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ARTICLE

Training of the teacher of chemistry in Brazil: the curricular logic of the license

Formação do professor de química no Brasil: a lógica curricular

Formación del profesor de química en Brasil: la lógica curricular de la licenciatura

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Abstract: The objective of this work is to reflect on the curricular logic of the pedagogical projects of some undergraduate courses in chemistry of federal teaching institutions in Brazil. Methodologically he works from a critical hermeneutic perspective. The analysis of four pedagogical projects of undergraduate courses in chemistry with bases in the critique of Kliebard to the thought of Tyler was made. From the study in question is the understanding that the future teachers little participated in the decision-making processes regarding the curriculum development; teachers who may have difficulties in building their professional identities, since it is not very clear in all projects the profiles of bachelors and licenced; possibly these teachers will have difficulties in articulating the chemical knowledge with the pedagogical doing, since a greater number of disciplines of the chemical knowledge prevails to the detriment of disciplines that deal with the teaching of the chemistry.

Keywords: Curriculum. Teacher training. Chemistry graduation.

Resumo: *O trabalho tem como objetivo refletir sobre a lógica curricular dos projetos pedagógicos de alguns cursos de licenciaturas em química de instituições federais de ensino do Brasil. Metodologicamente trabalha numa perspectiva da hermenêutica crítica. Foi feita a análise de quatro projetos pedagógicos de cursos de licenciatura em química com fundamentos na crítica de Kliebard ao pensamento de Tyler. Do estudo em questão fica a compreensão de que os futuros professores pouco participaram dos processos decisórios quanto à elaboração do currículo; professores que poderão ter dificuldades na construção de suas identidades profissionais, uma vez que não fica muito claro em todos os projetos os perfis dos bacharéis e dos licenciados; possivelmente estes professores terão dificuldades em articular o conhecimento químico com o fazer pedagógico, já que prevalece um número maior de disciplinas dos conhecimentos químicos em detrimento de disciplinas que tratam do ensino da química.*

Palavras-chave: *Currículo. Formação do professor. Licenciatura em química.*

Resumen: *El trabajo tiene como objetivo reflexionar sobre la lógica curricular de los proyectos pedagógicos de algunos cursos de licenciaturas en química de instituciones federales de enseñanza de Brasil. Metodológicamente trabaja en una perspectiva de la hermenéutica crítica. Se realizó el análisis de cuatro proyectos pedagógicos de cursos de licenciatura en química con fundamentos en la crítica de Kliebard al pensamiento de Tyler. Del estudio en cuestión queda la comprensión de que los futuros profesores poco participaron en los procesos decisorios en cuanto a la elaboración del currículo; profesores que pueden tener dificultades en la construcción de sus identidades profesionales, ya que no queda muy claro en todos los proyectos los perfiles de los bachilleres y de los licenciados; es posible que estos profesores tengan dificultades para articular el conocimiento químico con el hacer pedagógico, ya que prevalece un número mayor de disciplinas de los conocimientos químicos en detrimento de disciplinas que tratan de la enseñanza de la química.*

Palabras clave: *Currículo. Formación del profesor. Licenciatura en química.*

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Introduction

The teachers formation for the basic education in Brazil, especially for the teachers of natural sciences have been grindlocked during years, among them, it has been highlighted the dichotomy between the specific knowledge for the areas of natural science and the pedagogical way of making (MALDANER, 2006; CARVALHO; GIL-PÉREZ, 2006). This is a problem in which struggle the science teacher in schools, but also the chemistry, the physics and the mathematics, at last, from all the areas. The same grindlocked affects the reality in the major degree, which gives emphasis in a base of the knowledge of the bachelor's degree in detriment of the graduation subjects. This curricular fragmentation has relation with the own history of the graduations in Brazil, when happened the enactment of the decree law 1.190, 4th April 1939, which accordingly to Saviani (2009, p. 146):

> It has been extended to all the country, compounding the model which has been known as "scheme 3+1" adopted in the organization of the graduation and pedagogy. The first graduated the teacher to give the many subjects that compose the curriculum of the secundary schools; the second formed the teachers to execute the teaching in normal schools. Im both the cases vigorate the same scheme: three years for the study of the especific subjects, moreover, the cognitive contents or the "subject courses", on the expression of Anísio Teixeira, and one year form the for the didactic formation.

The 3+1 scheme have implications until nowadays in the teachers formation, even with many advances of legislation and in the curricular documents which amplify the quantity of hours in the bachelor's degree. The major implications seems to be the difficult of the initial formation of the licencee to be seen and act as teachers and thus begin to build their identities and teachers knowledge; this is due the curriculum and the own teachers, seem to not appraise the teaching, giving it a minor professional status, so they priorize specific subjects of the natural science and a few of them realtes these disciplines with the teaching work.

During the master's degree course in Education and Science Teaching, and the studies of the PhD Degree about didactics in the major in Chemistry in the research about the motive of the same with the disponibilization of the said pedagogical subjects as **teaching practices**, the methodologies, the instrumentalization, the internships, and even the especific didactics, there still remain many problems in the teacher's formation in the natural science area, that when it comes to the professorship, they demonstrate an enormous fragility when teaching the basic content in their knowledge areas.

