

Defining a philosophical background for chemistry teaching in high school: the case of electrochemistry content in textbooks

Artur Aldi (PG),^{1*} Carmen Fernandez (PQ),¹.

artur.aldi@usp.br

¹ Instituto de Química, Universidade de São Paulo.

Palavras Chave: (philosophy of chemistry, epistemology, electrochemistry, textbook, realism).

Highlights

Electrochemistry content in chemistry high school textbooks was analyzed. A strong chemical realism was found in the textbooks, identified mainly through the ways models are built and also through the ways models evoke a spatial dimension to concept explanations.

Resumo/Abstract

Every Science has an intrinsic philosophical basis which makes it epistemologically an ontologically consistent and different from other sciences. Having this in mind and that good science teaching should avoid creating distorted images of science, it would be important to identify what are the main philosophical aspects of chemical knowledge that can contribute to chemical teaching.

With this aim, we realized a three-stage project: (1) first, a review on the literature of philosophy of chemistry was carried out to summarize the main aspects and trends on the epistemology and ontology of modern chemistry. In preparation for the analysis of the didactic books and in sequence to the literature review, (2) a historical study on the main electrochemical concepts covered on chemistry courses was made. The concepts addressed were: the concept of oxidation, reduction and oxidation number; the discovery of electrolysis and of the laws of electrolysis; the invention of the pile; and the invention of Daniell Cell. Having done parts 1 and 2, it became possible to start part (3), which was to analyze chemistry textbooks. The seven science textbook collections approved by PNLD 2021 were analyzed.

Through the literature review from part 1, we came to a set of five philosophical aspects which together can describe modern chemical knowledge and chemical knowledge production in a satisfactory way. These aspects are: pragmatism, appreciation of empirical aspects of theories, appreciation of application of knowledge, pluralism and realism. In contrast to that, the historical studies of part 2 showed that many of the electrochemistry concepts had, at least in their origins, a very positivist perspective, reflecting the contemporary philosophy of science of their creators. In the textbooks, realism is the most prominent philosophical aspect, identifiable mainly through the use of models. This points to the need for teachers to have a better understanding of realism and, thus, may contribute to teacher education.

[1] Introdução à Filosofia Da química: Uma revisão bibliográfica Das Questões Mais Discutidas Na área E Sua importância Para O Ensino De química. RBPEC 2014, 13 (3), 121-147.

[2] SCHUMMER, J. The Philosophy of Chemistry: From Infancy Toward Maturity. Em: BAIRD, D.; SCERRI, E.; MCINTYRE, L. (Eds.). Philosophy of Chemistry: Synthesis of a New Discipline. [s.l.] Springer Dordrecht, 2006. p. 19–39.

Agradecimentos/Acknowledgments

We would like to thank the financial support of Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) processo #2013/07937-8 and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Processo #312017/2021-9.