

Training of chemistry teachers in the Distance Education modality: a state of the art

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Abstract

Seeking to understand teacher education, more specifically in chemistry, in the distance education modality, this text presents the steps in the construction of a State of the Art in educational research, aiming to produce a mapping of the productions that address the Education of Chemistry Teachers in this modality. For this, we used the repositories made available by Capes, Scielo, Google Scholar and BDTD that would offer us the necessary theoretical basis to build this tool and understand the path we are following. Through our analysis, it was possible to observe a majority field of research of a basic nature, with a qualitative approach and exploratory nature, discussing numerous topics about the formation processes. It should be noted that the themes found indicate the relevance of using the necessary assumptions regarding teacher training, in order to contribute to the development of the area.

Keywords: Teacher training. Chemistry teachers. DistanceTeachingModality

Formação de professores de química na modalidade Educação à Distância: um estado da arte

Resumo

Como fator de busca para compreender a formação docente, mais especificamente de Química, na modalidade EaD, este texto apresenta os passos da construção de um Estado da Arte na pesquisa educacional, tendo como objetivo produzir um mapeamento das produções que abordam temas que mais se aproximam do objeto de estudo, a Formação de Professores de Química na modalidade. Para isso, utilizamos dos repositórios disponibilizados pela Capes, Scielo, Google Scholar e BDTD que nos oferecessem o embasamento teórico necessário para construir essa ferramenta e compreender o caminho que ora traçamos. Por meio de nossa análise dos textos foi possível observar um campo majoritário de pesquisas de natureza básica, com a abordagem qualitativa e do tipo exploratória, discutindo inúmeros temas sobre os processos de formação. Cabe destacar que os temas encontrados indicam a relevância do

uso dos pressupostos necessários no tocante à formação docente, de modo a contribuir com o desenvolvimento da área.

Palavras-chave: Formação de professores. Professores de química. Modalidade EaD.

1 Introduction

As we know, Distance Education (DE) is a type of education that is conceived with the use of information and communication technologies, in which teachers and students are physically separated in space and/or time. In addition, we highlight that every day we observe an intense use of elements of DE being increasingly used in basic education, higher education, graduate studies, open courses, among others (Alves, 2011).

According to Nunes (1994, p.1), distance education is a "resource of incalculable importance to meet large contingents of students, more effectively than other modalities and without risk of reducing the quality of services offered due to the expansion of the clientele served. In this context, there is the implementation of new pedagogical approaches with the use of multimedia and distance interaction tools.

The teaching method has gone through historical milestones and has been consolidated all over the world. It had its initial milestone in 1728, by Professor Caleb Philipps. With its growth, DE has become an excellent opportunity for students who would find it difficult to attend a classroom course to complete a higher education course (or other courses) (PORTAL DO CONSÓRCIO CEDERJ/FUNDAÇÃO CECIERJ, 2010).

For Litwin (2001) apud Alves (2011, p.84):

The development of this teaching method served to implement the most diverse educational projects and for the most complex situations, such as: vocational courses, training for work or scientific dissemination, literacy campaigns and also formal studies in all levels and fields of the educational system (Litwin, 2001, *apud* Alves, 2011, p.84)

Regarding the constructions about the theme of EaD training of chemistry teachers, in this text, we searched for works from 2008 to 2019. Our sources were



abstracts available in the journal article bank of the Coordination for the Improvement of Higher Education Personnel (CAPES), the articles published and available in Scielo, Google Scholar and in the Brazilian Digital Library of Theses and Dissertations - BDTD.

Our objective is to conduct a state of the art to identify how the conceptions of teacher education expressed in the papers contribute to pedagogical practice and how the practices studied are contributing to the constructions or deconstructions of teacher education in the area of chemistry.

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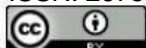
2 Methodological aspects about the state of the art

For the development of this research and in order to achieve its objectives, it becomes necessary to characterize the methodological aspects that were developed for its success. For Silveira e Córdoba (2009), research is an instrument that resulted from a detailed examination, once thought to solve a problem, based on scientific procedures. The procedure of characterizing the research is fundamental, emphasizing that this work presents a qualitative approach, of a basic nature and, as to procedures, a bibliographic research.

