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EXPERIMENTAL ACTIVITIES IN SCIENCE TEACHING: INITIAL REFLECTIONS

EXPERIMENTAL ACTIVITIES IN SCIENCE TEACHING: INITIAL REFLECTIONS

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SUMMARY

This article aims to discuss the texts worked on in the discipline of Experimentation in Science Teaching of the Professional Master's Postgraduate Course in Science and Mathematics Teaching (MPECIM) at the Federal University of Acre (UFAC), which address issues related to activities experimental studies in science teaching. This is a bibliographical approach based on the texts referenced in the discipline. To this end, the text is structured in two moments: first, science teaching in the current context is described, followed by reflections on the importance of experimental activities in the construction of scientific knowledge and their contributions to teaching and learning. From the analysis of related texts, it is understood that experimental activities contribute to the teaching of science in a significant way, making teaching and learning more attractive and playful, based on the problematization of real, everyday situations. In this way, it contributes to the construction of scientific thinking in a significant way.

Key words: experimental classes, scientific knowledge, science teaching

ABSTRACT

This article aims to discuss the texts worked in the subject Experimentation in Science Teaching of the Postgraduate Professional Master's Degree Course in Science and Mathematics Teaching (MPECIM) of the Federal University of Acre (UFAC) that addresses issues related to experimental activities in science teaching and its contributions to teaching learning and to scientific knowledge. It is a bibliographical approach based on the texts referenced in the discipline. At first I describe science teaching in the current context, then I seek to bring reflections on the importance of experimental activities in the construction of scientific knowledge and their contributions to teaching learning in an attractive and playful way for students, based on the problematization of the situation real and everyday.

Keywords:experimental classes, scientific knowledge, science teaching

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1. INTRODUCTION

Several studies discuss and affirm the importance of experimental activities in Science classes. Considering that the teacher's practice linked to his methodologies is fundamental for the development of more participatory classes, thus contributing to the relationship between theory and practice, making learning meaningful. stay.

> It is a fact that, when the teacher uses different methodologies to present a concept, he can encourage his student to build his own knowledge in a pleasurable way, without obligation, encouraging him to be part of the process, without putting pressure on him, as this type of methodology can provide an awakening to the knowledge of students, so that reciprocity of knowledge can be established, based on the didactic proposition, with situations so that the student becomes independent in the learning process (CATELAN by RINALDI,2018, p .)

In this sense, the Science teacher must seek teaching strategies in their pedagogical practices that can contribute to the construction of scientific knowledge based on the student's contextualized prior knowledge, so that they are the protagonists of their learning. In this sense, Catelan and Rinaldi (2018, p 307), state that

> It is necessary to continually reflect on why, when and how to teach Natural Sciences in our schools, even because we are in a world in full motion and rapidly evolving. In this context, the school is the legitimized institution to provide conditions for interaction between teacher-student-knowledge.

Thus, the role of the Science teacher in this process is important considering that the way in which personal relationships occur and the way in which the teacher conducts pedagogical mediation directly influences the student's teaching and learning. Therefore,

> The art of teaching Science requires an ability to make this connection, for this there is no specific methodology, or a single way of teaching, what is needed is a set of methodologies capable of building new knowledge". Therefore, it is important to use a variety of didactic-pedagogical tools to cover this set of methodologies. (TAHA*et. al*, 2016, p. 139).

Among the methodologies used by Science teachers as teaching strategies is experimentation. Experimentation is an important resource in the science teaching and learning process, this context can be observed among educators and researchers.

> When the teacher uses experimental activities, learning content takes place through the realization of the need to learn, triggered by challenging situations. These enable learners to act as mediators of their own knowledge. Therefore, the teacher who develops experimental activities allows students to be protagonists in learning, as they become leaders in the debate of ideas and allows the learner to develop.
> the ability to argue that underlies thinking. (CATELAN by, RINALDI, 2018, p 312),

However, according to the authors, experimental activities tend to be considered by some teachers as a mere demonstrative manipulation activity to prove the theory, to the detriment of interaction and critical reflection and discussion on the concepts covered. Therefore, Science teachers need to critically reflect on their teaching practice, taking into account the context in which the school is located.

To this end, this article is based on a bibliographical approach based on texts referenced in the discipline. To this end, the text is structured in two moments. Firstly, I describe science teaching in the current context, then I seek to bring reflections on the importance of experimental activities in the construction of scientific knowledge and their contributions to teaching and learning. Thus, we seek to answer the following question: Have experimental activities as a methodological strategy in Science teaching contributed to the teaching-learning process and the construction of scientific knowledge?

2 THEORETICAL FRAMEWORK

Teaching Science Possibilities and Challenges

The Science teacher training course is a *locus* privileged to discuss how scientific knowledge has been constructed throughout history. This being the case only from the two 1970s saw the democratization of access to public education.