This context impelled and justified the necessity of study about the formation of chemistry teachers with basis in the analysis of the curricular proposals of the courses. In this sense, the general objective of this work is to reflect about the curricular logic of the pedagogical projects of some major courses of chemistry in the federal institutions of Brazil. The criticism hermeneutics was a methodological option to interpret and comprehend this object. For this work were selected four projects of major courses of chemistry in federal universities in Brazil. The selection was made accordingly the performance index of courses in evaluation by competent bodies in the country. Besides analyzing the pedagogical projects, in other moment teachers and students of the selected courses were interviewed, although the

discussion of the data of those interviews is not present in these texts due the lack of space and delimitation of the group of questions for this paper.

Curriculum and the formation of the chemistry teachers

It is possible to verify that the curriculum while as a concept emerges in a context for the control of the teachers work. For Goodson (2006) the curriculum was basically invented as a concept to direct and control the accreditation of the teachers in their liberty potential in classrooms. Along the years, the alliance between prescription and power was carefully fomented, in such a way that the curriculum has become a mechanism of reproduction of the relations of existing powers in the society.

Terigi (1996) refers for the term distinguishing in three focuses, he says that: if the curriculum is a pedagogical tool of massification of the industrial society, it is possible to find its origin in the United States, in the middle of the XX Century or yet, a bit sooner, in the 20's decade; but if we comprehend that is a structured study plan, it is possible to identify for the first time in some European society in the XVI Century; and, on the other hand, we can say that it is some indication of what is being taught, then we can reach Plato, and, maybe, even earlier than him.

When attempting for the first focus, that Terigi (1996) presents, this is, the curriculum as a pedagogical tool of massification of the industrial society, it is perceived similarities with the discussion and the critics that Kliebard (2011a) makes about bureaucracy and the theory of the curriculum, when this trace the historical antecedents of the emphasis of efficiency in the educational moviments of USA and recognizes the Ralph Tyler's program as one of the most during in the curricular field. It must be highlighted that after the World War II have been set new challenges for the education and the way of plan and organize the processes of teaching and evaluation, in this sense, the systems have been organized by the logic of teaching, not by the learning, they were organized by the rationality of logic.

Kliebard (2011a) says about a chart that emerged from the educational activity, apparently frenetic in the USA, seems to be the reason of the crescent acceptance of the bureaucratic model for the education, powerful and restrictive, reflex of the techniques of administration utilizes by the industry and transformed in an ideal of excellence and source of inspiration. For Kliebard (2011a) the pressure of the corporative expansion and the urbanization of the XX century transformed the individual in a single tooth of an enormous gear. It was this pressure that conquered the imagination of the North Americans at the turn of the century, and made the idealized bureaucracy was recognized as a scientific administration. He also emphasizes that the extrapolation of principles of the scientific administration for the curriculum area "transformed the child in the work object of the bureaucratic gear of the school. She became the raw material to what the school-fabric should model in a product according to the society specifications" (KLIEBARD, 2011a, p. 10).

What the comprehension has with the curriculum and the formation of the teacher of chemistry in Brazil with the present? How have been verified the curriculum appeared as a tool of massification, and also as a way of direct and control the teachers, although this

perception of curriculum is related to a historical reality from the middle of the XX Century, it preoccupated the fact that even nowadays the curriculum can represent remainders of a massification. When it comes to the curriculum to form teachers, including the chemistry ones, it is possible to questionate even to a point which we get free from the control and the bureaucracy idealized given space to attend the formation of a teacher, considering what Silva and Oliveira (2009) understand being necessary for a curriculum in formation of a chemistry teacher, this is, the content to be taught, the curricular knowledge, the pedagogical knowledge about the school subject "Chemistry", the knowledges about the construction of the scientific knowledge, the specificity about teaching and learning of the chemistry science, among others.

Furthermore, we also consider that the chemistry teacher, as any teacher of basic education, needs to comprehend its social role, taking in consideration what Candau (2014) adverts when didactics was put into question, this is, to assume the multidimensionality of the process of teaching-learning. To analyze the different methodologies explaining its presuppositions, the context which were generated, the man's vision, the society one, the knowledge and the education which is vehiculated. Beyond the compromise with the social transformation.

The second comprehension that Terigi (1996) presents about the curriculum is that it can be a structured plan of teaching, it remembers a concept elaborated by Goodson (1995, p. 21), that is "a documental source, a map of the terrain subjected to modifications; and constitutes also one of the best official scripts for the internalized structure of schooling". For Goodson (1995, p. 21) the curriculum is written and prescript, but "it is not more than a visible testimony, public and subject to changes, a logic that choose to, through a rhetoric, legitimate a schooling". However, adverts the author: it is fundamental to distinguish between the written curriculum and the classroom curriculum, because there are risks on studying just the written curriculum (GOODSON, 1995).

In this case, it is possible to question which perception of the teaching formation is present in the curricular projects to form the chemistry teacher and which rhetoric to be made to legitimate a kind of teacher, the chemistry teacher. Which rhetoric is present in the projects? Moreover, how these documents elaborate comprehend and make clear so this structured plan is visible and subject to changes? Which frequency and on which intentionality are modified this plans/projects?

