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AN INTERDISCIPLINARY VISION: SCIENCE AND MUSIC

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SUMMARY

"The use of music as a pedagogical resource in the teaching-learning process in the curricular component of Science in the Initial Series**.**The paper argues that music, in the teaching of Science, aligned with well-defined objectives, can contribute to the integral development of students, transforming common sense into scientific knowledge. In this sense, what was proposed in the research corroborates the purpose of highlighting the importance of deepening interdisciplinary studies, from the perspective of music and science, as essential factors for advances in school disciplinary processes. A great example to highlight this contemporary watershed was the contribution of Cecília Meireles' words, which came to life in theater, music, films and recordings of her recited poems. Her influence on the Brazilian modernist movement leveraged several theoretical and methodological experiments within the universities where she led her work. It is important to look at an interdisciplinary culture, with an attitude that allows us to visualize a better relationship between man and knowledge, contributing to science and music.

Keywords: Music. Science. Interdisciplinarity.

SUMMARY

This article is part of an excerpt from the Master's Dissertation that addresses "The use of music as a pedagogical resource in the teaching-learning process in the Science curriculum component in the Initial Series. The work discusses that music, in the teaching of Science, aligned with well-defined objectives, can contribute to the integral development of the student, transforming common sense into scientific knowledge. In this sense, what was proposed to be raised in the research corroborates the purpose of the importance of in-depth interdisciplinary studies, highlighting of music and science, as essential factors for advances in school disciplinary processes. A great example to highlight this contemporary watershed was the contribution of Cecília Meireles' words, which came to life in theater, music, films and recordings of her recited poems. It is important to look at an interdisciplinary

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culture, with a stance that allows us to visualize a better relationship between man and knowledge, contributing to science and music.

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INTRODUCTION

The relationship between science and music is not something new, since interdisciplinarity permeates the history of humanity, which was marked by the Greek peoples and philosophers such as Pythagoras, Plato and Aristotle. Science and art also maintain similarities and a close relationship.

For Ferreira (2010), the unparalleled painter Leonardo da Vinci was a creator of Art, discoverer of Sciences and inventor of technologies, managing to integrate Science and Art in a paradigmatic way, in such a way that one would not be understood without the other.

The concept of science has been improved at different times and in different historical conceptions; for Chibeni (2020), there is a common vision of science, originating from modernism, in which the question of the “scientific method” was one of the main concerns of 17th century philosophers, with pioneering investigations being the studies conducted by Francis Bacon. Chibeni (2020) provides a retrospective of the entire trajectory of science, bringing to contemporary times a new concept, defined by Lakatos through the limitations and falsificationism, to which common science opposes itself.

Lakatos develops what was called Paul Feyerabend's methodological Dadaism, which denies the existence of any method in science. However, starting from Lakatos' (1979, p. 165) conception of contemporary science, this consists of “a partially articulated set of suggestions or ideas on how to change or develop the 'refutable variants' and how to modify, to refine, the 'refutable' protective belt”.

To think about science and music in an interdisciplinary proposal, it is suggested, first, to break paradigms, to leave the comfort zone, and not all teachers are able to establish relationships between these areas. Thus, for Santos (2014),

> Building interdisciplinarity only at the expense of disciplinary knowledge fosters a great epistemological dependence. A construction vice, determined by the degree of maturity of the areas

> disciplinary starting points, which creates a vicious cycle between disciplinarity and interdisciplinarity and which excludes non-disciplinary knowledge from other fields. Knowledge that is not limited to the classical disciplines and that must be viewed in terms of what it intends to respond to. On the other hand, it is important to take into account that there can be no interdisciplinarity without a deep, epistemologically grounded knowledge of the starting disciplines - methodology, content and objectives, the way they are organized in school and the reasons why disciplinarity constitutes an epistemological obstacle to interdisciplinary knowledge (SANTOS, 2014, p. 69).

The problem of interdisciplinarity, from the point of view of Santos (2014), points to the lack of depth in the content as a preponderant factor for this process not to occur in the school environment, mainly because the disciplinarity itself clashes with this principle. It is understood that there is a lack of greater interconnection between scientific knowledge and its areas, so distinct and, at the same time, convergent in knowledge accumulated by humanity, considering our Western cradle.