> The challenge of putting scientific knowledge within the reach of a school public on an unprecedented scale, a public represented, for the first time in our history, by all social segments, with a significant majority coming from classes and cultures that until then had not attended school, with exceptions- cannot be faced with the same teaching practices of previous decades or the school of a few for a few. (DELIZÓICOV, ANGOTTI, PERNAMBUCO, 2011, p. 33).

As a consequence, the school receives a more plural audience, and the form of interaction personal, forms of expression, beliefs, values, expectations and socio-family contextualization of students are no longer the same. In this sense, knowledge from research in Science teaching points to the need for changes in teacher performance at different levels of education. (DELIZÓICOV, ANGOTTI, PERNAMBUCO, 2011).

Providing scientific knowledge to the majority of the population requires the teacher to direct his work towards critical reflection on the part of the students, and thus the teacher's activity needs to build the understanding that the process of knowledge production constitutes a historically situated human activity in a given social context. (Ibidem).

As a characteristic of scientific knowledge we can list according to Nascimento and Carvalho (2014, p. 08), which,

> **Science with human activity**, highlighting their interests, social aspects and relationships between Science, Technology, Society and the Environment.**The provisional nature of scientific knowledge**, recognizing the existence of important crises and profound changes in the historical evolution of scientific knowledge, the limitations of current knowledge and open perspectives. [Chalmers (1993); Borges (1996), among others].
> **Historical and problematic view of science**and the construction of knowledge, highlighting the problems that generated the construction of knowledge, the difficulties, contextualizing them historically (Gil-Pérez, 1993; Solbes and Traver, 2001). (*emphasis added by the authors).*

To this end, the Science teacher must carry out an important didactic transposition of scientific knowledge, contained in the discipline, and transforming it into meaningful knowledge for students, through various methodological strategies. Therefore, the teacher must adopt different tools that help in the construction of scientific knowledge of the topic covered.

> It is important to take care of the appropriation of scientific knowledge through the adoption of theory and methodologies carefully chosen by the educator that can facilitate the construction of scientific knowledge, so that concepts can be understood and promote a more critical view of science. (CATELAN, by, RINALDI, 2018, p. 310),

In this sense, the teaching of Science, when worked in a contextualized way, has a social function and aims to promote the training of students so that they acquire civic awareness, within a process that includes the construction of scientific knowledge in a reflective and critical way. Given that,

> For the National Education Guidelines and Bases Law – LDB of 9393/96, proposals for implementation of science teaching must include elements in the curriculum that seek to follow advances in scientific knowledge, valuing the active participation of the student in the process of learning. Consequently, this teaching must meet the demands of the knowledge society, developing differentiated attitudes in the student so that he or she can act in a conscious, critical and reflective way. From this perspective, it is essential to include teaching methodologies different from those currently in force. (SILVA, MARQUES, MARQUES, 2020, p. 272).

However, we can still identify that science teaching is often presented in a decontextualized way, based on definitions of the content, with no relationship to the student's reality, in a process that leads to memorization as in the traditional teaching model. Thus, everyday school life is established with bookish Science teaching, aimed at the transmission of knowledge guided by the assimilation of concepts, laws and formulas" (DEITOS; by, STREIDER, 2018, p. 2).

For Castelan and Rinaldi (2018), we as teachers need to remain alert in the search for a stance that corroborates, in the day-to-day life of the classroom, a critical and reflective approach to historically constructed knowledge in the fight against mystification and caricature. of scientific knowledge. Bearing in mind that the relationships established at school favor the formation of citizens aware of their role in society. "Because these relationships, when properly worked on, enable the development of the ability to

thinking, reasoning, reflecting, discovering and solving problems in the student". (CATELAN by RINALDI, 2018, p. 310)

A methodological teaching strategy contrary to this teaching by memorization is the use of classes

Experimental experiments worked in a problematizing way, based on a constructivist paradigm, which aims to help the construction of scientific knowledge, in the student's interest and in promoting teaching and learning in Science in a meaningful way. According to Catelan and Rinaldi (2018, p. 311), “carrying out experimental activities represents an interesting approach as long as the learner carries out the experimentation from the perspective of constructing concepts, as well as being able to establish the dynamics and relationship between theory and practice ”

3.**MATERIAL AND METHOD**

The context of experimental activities and their contributions to Science teaching. The context of experimental activities is characterized by stimulating the student's abilities, such as: knowing how to listen, analyze, search, raise questions and have a new stance during the process of teaching and learning in the formal and informal space. Thus, stimulating student creativity promotes meaningful learning and the development of scientific thinking.

According to Thomaz (2000), for students to be motivated to carry out experimental work (and this aspect extends to any level of education, from basic to university), it is necessary that the task that teachers provide them with is attractive, which constitutes a challenge, a problem or an issue that the student feels motivated and interested in solving, that is, in seeking a solution.