Goodson (1995) warns about the danger of studying only the written curriculum, taking it as a simple prescription, this way it is something lifeless, without intrigue, disconnected from reality, sometimes it can be purposely misleading. This dimension of the curriculum, this is, what is not written and prescribed, but happens and comes to life, remembers us Apple (2002), when he dealt with the hidden curriculum. For him are "rules and values that are implicit but effectively transmitted by the school and are not usually mentioned at the presentation made for the teacher of their purposes and objectives" (APPLE, 2002, p. 127). As it was said before, this is a preoccupation that was not considered by us, because we also observed the daily training of the teachers at the universities, as well, we interviewed teachers and students of the majors in chemistry, but for this paper we focuses in the analysis of the written curriculum.

In the midst of this discussion about the field of the curriculum, the contradictions and challenges that he presents, we consider reporting the criticisms of some theorists about the current curriculum does not respond the necessities of the society. For Goodson (2006) himself, the old patterns of development and the curriculum studies are totally inadequate for a new society of risks, instabilities and quick changes in which we are living, because we are still stuck to the primary and prescriptive learning. He says that more than just write new prescriptions for the schools, a new curriculum or new guidelines for the reforms, they need to question the true validity of the prescriptions predetermined in a world in change. Like Goodson (2006), Pinar (2006) is also not convinced that the current model of curriculum to be the best for the society that we live and suggests that the pedagogical work must be simultaneously autobiographical and political.

The pedagogical projects of the major in chemistry courses in Brazil

That was the criteria for the selection of the projects of the major in chemistry in the different regions of the country, with the best performances at the evaluations at the Exame Nacional de Desempenho dos Estudantes (ENADE). The preliminary concept of the course (PCC) which is composed by the results of the outcomes of Enade and by factors that consider the entitlement of the teachers, the percentage of the teachers that meet the part-time or the full-time (non-hourly) regimen, didactical pedagogic resources, infrastructure ans physical installations. And the Course Concepts (CC), composed from the evaluation in loco of the course by the Ministry of Education (MEC), in addition, the General Index of Courses (IGC) which syn the sizes in a single indicator the quality of all the courses of graduation and PhD strictu sensu of each university. The option for Major in Chemistry is based mainly at the fact that Chemistry being a science that already question its own epistemological foundations.

In the North region was analyzed a project from the Federal University of Amazonas (UFAM); from the Northeast region the Federal University of Paraíba (UFPB); from the Central-West the Federal University of Mato Grosso do Sul (UFMS); from South region, the Federal University of Santa Catarina (UFSC). The best conceptualized course in Brazil, at the occasion of the data gathering was the Federal University of Minas Gerais (UFMG), however, this project was not accessible at the UFMG's site, and even contacting personally with the institution, the project was not available. For this reason, the project was not possible that the southeast of the country was included as an object of analysis of this work.

What are the pedagogical projects about and how they are structured? In a general way, the projects follow the same structure of a text, an introduction, the historical and/or context of its center and course, the legal fundaments, the objectives, the professional profile, the competences, the abilities, the coordination and administration of the course, the general structure of the course with the curricular composition and the syllabus. The project of the majors in chemistry of UFAM and UFMS have presented data of their institutions, the historical, the objectives, the universitarian structure and informations about teaching, research and extension, aspectos not observed at other projects.

The frame below shows in a succinctly way the textual structure of each project:

Frame 1. Textual Structure of the Pedagogical Projects of the Majors in Chemistry

UFAM	UFPB	UFMS	UFSC
Historical and Collegiate of the Course Objectives Professional Profile Skills and Abilities Technical Core Pedagogical Core Professional Core General Structure of the Course Teachers Qualification Curricular Components Syllabus Material Conditions Complementary Activities	Course Definition Objectives Professional Profile Abilities Skills Acting Field Curricular Composition Fluxogram	Introduction Historical of the Center Historical of the Course Social Necessity of the Course Academic Administration of the Course Course Coordination Structuring Core of the Course Academic-Administrative Organization Attention for the Students Course Identification Course Conception Theoretical-Methodological Foundation Legal Foundation Objectives Expected Profile of the Egress Skills and Abilities Curriculum Curricular Structure Equivalents Table Allotment of the Subjects at Centers and Colleges Syllabus and Bibliography	Course Contextualization Legal Foundations Course Objectives Major Concept and Organization of the Course Methodological Principles Structure and Dynamical Structure of the Course Curriculum Structure Workload Distribution Course Organization Subjects Syllabus Bibliography for the Course Subjects Learning Evaluation Course Evaluation Necessary Resources Consulted References

Source: Prepared by the authors from the field research, 2015.