Regarding the qualitative approach, several authors address and conceptualize this type of research, including Deslauriers (1991), Goldenberg (1997), Minayo (2001; 2007), Silveira and Córdoba (2009), among other authors. For Minayo (2007, p.21):

Qualitative research answers very particular questions. In the Social Sciences, it deals with a level of reality that cannot or should not be quantified. That is, it works with the universe of meanings, motives, aspirations, beliefs, values and attitudes. This set of human phenomena is understood here as part of social reality, because human beings distinguish themselves not only by acting, but by thinking about what they do and by interpreting their actions within and from the reality experienced and shared with their peers (MINAYO, 2007, p.21).

Corroborating with the authors, Silveira and Córdoba (2009) emphasize that the approach in question seeks to explain the why of things, in order to express what should be done. However, it should be emphasized that there is no quantification of values and





the symbolic bargains are not subject to the proof of facts, because what is analyzed are non-metric data, which constitute different approaches.

For being characterized as basic in nature, Silveira and Córdova (2009) contribute by highlighting that this type of research seeks to raise new knowledge, which is of significant importance for the development and advancement of science, and that does not necessarily have an expected practical application, involving accuracy and universal vehemence.

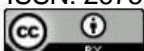
Still in the process of research characterization, when we relate it to the procedures, a bibliographical research is evidenced. For Fonseca (2002, p.32):

The bibliographical research is based on the survey of already analyzed theoretical references published in written and electronic media, such as books, scientific articles, and web pages. Any scientific work begins with a bibliographic search, which allows the researcher to know what has already been studied on the subject. There are, however, scientific researches that are based solely on bibliographic research, searching for published theoretical references with the objective of gathering information or previous knowledge about the problem to which an answer is being sought (FONSECA, 2002, p. 32).

Gil (2007, p.44) corroborates by highlighting that "the most characteristic examples of this type of research are about investigations on ideologies or those that propose to analyze the various positions about a problem".

In this sense, we followed some steps during the process of construction and writing of this paper. Initially, it was necessary to select the databases where the articles would be searched, which, in turn, should be related to the theme. The chosen repositories were Capes, Scielo, Google Scholar, and BDTD.

We used descriptors related to the proposal of the research theme, the two used being "training of chemistry teachers" and "distance training of chemistry teachers". We searched for works between the years 2008 and 2019, in order to investigate and promote a current and pertinent analysis about the theme. From the analysis of the texts, we selected 18 works in relevant journals in the aforementioned databases. Then, we read these papers and analyzed them, configuring a literature review or bibliographic review.



3 The exposition and analysis of the papers found

After evaluating the previously obtained studies and using the inclusion and exclusion criteria in the texts, the final material was organized in Chart 1, below, for better visualization. The chart presents the main information of each manuscript, pointing out its authorship, title, place and year of publication, as well as the keywords. After being exposed, the works that were closer to the theme were analyzed and criticized.

Chart 1 - Main information of the productions found

Author	Title	Place and year of publication	Keywords
AZEVEDO, Érica de Melo.	The importance of experimentation in EaD undergraduate chemistry courses	CIET:EnPED,2018	Experimentation; Teaching Chemistry; Chemistry Teaching EaD, Chemistry Laboratory Chemistry Laboratory.
CABRAL, Wallace Alves; FLÔR, Cristhiane Cunha; MOURA, Nielson.	Meanings attributed to writing by chemistry undergraduates in the distance learning modality.	ENPEC - National Meeting of Research in Education and Science/2013	Writing; French discourse analysis and writing habits.
GARCEZ, Edna Sheron da Costa.	The playfulness in teaching chemistry: a state-of-the-art study.	SIBI - Library Systems - UFG/2014	State of the art; games and playful activities in Chemistry teaching.
LEÃO, Marcelo Franco.	IFMT's Chemistry undergraduate degree in Ead modality: an analysis of the teaching knowledge constructed in this formative process.	LUME - Digital Repository - UFRGS/2018	Teacher training; distance education; teaching knowledge; undergraduate chemistry.
LEÃO, Marcelo Franco; OLIVEIRA, Eniz Conceição; PINTO, José Claudio Del.	Presential tutors' perceptions about the initial training of chemistry teachers in EaD offered by IFMT.	DIALNET Foundation/2019	Distance education; Teacher training; Tutoring.
LEÃO, Marcelo Franco; OLIVEIRA, Eniz Conceição; PINTO, José Claudio Del.	Analysis of the curricular structure of the degree course in Chemistry offered at IFMT in EaD modality.	Lines Magazine/ 2019	Curriculum; curriculum guidelines; teacher training; legislation.