However, the lack of knowledge between different types of knowledge makes the interdisciplinary proposal fragile; music and musicality, for example, so present in society since primitive times, become distant within the school context, as they are rarely presented as an interaction with any other disciplinary knowledge. The educational space should include an environment in which music is part of the daily routine of Art and Physical Education classes, whether through extracurricular workshops, orchestras, choirs, recitals, theater or dance, followed by theoretical and historical study.

Cachapuz (2014) points out:

> In addition to these epistemic difficulties, there are also biased educational policies that confuse education with instruction (particularly in secondary education), a lack of teaching materials, and inadequate teacher training. These obstacles are common to several countries. There is a bit of everything. Despite this, it is possible to identify changes, both in teaching and in science training, based on local work proposals and involving the exploration of various media such as poetry, painting, theater, among others (CACHAPUZ, 2014, p. 101).

When it comes to teacher training, they need to have a different perspective on this type of teaching, to provide their students with not only a scientific perspective, but also a critical one, through which they can learn the theories

of the discipline, and enjoy the artistic side of the content, trying to link one content with another.

There is currently a greater connection between these areas, but there is a lack of research that shows how these relationships occur in the classroom. It is known that some teachers are able to use different teaching methods in their classes, but not all are successful in innovating their pedagogical proposals.

1. Science and Music: an interdisciplinary view

It is observed that music is more linked to the emotional side of individuals, as it expresses feelings, while science expands a greater notion of reality. This leads students and teachers to rely on data and theories that allow them to expand or change the ways of understanding the world.

Music has proven to be an agent of great change in society, given its presence in social movements and struggles. Many artists use this art to portray their realities, demand rights and act as spokespersons for minorities. This is the case of the “hip-hop”, “rap” and “funk” movements in the city of Rio de Janeiro.

Silva and Neves (2015) point out that, in contemporary times, music, together with science, can open up new possibilities and can contribute to forming a more participatory, critical, creative and productive human being, a human being who becomes increasingly more human. Paião (*apud* VINCE, 2010) states:

> As a dimension of human culture, music is completely rooted in the society of which it is a part. Music reveals and constructs the society in which it participates, and is, at the same time, constructed by it. Music is part of the human universe, of human culture, and obviously influences the ways of life and social relations of those around it; and society, on the other hand, is constructing music at all times, reconstructing and rethinking it. These relations are like a two-way street; you cannot separate one from the other (PAIÃO *apud* VINCE, 2010, p. 1).

Music and art have always been present in the history of people, whether through drawings on stones that portrayed their daily lives, through dances in religious rituals or through music, serving humanity with different objectives.

In this way, it is impossible to dissociate artistic movements and their influences on society, in any period whatsoever. Hegel (1980) stated that art is the food of the soul; through it, it is possible to "[...] perceive what we feel, our emotions, our feelings, our passions, through the language and words with which we reveal or objectify [...]" (HEGEL, 1980, p. 218).

Martins (2019) highlights, in his thesis, the humanizing function of poetry, in the Adelian conception of poetry as a source of inspiration, in which he points out, in the words of Prado (2008, p. 1), that "Art does not alienate anyone, it does not take away from reality, on the contrary, it brings it to reality, touches on intimacy".

In this sense, what we proposed to raise in this research corroborates the purpose of highlighting the importance of deepening interdisciplinary studies, from the perspective of music and science, as essential factors for advances in school disciplinary processes. A great example to highlight this contemporary watershed was the contribution of Cecília Meireles' words, which came to life in theater, music, films and recordings of her recited poems.

Martins (2019, p. 73) highlights that "musicality is Meireles' essence and freedom is her poetic banner in the face of the historical and social context she experienced". Her influence on the Brazilian modernist movement leveraged several theoretical and methodological experiences within the universities where she led her work. Finally, for Martins (2019, p. 73) "[...] it is believed that Cecília Meireles' poetic declamations express a form of struggle for emancipation".

It is worth noting, according to Snow (1995), that the breakdown in communication between the sciences and the humanities and the lack of interdisciplinarity, already noted in the mid-20th century, was one of the main difficulties in solving global problems. However, the perception of the so-called "essence of things" falls to the scientist and the artist to unveil them, to reinterpret them in a way that makes it possible for those who do not belong to either of the "two cultures", the scientific and the humanistic.