It is observed that the projects look alike structurally, this could happen due to the established rules by the documents that normalize the elaboration of the pedagogical projects at the universities and the teacher training, including the chemistry teachers. The said documents in their own project as sources and foundations for their elaboration were: the National Curricular guidelines for teachers trainings, such in legal aspects on resolutions and evaluations of MEC, so as in the methodological and epistemological aspects; the Law of Guidelines and Bases for the National Education (LDB 9394/96) (BRASIL, 1996); the resolution 01/2002 – CP/CNE of 18/02/2002 that institute National Curricular Guidelines for the formation of teacher at basic education, on a higher level os education, the major, of full graduation (BRASIL, 2002a); the resolution 02/2002 – CP/CNE of 19/02/2002 that institute the duration and the timetable of the courses of major, of full graduation, of the teacher

training at high level (BRASIL, 2002b). The resolution in the 08/2002 – CP/CNE, of 11/03/2002 that establishes the Curricular guidelines for the courses of bachelor's degree and major in chemistry (BRASIL, 2002c), accompanied by the evaluation number 1.303/2001 – CNE/CES – National Curricular Guidelines (BRASIL, 2001). In addition to the resolution of the universities that dispose about the resolution for the courses functioning of teacher's trainings offered by them, which provide and propose parameter and guidelines for the elaboration of pedagogical projects of the graduation courses.

Although in 2018 there were already new guidelines for the teacher formations in Brazil, at the time of this research, in 2014, the universities had not yet these new documents that were published in 2015. Therefore, in the analysis of these projects we have the clarity that the same were elaborated before the current orientation and guidelines for the teachers training in Brazil.

The pedagogical projects of major in chemistry and the criticism of Kliebard to Tyler

In the analysis if these projects, it was chosen to seek similarities and divergences among them and the program proposed by Ralph Tyler for the curriculum elaboration. The intention was to make clear, until the point that the theoretical statement of the lasting impact at the curriculum areas, the program of Tyler, according to Kliebard (2011a) determines the curricular model in the training of teacher of chemistry. It has become the basis/foundation of the projects to the criticism made by Kliebard (2011a, p. 24), the steps and sources for the elaboration of the curriculum proposed by Tyler are namely:

> 1. What educational objectives should the school seek to achieve?
> 2. What educational experiences can be offered that can make possible to achieve these objectives?
> 3. How can these educational experiences be organized efficiently?
> 4. How can we determine if these objectives are being achieved?

The first and crucial phase in the Tyler principles, in which all the others depend and in which we seek to deepen our reflection, is the establishment of the objectives of the curriculum. Tyler points out them as sources of which the objectives should be taken: studies about the students, about the contemporary life and the suggestions made by the experts at this content. What Kliebard (2011b) does is to deconstruct this Tyler's ideia from some criticism, which will be seen below.

About the needs of the students as a source of objectives for the curriculum, Kliebard (2011b) remembers that Tyler himself wisely acknowledged that the concept of necessity has no meaning outside a set of norms. Tyler described the study that he envisioned as a process to get to know the necessity of the student, in essence, in two phases: First, to discover the current statuses of the students, then, to compare these statuses with the acceptable norms in order to identify gaps or necessities.

For Kliebard (2011b) the very serious questions about values associated with identification and the satisfaction of needs make the concept of needs extremely complex. In this sense, the author believes that Tyler is perfectly conscious of the difficulties of derivating the educational objectives from the studies made about children, for example. The reflection that Kliebard (2011b) makes is about the extreme complexity of the procedure and a crucial role, although maybe arbitrary, of the values hierarchy or life philosophy, this was, it can be questioned if there is a place for the concept of "necessity" in the process of the objectives formulation.

The studies about the contemporary life as a source of objectives for the curriculum follows the same criticism about the necessity of the student. The Tyler's conception of the role that such studies play in determining the objectives is, according to Kliebard (2011b), similar in many aspects to his spiritual precursor of Tyler, Franklin Bobbit. Like Bobbit, Tyler proposed that life can be divided into manipulable categories, ans it should be done after the data gathering of many species that compose these categories (KLIEBARD, 2011b).

However, Kliebard (2011b) warn us that contemporary life is a source too dependant of the philosophical inquiry as on the needs of the student. In fact, both the students' needs and the contemporary life are delimited by some society or by someone that "chooses" and establishes criteria from some point of view and values. From this criticism of Kliebard (2011a), then, we question ourselves which should be the sources that should provide the objectives in the curriculum? What about the curriculum of the chemistry teachers in Brazil?

After the reading of the pedagogical projects, we verified that all of them were composed without the participation of the students in formation. They were elaborated by a small group of people, or even by only two professors. These projects desconsider not only the participation of the students with their real needs, as it is possible to verify in the text of the pedagogical project of major in chemistry of UFSC: (2008, p. 17).

> We understand that the curriculum cannot be based by absolute criteria of quality or, in another extreme, to lower the quality of the courses of major to attend the reality of the students. In this sense, we understand that the general and specific formation should be solid, but we should promote an articulation among the disciplines of the chemistry contents with his pedagogical contents.

The fact of using the reality of the students as a measure to lower the quality of courses gives us indications that the life and the "needs" of the students were not considered in the elaboration of objectives of the project. Although, in one of the analyzed projects, describes and justifies that the course is based in a social need, it is the case of the pedagogical project of the major in chemistry of UFMS (2013, p. 5), which says:

> The course of chemistry embedded in 1981, was intended to attend the needs of the Mato Grosso do Sul state, about the training of professionals to perform their duties as teachers, in middle school and high school, also as business counselors, in government agencies, participation in councils, also working together with the state departments in the education areas, research, extension, environmental problems, expertises etc.