LEOPOLDINO, Kleison José M.	The affective relationships in tutorial practice and its relation to learning in the distance learning undergraduate course in Chemistry.	Institutional Repository - UFRN/ 2012	Distance higher education; affectivity; chemistry; experimental classes.
MOURA, Nielson; FLÔR, Cristhiane Carneiro Cunha; TRÓPIA, Guilherme.	Everyday school life and writing in distance education for Chemistry teachers.	Tecné, Episteme y Dadaxis/2009	Teacher Training; Writing; DE.
NATANYASSAI, NatanyDayani de Souza Assai; ARRIGO, Viviane; ARRUDA, Sergio de Mello.	Chemistry undergraduates' perceptions on distance education: reflections and proposals.	ACTIO: Teaching in Science, 2017	Distance Education; Initial Training; Chemistry; Textual Analysis.
PERDIGÃO, Daniel; IPOLITO, Michelle Zampieri	Construction of a national distance-learning undergraduate Chemistry course.	Intersaberes Magazine, 2017	Distance Education; teacher training; Chemistry Teaching; UAB System.
PERDIGÃO-NASS, Daniel	Distance learning in Physics and Chemistry in Tocantins: trajectories, possibilities and limits.	Digital Library - USP/2012.	Distance education; teacher education; science teaching.
PEREIRA, Franklin Kaic Dutra.	Adventures of telling (se): narratives of distance education for Chemistry teachers.	Institutional Repository - UFRN/2019	(Self)biographical narratives; teacher education in chemistry; distance education; training memorials; teacher identity.
QUADROS, Ana Luiza de; MIRANDA, Luciana Campos.	Chemistry undergraduate students' reading: analyzing the case of the distance learning course.	Química Nova Escola Magazine/2008	Reading; teacher training; learning.
SILVA, Caio R. F.; SANTOS, Ana L. B. S.; REIPERT, Érika C. D.; SILVA, Gerson N.	Digital learning objectives in Chemistry teaching: preliminary investigation on teacher training in EaD.	SBQ - Brazilian Chemical Society/ 2016	Chemistry teaching; teaching methodology. Virtual learning; digital learning object.
SILVA, Fábio Adriano Santos da; FIREMAN, Elton Casado	A case study of teacher training in the chemistry undergraduate course in the EaD modality at UFRN: reflections of the training based on the rationality of the tutors.	Scientific Journal in EaD em foco/2013	Teacher training; didactic laboratory; tutoring.





SILVA, Jaqueline Lima da; SILVA, Juvenal Carolino da	Distance and face-to-face teaching: an analysis of the main socioeconomic differences and the conditions of course offerings of undergraduate Chemistry majors at UFS.	EDaPECI Journal - distance education and communicative educational practices and interlocutors/2014.	Distance learning; face-to-face learning; characteristics.
SOBRINHO, Natália Nogueira; VERAS, Kleyane Moraes; OLIVEIRA, Micheline Soares Costa.	Teaching chemistry through distance learning at UECE.	Secretariat of Education - UECE/2015.	Distance education; teaching chemistry; higher education.
SOUZA, Carla Simone Bittencourt Netto de.	Distance learning undergraduate degrees and the challenge of quality: a proposal for indicators to assess quality in Physics, Chemistry, Biology and Mathematics courses.	TEDE - Electronic publication systems for theses and dissertations - PUCRS/2009.	Quality in higher education; quality in distance education; indicators and metrics of quality in education.