However, music can also be used as a pedagogical resource, as long as its central objectives are to promote the development of programmatic content, based on the process of transforming spontaneous concepts into scientific concepts. This is the main point

relevance in this research: highlight the importance of music as a pedagogical resource in the teaching of Science. Music and its didactic application can be an instrument that facilitates the teaching and learning process.

According to the National Curricular Parameters for Natural Sciences (BRASIL, 1997), science teaching allows the introduction and exploration of information related to natural phenomena, health, technology, society and the environment, favoring the construction and expansion of new knowledge.

One of the major challenges for Science teachers in Elementary School I is that they are multipurpose teachers, teaching several specific subjects, and it is not possible to separate them from their working conditions and ongoing training, that is, from the need for continuous improvement and study throughout their career (MARTINS, 2005).

Due to the high accumulation of demands, the teacher opts for mechanical classes, repetitive and less attractive to students, not instigating students' interest in learning. According to Lima and Maués (2006, p. 164):

> There is a relatively consensus in these studies regarding the diagnosis regarding the low quality of teaching, regarding the ineffectiveness of the methodological strategies adopted and, mainly, regarding the "precarious" content knowledge presented by teachers (LIMA; MAUÉS, 2006, p. 164).

In this sense, it is urgent to rethink and redefine new methodologies for teaching Science, so that classes are not limited to reading and copying texts, turning a moment that could be rich, in the exchange of experiences between educator and student, into something exhausting and overwhelming.

> Often, the practices conventionally adopted by teachers (even unconsciously) include rigid methodological options and exclude the environment conducive to carrying out questions, observations and experiments, which causes difficulties of different origins to arise when systematically implementing investigative activities in teaching (ZANON; FREITAS, 2007, p. 101).

By using music as a pedagogical resource, we aim to awaken students' interest in teaching Science, through a playful tool and contributing to the construction of their knowledge. Lima and Maués (2006) state:

> Teaching science in the early grades plays an important role in development, as long as it provides children with the opportunity to express their ways of thinking, questioning and explaining the world. In this case, the role of the teacher is that of a traveling companion, more experienced in the paths, in reading maps, in recording and systematizing lived experiences. We share the idea that it is possible to teach science in the early grades as a shared experience (LIMA; MAUÉS, 2006, p. 170).

In Science teaching, there is a plurality of nomenclatures, which require even greater effort on the part of the student to assimilate the content. In this way, music can provide new learning possibilities. According to Bueno (2012, p. 49): "Music is a great and very important tool for the assimilation of different content in the students' routine, as it transports scientific concepts from different subjects to their universe in a playful way".

Studies show that it is urgent to rethink the pedagogical practice of teaching Science. Kiouranis, Silveira and Silva (2005) conclude:

> [...] analyses have shown that, in general, scientific education practiced in schools still focuses on the conceptual aspects organized by the authors of traditional textbooks, which often convey an impoverished view of science and scientific activity (KIOURANIS; SILVEIRA; SILVA, 2005, p. 4).

The use of music as a pedagogical resource in the teaching of Science can contribute to the redefinition of knowledge acquired by the student, providing opportunities for new attitudes in society, and, according to Gasparin (2005), it becomes a

> [...] a new way of understanding reality and positioning oneself in it, not only in relation to the phenomenon, but to the essence of concrete reality. It is the manifestation of a new practical stance, a new attitude, a new vision of content in everyday life. It is, at the same time, the moment of conscious action, from the perspective of social transformation, returning to the Initial Social Practice, now modified by learning (GASPARIN, 2005, p. 147).

The teaching and learning process becomes more enjoyable when students can share their experiences in the classroom, and from this, new possibilities are created for the construction of their scientific knowledge. Freire (2007) states:

> It is not possible to respect students, their dignity, their being in formation, their identity in formation, if they are not taken into account.

> taking into account the conditions in which they have been existing, if the importance of the “experience-based knowledge” with which they arrive at school is not recognized. The respect due to the dignity of the student does not allow me to underestimate, worse still, mock the knowledge that he brings with him to school (FREIRE, 2007, p. 64).

