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Construction of identities in a teacher training course in chemistry*

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ABSTRACT

The purpose of this article is to present the results obtained in the investigation of a chemistry degree course at a public university. Theoretical references on teacher professionalization, identity and curriculum were used, particularly cultural studies and sociological approach. The qualitative methodology is based on the discursive textual analysis of data collected through 71 questionnaires applied to teacher-training undergraduate students and interviews with six of them, plus with six graduated chemistry teachers. The analysis suggests that the course's current curriculum induces professionalization aimed to research in chemistry (bachelor's profile). It concludes that the professors have to change their practices in order to break the current model, which devalues the professional training aimed to chemistry teaching for youth, an activity that is considered of less importance to many of them.

KEYWORDS

teacher education; teacher professional identity; teacher training course in chemistry.

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CONSTITUIÇÃO DE IDENTIDADES EM UM CURSO DE LICENCIATURA EM QUÍMICA

RESUMO

O objetivo deste artigo é apresentar os resultados obtidos na investigação de um curso de licenciatura em química de uma universidade pública. Foram utilizados referenciais teóricos sobre profissionalização docente, identidade e currículo, particularmente dos estudos culturais e da abordagem sociológica. A metodologia de cunho qualitativo baseia-se na análise de questionários aplicados a 71 licenciandos e entrevistas realizadas com 6 licenciandos e com 6 egressos por meio da análise textual discursiva dos dados obtidos. Os resultados indicaram que o currículo ativo do curso induz a profissionalização para a pesquisa na área específica de química (caráter bacharelizante). Conclui-se pela necessidade de os formadores atuarem adotando práticas curriculares que rompam com modelos de formação que privilegiem a formação do profissional químico em detrimento da formação do professor de química para os jovens, uma atividade considerada de pouca importância para muitos deles.

PALAVRAS-CHAVE

formação de professores; identidade profissional docente; licenciatura em química.

LA CONSTRUCCIÓN DE IDENTIDADES EN UN CURSO DE FORMACIÓN DE MAESTROS EN CIENCIAS QUÍMICAS

RESUMEN

El propósito de este artículo es presentar los resultados obtenidos en la investigación de un curso de formación de maestros en ciencias químicas en una universidad pública. Fueron utilizadas referencias teóricas acerca de la profesionalización docente, identidad y currículo, particularmente los estudios culturales y el abordaje sociológico. La metodología de carácter cualitativo se basa en el análisis de cuestionarios aplicados a 71 licenciandos y entrevistas con seis licenciandos y seis graduados a través del análisis textual del discurso de los datos obtenidos. Los resultados indicaron que el currículo actual del curso conduce a la profesionalización para la investigación específica en ciencias química. Se concluye que los profesores tendrán que cambiar sus prácticas con el fin de romper el modelo de formación que devalúa la profesionalización para la enseñanza de química para los jóvenes, una actividad considerada de poca importancia para muchos de ellos.

PALABRAS CLAVE

formación del profesorado; identidad profesional del maestro; formación de maestros en ciencias químicas.

The shortage of chemistry teachers for basic education (BE) has been recognized for years and researchers have tried to identify the causes (Andrade *et al*, 2004; Zucco, 2005). To reduce this shortage, several Institutes of Technological Training have recently established chemistry degree programs that lead to teacher accreditation. The federal government implemented public policies to expand the offer of new courses and encourage teacher education. Teacher education courses were created in various fields in the distance education modality with partnerships between the Open University of Brazil, several Brazilian universities, and various programs such as the Initiation to Teaching Grant Program (PIBID), and the University for All Program (PROUNI).

It is understood that the shortage of teachers cannot be resolved solely by increasing the offer of teacher education courses, since the problem lies within a national context in which the devaluation of teachers is part of a structural problem caused by the gradual failure of the state to take responsibility for the quality of basic education and teacher education (Freitas, 2007). We agree with Freitas that overcoming this situation requires the establishment of a comprehensive teacher education policy and the valorization of teachers. In fact, this has been the goal of movements of Brazilian educators, who since the 1920s sought have to improve public education (Saviani, 2007). Meanwhile, it is also believed that there are mechanisms internal to teacher accreditation programs that can increase or decrease the adhesion of those certified to the practice of teaching.

Concern for the initial education of teachers increased in the last decades of the twentieth century and various authors have discussed the professionalization, professionalism and identities of teachers (D'Ávila; Sonnevile, 2008; Lopes, s/d; Veiga; D'Ávila, 2008; Veiga, 2008).