However, according to the author, many experimental works constitute a vague, uninteresting, unmotivating task that leads them to follow step by step a very guiding protocol that inhibits their creative abilities, thus transforming them into a boring task that they are forced to perform and that leads many students to complain about the activities. According to Thomaz (2000, p. 362),

> [...] many of the experimental works that are proposed in our schools and also in our universities (just analyze some guides or work protocols for the disciplines and listen to the students) are structured in this way, not providing opportunities for the development of skills in students that help them to act in a more scientific way in their future lives as professionals and citizens.

Therefore, the teacher needs to reflect on the objective of his experimental class and what pedagogical approach will be given to this activity for teaching Science. Bearing in mind that, when the teacher plans an experimental activity, the purpose of which is reduced to supposedly proving concepts that have already been worked on, or that are in textbooks, in addition to only contributing to the manipulation of materials, this activity does not contribute to student learning . (FELIPE, FILHO, GONÇALVES, 2018).

According to Borges (2002, p. 12), “The important thing is not the manipulation of concrete objects and artifacts, but rather the committed involvement in the search for well-articulated answers/solutions to the questions posed, in activities that can be purely of thought. ”.

> The main criticisms made of these practical activities are that they are not effectively related to physical concepts; that many of them are not relevant from the students' point of view, since both the problem and the procedure to solve it are previously determined; that equipment assembly operations, data collection activities and calculations to obtain expected answers consume much or all of the available time.

In this sense, it is important that the teacher learns the different approaches to experimentation so that they can meet their expectations and objectives. As per Taha*et al.* (2016), experimental classes they can present different approaches such as: show experimentation, illustrative experimentation, investigative experimentation and problematizing experimentation.

> A**experimentation show**It is sometimes a way of attracting students' attention to Science teaching.
> A**illustrative experiment**is very common in schools, 'Giordan (1999) highlights illustrative experimentation as one that is generally used to demonstrate concepts already discussed'.
> A**experimental investigation**has the same character as scientific investigation: it does the

survey the problem, develop hypotheses, carry out the experiment to prove your hypotheses and organize the results to make your own conclusions.
A**problematizing experiment**it favors discussion, enabling the expansion of reflections and possibilities of using knowledge in other contexts. (TAHA*et al.*, 2016, p. 141-143).

In this way, we can distinguish between various approaches assigned to experimental classes, depending on the teacher's proposal and objectives. Among the approaches related to the proposal that has contributed to the formation of citizens and scientific knowledge is experimentation through investigation.

For Borges (2002), in experimental activities of an investigative nature, students tend to be more participatory, getting directly involved in different stages of the activity. In other words, in this context the student is the subject of learning, active and the construction of knowledge takes place based on what he or she already knows.

In this experimental activity, teachers are mediators of knowledge, adapting their experiments or problems to the levels of their students, based on skills or thought processes and thus, the educator is the facilitator of meaningful learning.

To this end, it is necessary to have a new attitude during the teaching-learning process, which can stimulate the student's creativity and thus form active and active citizens.

participatory.

To this end, I understand together with Borges (2002, p. 15) that experimental classes contribute to teaching, learning and scientific knowledge "there is no need for a special environment reserved for such activities, with instruments and tables for experiments, but only that there is planning and clarity of the objectives of the proposed activities".

FINAL CONSIDERATIONS

This article aims to discuss the texts worked on in the subject of Experimentation in Science Teaching, seeking to reflect on the perspective of experimental classes in science teaching.

Firstly, discuss the possibilities and challenges for teaching Science. What has been observed as possibilities for teaching Science is that it must be carried out using different methodological strategies, which have a contextualized approach and can contribute to the production of scientific knowledge in a significant way, in addition to promoting the formation of citizen.

And as a challenge, we seek to overcome memoristic Science teaching, in which the teacher is the transmitter and the student is the receiver of knowledge as in a "banking education" (FREIRE, 1996).

In order to try to overcome traditional education, the teacher needs to have an adequate context, for which he needs adequate training, as well as respect from the whole society. These issues directly interfere with the student's desire to learn, based on strategies such as constructed experimental classes, which promote a more attractive class for the student, we can make our practice increasingly better, with appropriate readings, with discussions that allow us to express our conceptions and can compare with other epistemologies that serve as references in our teaching work.

And a strategy widely used by Science teachers is experimental classes. Experimental classes need to be carried out in a contextualized way, based on what the student already knows so as not to become an aseptic class outside the student's reality, bearing in mind that students are not blank slates.

Critical reflection in relation to the educational context must be continuous and the curriculum needs to be continually rethought. The same must be observed in relation to the context of practical-experimental activities that need to be reformulated in order to be more creative and efficient with defined purposes.

previously and thus contribute to science learning (BORGES, 2002),

In this way, it is observed that there is a great need for articulation to occur on the part of the Science teacher, proposing discussions and reflections that can contribute to the construction of knowledge and significant learning from experimental activities that can be carried out in laboratories, at the same time. outdoors, in workshops, among others, valuing the student's prior knowledge and thus contributing to the formation of citizens.

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