Source: Prepared by the authors (2020).

We began the analyses with the works that refer to the training of chemistry teachers in the modality in question, especially, those that are closer to the subject matter, a task somewhat difficult to accomplish, but when we do, we create skills that are conditioned to play the indispensable role for the development of the profession. It is this task that stimulates us to learn by doing and reflecting on our practice. As Moraes and Soares (2005, p.271) argue, regarding this training:

the defense of "learning how to learn", both in what concerns students and teachers' training (the "reflection in practice" and the reflection "on practice"), puts in second place or even annuls what seems essential to us: a training focused on "learning how to teach" (MORAES; SOARES, 2005, p.271).

Among the 18 texts found, we clipped the descriptor "training of teachers of chemistry" and some referred to the theme, we listed those that were closest to the object of study and, in addition, we used the descriptor "teacher training in EaD modality" and found little work that approached the theme.



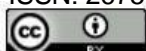


From the considerations regarding the training of teachers of chemistry and as it was not possible to analyze all the works that we now found and listed in the previous table, we deemed it necessary to discuss in this text only a few: those that came closest to the object of study.

The text by Cabral, Flôr and Moura (2013) seeks to understand how the students of the Undergraduate Degree in Chemistry at UFJF - EaD attributes meaning to the writing process, in addition to verifying how the course can influence the students' writing. For this, the authors use a questionnaire to analyze the taste and the habit of writing of the research participants. Through the analysis, it was possible to describe that the students do not present a polarization in the perception of liking or not liking to write, but they are between these extremes. Finally, it is observed that the participants see the "importance of working with writing in its different modes in the formation of chemistry teachers, seeking to overcome the dualities towards a more critical and creative learning" (Cabral, Flôr and Moura, 2013, p.1).

Sobrinho, Veras and Oliveira (2015) point out that EaD has also arrived in the teaching of Chemistry at the State University of Ceará (UECE) and their work seeks to discuss the functioning of the course in question. The research was pointed out as investigative and qualitative investigative, using letters and documents related to the course, in addition to analyzing the general understanding of how this undergraduate course runs through the perception of teachers, tutors and students in the courses offered in Orós and Mauriti, in the State of Ceará. The analysis of the subjects took place through an interview and the data were treated and made available in texts and tables. Through the analyses performed it was possible to understand the experiences of the participants in the evaluated courses, in addition to understanding the processes of chemistry teacher training offered.

The author Azevedo (2018) presents an analysis of the degree courses in Chemistry of the Open University of Brazil (UAB) regarding the experimental subjects offered in their respective curricula for initial training. Initially, a survey of the Higher Education Institutions (HEI) that offered such courses and then the author verified the





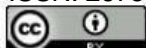
From the analysis of the total workload (CH) of the undergraduate courses that were evaluated, it was observed that it varies between 2820 hours and 3125 hours. Regarding the CH of experimental subjects that dealt directly with chemistry, it was observed a minimum value of 4.8% and a maximum of 15.7% of the total. Besides, it was possible to infer that 2 of the evaluated courses have their courses organized by thematic axes and 5 by traditional axes.

The work in question concludes its analysis emphasizing the main difficulties in relation to the process of development of experimental activities in the in-person centers, especially with regard to their infrastructure. Even so, the use of virtual laboratories is pointed out as a possible solution, which, according to the author, should not replace these face-to-face meetings, but should also be characterized as an important support tool for the learning process of chemistry students.

The authors Assai, Arrigo and Arruda (2017), on the other hand, seek to analyze how students of the Degree in Chemistry in EaD modality perceive their own process of initial training in order to explore it as a means to work in Distance Education in their future teaching activities. The research had as sample students of the 8th period of the course who answered a questionnaire with 4 questions. The data were analyzed using content analysis, as proposed by Moraes (1999).