Despite this mention, the implementation of the major course at the university, if compared to the studies of the contemporary life that Tyler defended as a source of

objectives, when we observe the project, it reveals that the sources of the elaboration of the documents which mainly normalize and regularize the functioning of the courses at universities.

On below, follows some specific objectives of one of the projects:

> To train professionals who can: Act in the professorship, in primary and secondary education, according with the specific legislation, using the varied teaching methodology, contributing for the intellectual development of students ans to awaken the scientifically interest in teenagers; to organize and use the chemistry laboratories write and critically analyze didactic and paradidactic books and indicate bibliography for teaching Chemistry; to analyze and elaborate programmes for these levels of teaching; to exercise their profession with dynamism and creativity at seeking new educational alternatives, facing challenges like the professorship difficulties; to know critically the educational Brazilian problems (UFAM, 2011).

In spite of the fact that there are many specific objectives linked to the formation of the teacher of chemistry and the practice of teaching, but when we analyse the curricular structure, it is evident that a great number of subjects of the specific area, which are focused in this science, in detriment of the pedagogical subjects, or which articulate the chemical knowledges with the pedagogical practices and contribute directly with the knowledges of the teachers. The objectives of the pedagogical project of UFMS, on the other hand, differ from those of UFAM and form the other, being specific for the teaching of chemistry. It can be said that the objectives that try to articulate with the pedagogical knowledges with the specific area of chemistry.

The pedagogical project of UFPB presents a particularity, that is, it serves both for the major course and the bachelor's degree, and the proposed objectives, either to try to distinguish the differences of the professions, or to try to articulate with the common to them, the teacher's one and the bachelor's degree.

> To make possible the training of the professionals, altogether with the current society problems and able to answer for their needs with the necessary competence and quality to offer a solid theoretical formation and practice based in the fundamental knowledges for the professional acting of the bachelor's degree and the major in chemistry, enabling that egresses act critically and innovatively towards the challenges of the society (UFPB, 2006).

It is possible to question whether the way in which way are disposed these objectives, that is, objectives that serve both to trains teachers and bachelor's degrees, can be considered obstacles for the specificity and the construction of identity of each professional, teacher and bachelor's degree. This question also worried us when we observed that the student of the chemistry course of UFSC that still has the 3 + 1 scheme.

The experiences that both the broad and the multidisciplinary formation can offer to the student can be also favorable and necessary for the teacher's formation. However, can this also become an impediment for the identification with the profession? Even so, by knowing the reality of the major courses and the influence that the training professors can exercise in their students, and the most of them are from bachelor's degree and not from major courses (GONÇALVES; MARQUES; DELIZOICOV, 2007). Generally, these

teachers/baccalaureates bring with them the conception of investigation connected to a naturalistic and empirical research of character, which makes possible the controlled observation of the nature phenomena, and the construction of explanation models for such phenomena, as being the only valid knowledge for the science as observes Rosa (2004).

When analyzing the training system of the science teachers, Carvalho and Gil-Pérez (2006, p. 68-69) warn about the following:

> The authentic danger emerges from the tendency of contemplating the teacher training as the sum of a basic scientific formation and a psychosocial-pedagogical formation [...]. The departments do not offer special courses for the future teachers, considering that the teaching preparation is the responsibility for schools or educational departments, and that the required scientifically formation for a future teacher do not differ, for example, of a future professional from industry.

This is a kind of danger that still remain in the Brazilian universities, since it is common to find major courses thar offer to their future majors the specific subjects for their formation area, but the said pedagogical are offered by the education colleges, and only at the end of the course. On this case for example, Maldaner (2006) affirms that are, in fact, this separation between specific disciplines of the chemistry area, from the pedagogical disciplines in the teacher's formation in the university's areas, what has prevented them from thinking the courses as a whole, and emphasizes the most,

> The most frequent initial formation of teachers, this is, the separation of the specific formation in contents, creates a sensation of emptiness of knowing that in the teacher's mind, because it is different to know the contents of chemistry, for example, in a chemistry context than to know them in a context of pedagogical meditation with the chemistry knowledge (MALDANER, 2006, p. 45).

Therefore, for this author, the universities have been forming teacher creating and strengthening a gap between the specific knowledges in the field of knowledge which this teacher will act, and the pedagogical formation, giving to the future teacher the sensation of emptiness. We will verify on the following a curricular structure presented in the Pedagogical Project of Major in Chemistry to know how are articulated these knowledges.

