the perception of sound by hearing people.

The textbook by Ribeiro-Gomes et al. (2024) was developed at the micro-curriculum level. This level, one of five hierarchical curricular levels (including supra, macro, meso, micro, and nano-curriculum), relates to curriculum development at the classroom level. Here, teachers are agents for didactic, pedagogical, and methodological actions. (van den Akker, 2010).

Based on Freire (1970), we conceived the work to produce this textbook as a praxis of curriculum designing. To Freire, praxis expresses the theory-practice dialectical pair, an inseparable unity that considers the social context. From CHAT, we called our unit of analysis

Designing an Inclusive Science Curriculum Praxical Activity (DISCPA). The Object of the DISCPA was the Acoustics teaching-learning process.

Acoustics for and with Peasant and the Deaf

We developed the DISCPA by considering students' feedback, which guided the teacher's curricular choices as they expressed difficulties and suggestions, which served as a base to choose, insert and reorganize the physics teaching-learning contents into the textbook. Therefore, the textbook served dialectically as both a product and an instrument of the DISCPA.

Our results comprised the following five categories of inclusive criteria. **Biophysics of the human body – phonation**: explaining the origin of sound in the human vocal apparatus, from mechanical pressure waves originating from the lungs and the resonance of the vocal folds at different frequencies; **Biophysics of the human body – hearing**: describing conductive deafness, sensorineural deafness and hearing as a phenomenon in which mechanical pressure waves cause successive resonance events in the human hearing apparatus, until the hair cells of the cochlea vibrate, according to their physical properties, at various frequencies, which are neurologically distinguished by hearing people; **Physical representation of sound waves:** characterizing the relationship between the pitch perceived by hearing people and the frequency and wavelength of the longitudinal waves associated with it; **Multiculturality and multilingualism:** discussion on the prejudice implicit in the term "deaf-mute," the ability of Deaf individuals to perceive sound through non-auditory means, the relationships established between vocal range and gender issues, the distinctions between popular, artistic, and scientific language in the use of the words "high" and "low" (in Portuguese), referring to sound pitch and volume, and the lexicon of sign language in teaching-learning sound frequency, wavelength and pitch. **Didactic sequence:** debating the curriculum choice of Acoustics teaching-learning contents, which are prerequisites for others.

These inclusive criteria emerged within the DISCPA, which impacted the teacher training processes since it was developed using an inclusive approach, wherein students participated as co-designers of the Acoustics micro-curriculum with inclusive objectives. Hence, we understand this curriculum designing model as an inclusive praxis, and the criteria resulting from it can guide other curriculum design processes with an inclusive perspective.

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