Through the analysis of the results, it was possible to show that the students of the period studied presented divergences in their answers regarding the possibilities of distance education, denoting a lack of knowledge about this type of education. It can also be seen that, for the interviewees, teaching in this modality has only progressed due to technological developments, which also demonstrates a lack of knowledge about the history of DE itself. Still, they mention the difficulties of teaching chemistry in this modality, where they consider the students' difficulty with the subject an important factor.

The authors defended at the end of the research how important it is to discuss the theoretical and practical issues in the processes of teacher training in DE modality, in view of the fact that they will be able to act in their career in a more directed way.





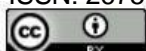
In concluding the analysis of the works, we verified that many researches point investigative paths, contextualizing the profession of chemistry teachers and we perceived that this area is still in its infancy in the modality under study. The works found tried to dimension the diverse subjects contextualizing the formation of the chemist in the EaD modality, as well as analyzing the knowledge of teachers constructed in the formative process, glimpsing the perceptions observed by the on-site tutors with respect to the process of initial formation offered, analysis of the curricular structure.

We also saw the reflective authors with affective relations about the tutorial practice and its possible relation to the learning of students in the distance course, concerned with daily life and writing in teacher training, the construction of a national course in chemistry, the trajectories, possibilities and limits, the narratives and adventures in training in chemistry, the work with learning digitals investigating training, training based on the rationality of tutors, the socioeconomic differences and conditions of offers of this course in training and, finally, the challenge of the effectiveness of the quality of teaching through a proposal of indicators for measuring quality in DE courses.

More generally, it is possible to infer that, through the readings of the material selected in our work, one of the main purposes of this training is to enable future chemistry teachers to reflect on the nature of chemical knowledge, investigating their position during their initial training process, being able to explore popular knowledge and have possibilities to insert themselves into today's world. We also noticed that many works explore the idea of teacher training in the initial phase, but we should discuss the modality that both 'bothers' our future professionals and those who are working: the DE modality.

4 Final considerations

Analyzing by means of literature review what the literature has been discussing about a certain theme becomes pertinent once it promotes reflections about the theme discussed and proposed here, besides understanding what the academy seeks about our





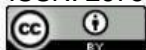
object of research. The discussions proposed here were based on the works that addressed teacher training in a broad view, as well as the training of chemistry teachers in the context of distance education modality.

Thinking about the training of chemistry teachers in distance education, in the context of the importance of this subject as a school curriculum component, more specifically in high school, becomes relevant to reflect on the subject itself. Labeled as a subject that is difficult for students to understand, thinking about strategies from the perspective of training these professionals is urgent, in order to promote reflections that enable a training that prepares them for the challenges experienced in the context of the school space and, especially, outside of it.

It is necessary to review the isolated practices that many of these professionals use, trying, whenever possible, to contextualize the contents with the students' reality, a proposal that must be thought about since the teacher's training. However, we cannot fail to mention their working conditions in the school environment, which, by not having adequate structures and tools available, ends up limiting the performance of this professional, who distances himself from the proposals made for High School.

The teacher training courses are offered by the educational system with the purpose of overcoming existing deficiencies in the teachers' actions and to refresh the subjects that guide the mentioned profession. These courses, sometimes, end up not giving the expected result, since the teacher, who is always overloaded, ends up not finding the incentive to complete or dedicate time to these courses.

Therefore, through this work, a reflection is also proposed to the educators and researchers of education to fight for educational improvements, to rescue the history of chemistry, to make theory and methodological practice really go hand in hand, because it is advocated a quality education, and for this to happen, it is necessary that teachers act to combat the problems that exist in the school system. Such talk should also, and most especially, the urgent problems arising from the training of chemistry teachers, who have been using and expanding their work in such an important modality for the present moment: distance learning.





That we make changes happen in order to improve education and that our students feel more pleasure for the acts performed by both the educator and those who make up the educational system in general.

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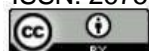
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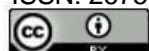
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