One of the biggest challenges facing schools in the 21st century is how to deal with school dropouts. Even though this research encompasses elementary school I, there are a variety of factors that lead to school dropout. Among them, we can mention social, economic, political and religious issues. According to Lopes (2017), students dropping out of school is also a factor linked to student demotivation:

> The teachers' discourse also confirms that precariousness contributes to dropout, as uninspiring, unattractive classes interfere with teaching and learning. In this sense, we agree with these teachers when they state that schools and teachers need to offer quality education, because "the better the class, the longer the student stays in school" (LOPES, 2017, p. 359).

We have found that one of the reasons for dropping out of school is rigid teaching practices that distance scientific knowledge from students' experiences. A well-planned, creative class with adopted strategies, such as music, can motivate students.

> Music can and should be used at various moments in the teaching and learning process, being an essential instrument in the search for knowledge, always organized in a playful, creative, emotional and cognitive way (CORREIA, 2010, p. 139).

One of the strategies in which music can be used as a pedagogical resource in teaching Science is through popular repertoire, presenting the lyrics of a song that deals with a certain content, or proposing to the class of students the creation of a parody, exploring creativity and emotion, which are involved in the interdisciplinary, subjective and aesthetic practice of this artistic language, enabling experimentation.

Froebel (2001, p. 177) states that “there are many songs, ditties and short poems from which teachers can create others that relate to teaching”. Thus, proposing a musical repertoire with Science content can be a motivating path for learning.

Popular songs can encourage students to pay more attention to listening to music, in the search for knowing and appreciating new music that explores scientific themes, and, consequently, their learning will be more meaningful. According to Oliveira *et al*. (2001), in a case study report,

> [...] two students stated that they had never paid attention to which song lyrics could contain information about scientific subjects. In another statement, a student stated that he had paid more attention to the lyrics of other songs he heard the day after class. Also as a result of this stage, the students brought other songs to share with their classmates, whose lyrics also contain content of scientific interest, revealing the success in the significant learning that the activity provided them (OLIVEIRA *et al*., 2011, p. 237).

Parodies are a way of synthesizing the content worked on in Science and bringing students closer to their social reality, helping them understand concepts, build their knowledge and critical thinking. For Trezza, Santos and Santos (2007),

> Parodies are intended to allow information to be memorized more easily through the use of well-known songs. Thus, it is an expressive resource when it comes to teaching things that are quickly assimilated or in situations where one wishes to increase interest in the subject being addressed (TREZZA; SANTOS; SANTOS, 2007, p. 3).

To develop a proposal with the creation of parodies or present a popular repertoire to students with a scientific theme, it is necessary to know each student individually, considering their particularities:

> As social beings, students are not the same. They are constructed through social experiences in different places, at home, at church, in neighborhoods, schools, and are constructed as different and differentiated subjects in their time and space. And we, teachers, are not faced with identical students, but with young people or children who are unique and heterogeneous socioculturally, and immersed in the complexity of human life (SOUZA, 2004, p. 10).

FINAL CONSIDERATIONS

The work showed that the use of music in the classroom is a playful and creative pedagogical practice, low cost, surpassing traditional teaching and, therefore,

its nature, extends to the physical and mathematical sciences, dialoguing and establishing interdisciplinary relationships.

In view of all the challenges presented, Souza (2004) points out reflections for today's teachers.

> [...] to think about establishing a dialogue between the subjects of the teaching and learning process and musical knowledge. In this way, knowing the student as a sociocultural being, mapping the external scenarios of music with which students experience their time, their space and their "world", thinking about their perspectives in relation to music in the school space, are propositions to think about this discipline and broaden the reflections on the dimensions of the curriculum, content-form and teaching-learning offered to students. Who are the students, subjects with whom we dialogue in the classroom? What songs are references and referents for the culture, with which these students identify, configuring the spaces and sociocultural environments of the world in which they live? How do young people/children learn music? And finally: how is the relationship between the inherited and constructed dimensions in the music experienced in the place/world, the curriculum of the students' lives and the music taught/learned in the curriculum of the school space? (SOUZA, 2004, p. 9).

This makes us reflect that one of the objectives of music in the educational context is to contribute to the formation and development of the child's personality, providing cultural knowledge, expanding intelligence and musical sensitivity.

We have also seen that music provides numerous benefits for children, such as the development of cognitive and motor skills, oral skills, social interaction, concentration and creativity. Thus, we can see that the use of music in Science teaching can contribute positively to the overall development of the student.

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