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## LOCAL KNOWLEDGE AND DOINGS AND THE CONTRIBUTIONS TO THE REDESIGN OF THE INITIAL TRAINING OF CHEMISTRY TEACHERS IN THE AMAZON

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## INTRODUCTION

The initial training of Chemistry teachers in Brazil has been the target of harsh criticism by educators who defend a dynamic, pleasant, instigating, interactive and dialogic training. Teachers need to master the contents to be taught, so that they teach well and adequately. This is a fact! Is important? Yes, it is important! Knowledge (professional knowledge) based on science and erudition alone does not prepare a good teacher. For Tardif (2014), the knowledge that serves as the basis for professional work forms a set of knowledge from different sources: textbooks, training course curriculum, school curriculum, the experience and experience of the social actors who are part of the school and university context.

In a teacher training course, the teacher trainer plays an important role, he is the one who guides, stimulates and encourages the student to continue the training process, as many try to give up when faced with the pedagogical disciplines and supervised internship. What they do not realize is that these disciplines will contribute significantly to their training and, subsequently, to the construction of teaching work. This is due to the structure of the course, which almost always follows the traditional way of teaching, highlighting the specific contents of the area of knowledge. Many educators go so far as to say that the undergraduate course in Chemistry has the characteristics of a bachelor's degree. The study carried out by Gatti (2020), corroborated by Gatti (2015, 2013) and Pimenta et al. (2017) on the curricula of degree courses in different areas of knowledge, shows the generic character and emphasis on knowledge in specific areas. We emphasize that this type of practice sustains a fragile teaching work with no perspective to accept the new. For Almeida and Biajone (2007), it is necessary that initial training

courses and training teachers promote new practices, seek new methodologies, create research instruments, such as: case studies and practices, long-term internships, professional memory, analysis reflection, problematizations, etc.

In teacher training courses, we cannot fail to contemplate the social reality of students, hence the need to include other approaches in the curriculum, such as: Experimentation, CTSA (Science, Technology, Society and Environment), Social Themes, Curriculum, Didactics and Practice Teaching, Environmental Education, Ludicity, Ethnoknowledge, etc. These approaches make it possible to transgress the boundaries of disciplines and allow teachers to reflect on their teaching activities. It is important to remember that in the 90's, the PCN's – National Curricular Parameters (1997) were elaborated with the intention of providing the teacher with moments of reflection and discussion of aspects of daily life and pedagogical practice [...], reviewing objectives, the contents, ways of conducting didactic and pedagogical activities, ways of evaluating; to identify students' everyday knowledge, to produce [...] didactic materials that enable more meaningful learning contexts. At the time, the PCN's for many of us teachers were configured as a continuing education because, in a region as distant and forgotten as our Amazon, continuing education courses were scarce, and the proposals and methodological guidelines of these documents contributed to the strengthening of the dialogue, the exchange of knowledge and experiences at school and beyond its walls. The study by Guedes, Nascimento and Lopes (2017), for example, contributes to the reflection process when they state that the construction of knowledge does not need to be thought only concretely, in the *ipsis litteris* of the curriculum, in

the content of the disciplines, in the topics contained in the books didactic materials, in handouts and not even in the pure and simple adoption of popular theories in higher education and basic education institutions.

From this perspective, we understand the need to value the knowledge of academics, the result of their experiences and everyday experiences. According to Gondim and Mól (2009) the university and the school are configured in this scenario, the ideal place for mediation between theory and practice, the ideal and the real, the scientific and the everyday. From this perspective, and with the intention of carrying out a redesign of the current process of initial training of teachers who teach Chemistry in the Amazon, we chose to bring to the training context, the contributions of local knowledge and practices, justified by the urgency and need to develop a liberating education that allows dialogue and interaction with other areas of knowledge, that stimulates the construction of new ways of teaching without neglecting to consider the knowledge that the student brings with him to the academy or to school. It is this way that we will arrive at a transforming praxis (dialectical relationship between theory, reflection and action).

## **MATERIAL AND METHODS**

This research has a qualitative characteristic and describes the contributions of local knowledge and practices aiming at a redesign of the initial training of Chemistry teachers in the Amazon. Teachers who teach Chemistry in different places in the Amazon and graduated from two public institutions called IESF (Federal Higher Education Institution) and IESE (State Higher Education Institution) were involved in the research. Basic education teachers were identified by the nomenclature PEB1, PEB2, PEB3, PEB4, PEB5...

The epistemological dimension of this research is evidenced by the foundations of the dialectical approach. This type of approach considers that, in the school context, pedagogical methods are articulated dialectically and that the practice, experience and experience of social actors constitute the starting and ending point for an educational action (LAVOURA; MARTINS, 2017). For these authors, a teaching practice developed from a dialectical perspective confirms that it is not possible to ignore the concrete reality of students, that is, knowledge about the world cannot be separated from the effective existence of this world itself. They emphasize the existence of relations between school contents and human activity developed in different contexts.