Frame 2. UFAM Curricular Structure of the Major in Chemistry of UFAM

Mathematics	**Didactical**
Mathematics foundations	Educational Psychology I
Differential and Integral Calculus A	Educational Psychology II
Differential and Integral Calculus B	General Didactics
Physics	Educational Problems at the Amazonian Region
General and Experimental Physics A	**Philosophical and Social Foundations**
General and Experimental Physics B	Deontology for Chemicals
Chemistry	Chemistry History A
General Chemistry	Educational Foundations
General and Experimental Chemistry	Basic Teaching Legislation
Organic Chemistry I-A	**Practice as a Curricular Component**
Organic Chemistry II-A	Curricular Practice I
Organic Chemistry III-A	Curricular Practice II
Organic Chemistry - Experimental	Instrumentalization for the Teaching of Chemistry I
Biological Chemistry	Instrumentalization for the Teaching of Chemistry II
Biological Chemistry - Experimental	Informatics Applied to Chemistry
Inorganic Chemistry D	Introduction of Data Processing
Inorganic Chemistry E	**Supervisioned Internship in Teaching**
Inorganic Chemistry - Experimental	Supervisioned Internship in Teaching I
Analytics Chemistry I-F	Supervisioned Internship in Teaching II
Analytics Chemistry - Experimental F	Supervisioned Internship in Teaching III
Analytics Chemistry I-G	Supervisioned Internship in Teaching IV
Analytics Chemistry - Experimental G	Academic Scientific-Cultural Activities
Physics-Chemistry I-A	Complementary Activities
Physics-Chemistry II-A	
Physics-Chemistry - Experimental	

Source: Prepared by the authors from the field research.

It is surprising when we observe a curricular structure like this and verify that what occurs, in fact, is different from what is proposed in the course objectives, this is, a bigger quantity of disciplines in the technical or specific area of chemistry and of other sciences of nature like physics and mathematics. On the other hand, we cannot overlook the new curricular structures already advanced in the attempt of articulating the didactical or pedagogical disciplines with those of specific knowledge of chemistry.

In the case of the curricular structure of UFAM, from the 41 compulsory subjects, only 14 are didactic-pedagogical subjects, and from these, only 8 seem to articulate knowledges of the sciences of nature with the didactic-pedagogical knowledges, this is, only this eight seems to proportionate for the students a reflection about the act of teaching chemistry.

In the curriculum structure of UFSC, there are 51 compulsory subjects, 18 we consider didactical-pedagogical, and from these, 12 articulate with the specific knowledges of chemistry with the didactical-pedagogical knowledges. Furthermore, the UFSC's structure offers two subjects thar develop knowledges related to research in education.

What we are questioning is not about only the quantity of specific subjects of chemistry in detriment to the didactical-pedagogical ones. What is questioned is there is a few articulation among the knowledges in a course to train teachers to teach chemistry, it is

known this occurs due to many reasons: the very history of the teachers formation in the sciences of the nature help us to understand this, because when the major courses begin to being implemented into the universities, the scenario of the trainer teachers which prevailed were from other areas of majoring, such as engineering and medicine, and lately, from the graduate courses. This scenario has been changing for the raise of the quantity of major courses and also with the new programs of post-graduation in the teaching of sciences, teaching of mathematics and education in sciences which have been rising at the Brazilian universities in recent years.

The criticism that Kliebard (2011b) made from the Tyler's ideas about the content as a source of objectives for the elaboration of the curriculum program is linked to the belief that the suggestion of specialists in the content do not constitute actually a source, this is only one of the many means which satisfy the individual needs of the curriculum proposers, such as vocational aspirations.

In the case of major in chemistry courses it is possible to question if the knowledges and if the subjects of the course are not defined according to Goodson (2007), in an uninterested academical way, but in a tight relation with the power and social groups interests. This dispute of knowledges and subjects, not only in the course of major in chemistry, is linked to the own trajectory of the modern science. The modern science was intended to transform the reason and science in myths, to convert them in supreme entities entrusted with the humanity salvation (MORIN, 2008).

The modern science has as a characteristic the epistemological unitarism or dualism between the natural science and social science, with is marked by the hegemony of the positivist philosophy of the natural sciences (SANTOS, 1989). According to this author, there was a supremacy of the natural sciences about the social ones, what constitute an epistemological obstacle to the advance of the scientifically knowledge, with consequences for both. We understand being one of the consequences, this difficulty of articulation between the chemistry knowledges and the didactical-pedagogical knowledges in the curriculum, which are fundamental for the teacher who will teach sciences.

Questions that still need to be studied...

Other aspects of the projects, besides the source of the objectives and the fragmentation of the knowledges in the curricular structures need some study and reflection, for example, to verify that there is no mention in the projects about the selection and organization of the experiences and subject activities. Moreover, to verify if the objectives of the projects serve as a base for the selection and organization of the experiences and learning activities during the course, or are simply a pattern following which the curriculum is evaluated by the system? Besides, which treatment is given to the evaluation of the projects?

For short, we have identified a given treatment for the evaluation by one of the projects. The evaluation indicates to have been focuses in the students results, we verified this in the projects of UFAM and UFMS, which are said to be based in a law which establishes the Sistema Nacional de Avaliação da Educação Superior (SINAES) and in the ENADE. In

the critique of Kliebard (2011b) to the Tyler's program, the evaluation would need to confront the anticipated consequences and the obtained results, this is, would need to consider the objectives and the experiences/activities that were not planned and not simply being a prescription and application of criteria of excellence to the own activity, or to serve as a pattern on which the course is evaluated. The other projects do not mention about the evaluation in their texts. We could ask which are the motivations of evaluation to receive this kind of treatment, or rather, which are the motives to not have a treatment for the evaluation of the project of the courses? Which implication this has in the teacher's formation?