In order to meet the objectives proposed for this research, we opted for the comparative method, since the research design involves similarities, differences and comparisons between three groups of Chemistry professors who graduated from IESF in the 80s, 90s and IESE from 2001 onwards. It made it possible to know the teaching practices that involve methodologies, didactic strategies and the dialogue between academic knowledge and local knowledge and practices.

To collect data, we used documentary research (CELLARD, 2014), content analysis (FRANCO, 2005) and interview (GIL, 2019) as a technique. Twenty-five teachers who teach Chemistry in basic education in different places in the Amazon were involved in the research. The data collection procedure was structured in four different moments: identification of the Chemistry teachers, the institution responsible for the academic training and the period of training.

After this process, the curriculum of the undergraduate course in Chemistry of the educational institutions was analyzed with the objective of verifying the existence of

disciplines that would allow the dialogue between academic knowledge and local knowledge and practices. The third moment was aimed at surveying pedagogical practices to check the relationship between academic knowledge and local knowledge and practices. The fourth moment was configured in a space for dialogue that served to prove the contributions of local knowledge and practices to the redesign of the initial training of Chemistry teachers in the Amazon. The research results were organized in text form for a better understanding of the reader.

## RESULT AND DISCUSSION

Since the Law of Guidelines and Bases of Education – Law 9394/96 was enacted, several actions were designed with the aim of improving the quality of education in Brazil. On June 25, 2014, for example, the Law that deals with the National Education Plan, valid for ten consecutive years, was approved. We stress that improving the quality of education, overcoming educational inequalities, with an emphasis on promoting citizenship and eradicating all forms of discrimination are some of the goals to be achieved by educators by 2024. Official documents: LDB-9394/96, PCN's from 1997; National Curriculum Guidelines for Secondary Education (1998), Guidelines for the Training of Basic Education Teachers, at a higher level, degree courses, full graduation (2002); General National Curriculum Guidelines for Basic Education (2013) and other documents, guided and encouraged chemistry teachers from different Amazonian contexts, the development of a new teaching practice. In addition, they highlighted the importance of the theme and supported the research results. During the research, it was found that two professors (IESF) had graduated before the enactment of LDB-9394/96, which justifies the absence of disciplines that would

allow reflection on the knowledge necessary for the exercise of teaching (professional, disciplinary, curricular and experiential).

The curricula in general followed the guidelines of Law 5692/71, which adopted the complete integration of technical education into the regular education system, establishing full equivalence between professional and preparatory courses, for the purpose of continuing studies (NASCIMENTO; COLARES, 2005). At that time, higher education prepared the student to be an intellectual (doctor), that is, a holder of scientific knowledge and the history and philosophy of science.

Four professors graduated during the period in which Law 9394/96 was enacted, but the curricula did not change. Nineteen started training in 2001, four years after the enactment of this Law and other official documents that guide basic education throughout Brazil. Even after the guidelines and suggestions of these documents, we did not perceive in the curricula disciplines that would allow the dialogue between local knowledge and practices.

Regarding teaching practice, six teachers (IESF) carried out activities linked to the technical experimental approach, four (IESE) carried out other types of activities (playful activities, social issues related to environmental education, etc.) and fifteen (IESE) used the empirical experimental approach. As experimentation is the main characteristic of Chemistry courses (degree/baccalaureate) it is not possible to exclude from the professional training process this type of approach that in this research we call Technical Experimentation and Empirical Experimentation.

The first approach involves instruments and analytical reagents with the aim of validating the contents of classical disciplines (organic, analytical, biochemistry, physical-

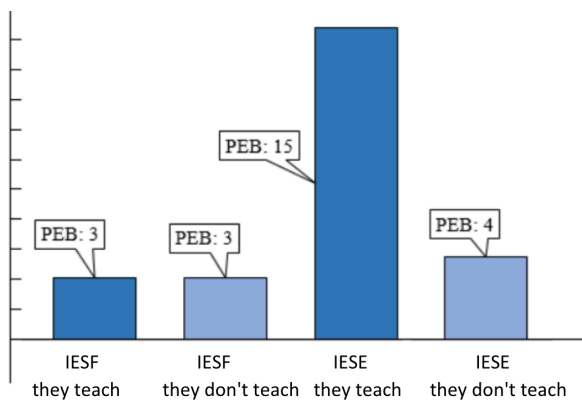
chemistry, etc.). Example: “acid-base neutralization” which uses titration as a laboratory procedure. The second is linked to different types of knowledge: primitive (CHASSOT, 2008), traditional (SANTOS; QUINTERO, 2018), popular (XAVIER; FLÔR, 2015), local (BASÍLIO, 2006). Example: “acid-base neutralization”, which uses fish (pitiú) from the Amazon region to demonstrate the neutralization process using lemon. In this experiment, the professor emphasizes that the amines responsible for this odor (pitiú) are basic organic compounds that are neutralized by the citric acid present in the lemon.

As of 2010, even though the curriculum of the Chemistry course at IESE has not changed, and with the arrival of new professors at the institution, significant changes can already be seen in the initial training process. Among the nineteen professors graduated at that time, fifteen teach chemistry taking as a theme of contextualization and dialogue (discussed contents), local knowledge and practices, as presented below: PEB1: The ethnoknowledge and popular knowledge of the Amazonian caboclo: an approach in science teaching Natural Products and Chemistry from artisanal extraction of copaiba (*Copaifera* sp.) and andiroba (*Carapa* sp.) oil (separation of mixtures, organic compounds, reactions, environmental education). PEB2: Cumate extract and tacacá gourd dyeing: from ethnographic knowledge to its mediation for Science and Chemistry Teaching in Basic Education (physical states of matter, separation of mixtures, solutions, solubility, concentration, organic functions). PEB3: Slow Food: bonbons produced with cassava mass (*Manihot esculenta* Crantz) and Brazil nut granules (*Bertholletia excelsa* H.B.K.) (chemical reaction functions, thermochemistry, chemical kinetics, organic functions). PEB4: Calcined clay replacing caraipé bark (*Licania scabra*) in the production

of clay pots: a sustainable alternative (inorganic functions, chemical reactions, thermochemistry, chemical kinetics). PEB5: Artisanal cheese production: rescue of traditional knowledge and didactic strategy for the study of dairy fermentation during the Supervised Internship (dairy fermentation). PEB6 – PEB7: Sustainable artisanal practice: chocolate from cocoa beans (*Theobroma cocoa* L) (lipids, vitamins and minerals). PEB8 – PEB9: The production of cassava flour (*Manihot esculenta* Crantz) as an articulating axis of chemical knowledge: a teaching proposal for peasant schools (separation of mixtures, inorganic and organic functions, chemical reactions, thermochemistry, chemical kinetics). PEB10: Determination of the titratable acidity index of Cumaru oil (*Dipteryx odorata*): experience developed in the Supervised Internship (inorganic and organic functions, chemical reactions). PEB11 – PEB12: Aromatic candle produced from white pitch (*Protium heptaphyllum*): possibility of fighting the culex mosquito (substances, inorganic functions, chemical reactions, thermochemistry, chemical kinetics, organic functions). PEB13: Jutaicica - natural resin from the Amazon: indicative for studying polymers in high school (polymers). PEB14: Extraction of residual oil from andiroba cakes (*Carapa guianensis* Aubl.) by means of centrifugation: interdisciplinary experience developed in the Supervised Internship (separation of mixtures, organic compounds, reactions, environmental education). PEB15: Natural Pigments from the Amazon: *Bixa orellana* L. as a strategy for the study of chemical compounds (chemical reactions and organic functions). It was also found that three regent professors graduated from IESF who, since 2010, have been working with undergraduate students during the Supervised Internship, are already developing work in the same line of research.

PEB16 – PEB17 – PEB18: Amazon culture: a look at the physical-chemical and nutritional properties of flours produced with the plant species *Manihot esculenta* Crantz (Cassava). (pH, acidity index, nutritional composition).  
 PEB16 – PEB17: Identification of chemical substances present in the saaripé: historical and cultural relevance of the tucandeira ritual (organic functions, biochemistry, vitamins and tannic substances).

The results responded to the research objectives, met the prerogatives of the National Education Plan and showed that in an initial teacher training course (Graph 1) it is possible to develop strategies that make it possible to overcome educational inequalities, mobilize, apply and value the cultural diversity of diverse social groups, their knowledge and actions, identities, cultures and potentialities, without discrimination and prejudice.



Graph 1 – Basic education teachers (PEB) who use local knowledge and practices in Chemistry classes.

## CONCLUSIONS

The results showed that it is indeed possible to redesign the initial training of teachers even if the curriculum does not encourage the development of this practice. It is important to think of a training that goes beyond strongly demarcated disciplinary boundaries, without connections and dialogues between them and social reality.

The curricula of teacher training courses must break with the distance of everyday life, strengthen proposals that allow all knowledge to be contextualized and that teacher trainers and teachers in training establish relationships with their experiences – knowledge and practices.

These are the kinds of knowledge that Tardif (2014) calls “experiential knowledge” and which gain prominence when he clarifies that “experiential knowledge” becomes functional, practical, interactive, syncretic and plural, heterogeneous, non-analytical, open, personalized, existential, little formalized, temporal and social. Experiential knowledge is the knowledge that arises from the pedagogical action of teacher trainers, conductors and teachers in training. The knowledge that involves the experiences lived in the context of each social actor can enrich the curriculum, making school and academic knowledge more alive and challenging for everyone. This plurality of knowledge strengthens the teacher’s identity and constitutes a fundamental element of reflection on their teaching practice.

## ACKNOWLEDGMENTS

To basic education teachers from different Amazonian contexts.

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