There are other questions to be discussed from the reading of the projects, among them: to investigate the reason why the projects propose general and specific objectives, they also propose the development of competences and abilities. On what is based? Why these competences and not others? To know which are the means that the Supervisioned internship articulates between the theory and the practice, if there is some link between the theory and practice with the term paper and with the research in scientifically education, and the teaching-learning in chemistry, among other questions.

Conclusion

It is possible that from the Kliebard's (2011b) analysis of the projects and his criticism about Tyler's program to consider that depurating the educational objectives based on a philosophical sieve is simply a manner of saying that we are obliged to make options among thousands or maybe millions of objectives that can, in fact, represent the reality in which they are settled. Therefore, it is necessary to consider the subjects, their life experiences, their conceptions, their effective participation in the elaboration of the projects of formation, and even so, the curriculum will never be neutral.

The selection and organization of the experiences from learning need to be part of the curriculum, and this mean to dialogue and interact with the students, future teachers, their environments, and to question if the process of evaluation it must essentially to determine even where the educational objectives are being really achieved by the curriculum and teaching program, or if they are just there to attend a demand of the system and to give answers to external evaluations, which little interfere in the learning of the future teachers. In other words, to verify if the enunciation of the objectives, activities and evaluation are just serving to establish a pattern according to which the program is concepted by the agencies and institutions that apply large-scale evaluations.

Which prescriptions of the courses of major in chemistry are the teachers forming? It was possible from this study to make some approximations...

(i) a teacher who did not participated in the elaboration of the curriculum which formed him, and which did not discussed about the expectations and needs, one was not present in the elaboration and evaluation of the pedagogical project of its own course, then it is assumed that these teachers were distant of the decision-making processes linked to this formation;

(ii) a teacher who has experienced few significant experiences as regards on learning to teach chemistry in basic education, once curricular structures describe a few disciplines that actually link the technical knowledge of chemistry with the knowledge of teaching;

(iii) and the difficult that these future teachers may have in constituting their professional identities of teacher, due to the way the objectives are proposed in the courses, sometimes do not distinguish the profile and role of the teacher from the profile and role of the baccalaureate. Then, the way that the curricular structures are organized, which give privilege to the chemistry knowledges in detriment to the teaching knowledges.

About the questions: Where should be the objectives of curriculum come from? What about the curriculum to form chemistry teachers in Brazil? Kliebard (2011b) himself dos not need a clarification to help us to answer them. Whereas after analyzing Tyler's sources, he verifies that:

> This studies about the students and about the society depend both of the philosophical sieve to be maintained as sources, which can also be considered that in fact is the philosophical sieve that determine the nature and scope of the objectives. To say that the educational objectives are derived from the individual philosophy, is to say that the individual must choose the educational objectives in a way related with the hierarchy of values that he adopts. This says so little, about the process of selecting the objectives, to the point to be virtually meaningless (KLIEBARD, 2011b, p. 32).

For Kliebard (2011b), someone can doubt the validity of the repeated insistence of curriculum specialists that the first step for the elaboration of the specification of objectives. We understand that even with this criticism of Kliebard (2011b) to Tyler's thinking, there no way to disregard that improvements in education can have a direct relation with the definition of objectives to be achieved by the education institutions. In this way, the criticism of Kliebard (2011b) to the sources of the curriculum elaboration is pertinent when the he warns to be careful about the illusion in the definition of objectives based on the needs of the students and the society, because they depend of a philosophical sieve, this way, like the warn, the bureaucracy in the curriculum theory, to the scientific administration.

In this way, we understand that the curriculum to form teachers of chemistry must provide its objectives from the students and society needs, but these need to be said by the subjects who actively participate in this formation, not only specialists of curriculum and legislation. This mean that the future teachers must be heard in the elaboration of the pedagogical projects of their courses. Furthermore, the formation teachers also must use their power as curriculum configurator idealizers (LEITE; FERNANDES, 2010), so the quality of formation is not limited to exam results that measure only cognitive skills. The teachers in formation need to be protagonists and authors of their own learning and formation processes.

The most significant dimensions of an educational activity or of any formative activity may be those that were not absolutely planned or anticipated. Despite making all this criticism about the Tyler's thinking, Kliebard (2011b) recognizes that he deserves to be enthroned in the gallery of the famous names in the field of curriculum by his moderation, wisdom and influence. However, he also remembers that one of the reasons of Tyler's principle success is its own rationality.

References

APPLE, Michael W. Podem as pedagogias críticas sustar as políticas de direita? **Cadernos de Pesquisa**. São Paulo, n. 116, p. 107-142, jul. 2002.

BRASIL. Lei nº 9.394/96, de 20 de dezembro de 1996. Estabelece as diretrizes e bases da educação nacional. **Senado Federal**. Brasília: DF, 1996.

BRASIL. Parecer CNE/CES nº 1.303/2001. Diretrizes curriculares nacionais para os cursos de química. **Conselho Nacional de Educação/Câmara da Educação**. Brasília: DF, 2001.

BRASIL. Resolução CNE/CP nº 01, de 18 de fevereiro de 2002. Institui diretrizes curriculares nacionais para a formação de professores da educação básica, em nível superior, curso de licenciatura, de graduação plena. **Conselho Nacional de Educação**. Brasília: DF, 2002.

BRASIL. Resolução CNE/CP nº 02, de 19 de fevereiro de 2002. Institui a duração e a carga horária dos cursos de licenciatura, de graduação plena, de formação de professores da Educação Básica em nível superior. **Conselho Nacional de Educação**. Brasília: DF, 2002.

BRASIL. Resolução CNE/CES nº 08, de 11 de março de 2002. Estabelece as diretrizes curriculares para os cursos de bacharelado e licenciatura em química. **Conselho Nacional de Educação/Câmara de Educação Superior.** Brasília: DF, 2002.

CANDAU, Vera Maria (org.). A didática em questão. 36. ed. Petrópolis, RJ: Vozes, 2014.

CARVALHO, Anna Maria Pessoa de; GIL-PÉREZ, Daniel. **Formação de professores de ciências:** tendências e inovações. 8 ed. São Paulo: Cortez, 2006.

GONÇALVES, Fábio Peres; MARQUES, Carlos Alberto; DELIZOICOV, Demétrio. O desenvolvimento profissional dos formadores de professores de Química: contribuições epistemológicas. **Revista Brasileira de Pesquisa em Educação em Ciências.** Belo Horizonte, v. 7, n. 3, set./dez. 2007.

GOODSON, Ivor Frederick. **Currículo**: teoria e história. Tradução de Attílio Brunetta. Petrópolis, RJ: Vozes, 1995.

GOODSON, Ivor Frederick. **As políticas de currículo e de escolarização**. Abordagens históricas. Tradução de Vera Joscelyn. Petrópolis, RJ: Vozes, 2006.

GOODSON, Ivor Frederick. Currículo, narrativa e o futuro social. **Revista Brasileira de Educação**. Rio de Janeiro, v. 12, n. 35, p. 241-252, maio/ago. 2007.

KLIEBARD, Herbert M. Burocracia e Teoria de Currículo. **Currículo sem Fronteiras**. v. 11, n. 2, p. 5-22, jul./dez. 2011a.

KLIEBARD, Herbert M. Os Princípios de Tyler. **Currículo sem Fronteiras.** v. 11, n. 2, p. 23-35, jul./dez. 2011b.

LEITE, Carlinda; FERNANDES, Preciosa. Desafios aos professores na construção de mudanças educacionais e curriculares: que possibilidades e que constrangimentos? **Educação.** Porto Alegre, v. 33, n. 3, p. 198-204, set./dez. 2010.

MALDANER, Otavio Aloisio. **A formação inicial e continuada de professores de química:** professores/pesquisadores. 3 ed. Ijuí: Editora Unijuí, 2006.

MORIN, Edgar. **O método 3**: O conhecimento do conhecimento. Tradução de Juremir Machado da Silva. 4. ed. Porto Alegre: Editora Sulina, 2008.

PINAR, William F. A política de raça e gênero da reforma curricular contemporânea nos Estados Unidos. **Currículo sem Fronteiras.** v. 6, n. 2, p. 126-139, jul./dez. 2006.

ROSA, Maria Inês Petrucci. **Investigação e ensino:** articulações e possibilidades na formação de professores de ciências. Ijuí: Editora Unijuí, 2004.

SANTOS, Boaventura de Sousa. **Introdução a uma ciência pós-moderna.** Rio de Janeiro: Graal, 1989.

SAVIANI, Dermeval. Formação de professores: aspectos históricos e teóricos do problema no contexto brasileiro**. Rev. Bras. Educ**. Rio de Janeiro, v. 14, n. 40, p. 143-155, jan./ab. 2009.

SILVA, Camila Silveira da Silva; OLIVEIRA, Luiz Antonio Andrade de. Formação inicial de professores de química: formação específica e pedagógica. *In*: NARDI, Roberto (org). **Ensino de ciências e matemática**, I: temas sobre a formação de professores [online]. São Paulo: Editora UNESP; São Paulo: Cultura Acadêmica, 2009. p. 43-57.

TERIGI, Flávia. Notas para uma genealogia do curriculum escolar. **Educação e Realidade.** Porto Alegre, v. 21, n. 1, p. 159-186, jan./jun. 1996.

UFAM. Universidade Federal do Amazonas. Reestruturação do Curso de Licenciatura em Química. **Projeto Pedagógico**. Manaus: UFAM, 2011.

UFMS. Universidade Federal do Mato Grosso do Sul. Resolução nº 36, de 6 de dezembro de 2013. **Aprova o Projeto Pedagógico do Curso de Química – Licenciatura**. Campo Grande: UFMS, 2013.

UFPB. Resolução nº 11/2006, de 18 de abril de 2006. Aprova o novo Projeto Político-Pedagógico dos Cursos de Graduação em Química, Bacharelado e Licenciatura, do Centro de Ciências Exatas e da Natureza, Campus I, desta Universidade, e revoga as Resoluções nº 40/90, 26/94 e 04/98, do CONSEPE. **Conselho Superior de Ensino, Pesquisa e Extensão, da Universidade Federal da Paraíba.** Paraíba: UFPB, 2006.

UFSC. Universidade Federal de Santa Catarina. **Projeto pedagógico do Curso de Licenciatura em Química**. Florianópolis: UFSC, 2008.