Specifically relating to teacher certification courses in chemistry, there is a movement to reformulate the curricula (Echeverría; Zanon, 2010) induced not only by norms of the National Education Council (CNE) that followed the National Education Guidelines and Framework Law (LDB/1996), but mainly by the need felt by many educators who have taken graduate level courses in education or chemistry and science education since the 1990s. One of the steps necessary for reforming the curricula of teacher certification courses, is the creation of an identity profile of graduates that is sufficient for them to face the challenges of a teaching career. This profile should be induced by the courses created for this purpose (Gauche *et al.*, 2008).

There has been a connection in the educational field between studies of identity constitution, teacher education and curricula (see for example Lopes, s/d; Rosa; Corradi, 2007; Silva, 2009a; 2009b). This study was conducted within this context to investigate the constitution of identity profiles promoted by the active

curriculum¹ of a chemistry teaching certification course of a public university in Brazil's northeast, as well as the interest of students and graduates in teaching.

The research sought to identify in the discourses of undergraduate students and graduates from the course the various identities established by its active curriculum. It was assumed that, although the objective of the prescribed curriculum is the education of teachers, other professional identities have been constructed because of the way some educators work with the subjects they teach, the research they do, how they relate to students, encouraging those who, by their biographical trajectories, can identify with them and take on their discourses and practices, favoring certain types of knowledge, education and identity.

The indicators obtained in the survey point to a “bachelorizing character” of the active curriculum in the chemistry teacher accreditation course investigated. It is understood that this character has contributed to a lower adhesion of graduates to the teaching profession. The results are based on a reflection on the curricula of the course and especially the practices carried out by educators and the need for actions that break with the prevailing culture in chemistry teacher education courses, which relegates teaching to a secondary position in relation to other professionals in the field of chemistry.

THE CERTIFICATION COURSE UNDER STUDY

To contextualize the research, we present here a summary of the history of the course, drawn from various institutional documents, personal memories and also the findings presented in Varjão (2008).

The genesis of this course goes back to the policies implemented by Law 5.692/71 which established the compulsory professionalization of secondary education. This law was enacted during the military dictatorship (1964-1985), and the period between its approval and implementation was very short, leaving schools very little time to adapt physically and gather the required materials. Moreover, there were simply not enough teachers qualified to teach these professionalizing courses.

To meet the need for teachers for special professional education at the high school level, the state secretariat of education signed an agreement with a former public institution of higher education, which is now a university, to create the Teachers Accreditation Program for teachers of special high school curriculums.. The course was established in 1978 with ten certification programs, including one in applied chemistry.

Under the adverse conditions in which compulsory professionalization of secondary education was implemented in Brazil, the failure of the program was soon manifest and in 1982 Law 7044 terminated the compulsory offer of professional education in all schools. This led to the gradual deactivation of the professional

1 In this study the term “active curriculum” is used to refer to curriculum in action, which corresponds to the social practice conducted in a course that establishes the base of professional identity as discussed in this text.

secondary schools throughout the country. Consequently, the teacher certification programs designed to meet this specific demand were also extinguished. In fact, some of the original certification programs were only offered once at the school studied, however, the certification in applied chemistry was offered regularly until 1997 and prepared teachers who were absorbed by other schools. However, the program had a serious curriculum problem: a student could attend all the classes in the pedagogical area and reach the supervised internship at the end of the course without having completed the subjects in specific and complementary fields of knowledge, that is, there were two completely independent curricular lines.

In 1998, after three years of internal discussions, applied chemistry certification was terminated and the current course was implemented. While its curriculum has sought a greater integration of courses in specific fields of knowledge with those in pedagogy, some teachers soon realized that the great change that had occurred, in fact, was the increase in total course hours, mainly in chemistry disciplines. The course load in general and teacher education courses (including the supervised internship) had actually shrunk slightly.

It is understood that the initial curriculum design included the naive idea that if students learned the chemistry subjects, and were trained in some pedagogical techniques, they would be well qualified to teach.

While the academic coordination and the teachers most involved with pedagogical courses reflected on and sought to resolve the problems detected in that curriculum, report CNE/CP 09/2001 concerning the Curriculum Guidelines for Teacher Education for Basic Education Teachers was published. Discussions intensified and began to be guided by the report. In 2002, resolution CNE/CP 01 was published and established new curriculum guidelines.

The School Council studied continued the discussion, now with a goal to redesign the course and introduce changes considered essential to improving its quality. Several meetings were held with representatives of students and professors of chemistry, physics, mathematics and pedagogy.

Since April 2003, the university began redimensioning all its teacher education courses by instituting commissions in each one of them and coordinating the work. At the end of the process, in 2004, contrary to the general trend at other schools that have adopted network curriculums, it was decided to maintain a disciplinary curriculum in the program, understanding that profound changes could actually lead to more harm than advantages. However, it sought to develop a curriculum matrix that would foster increased integration of curricular components through the joint work of several professors.

After the reformulation of 2004, the curriculum included four components. The three respectively denominated teaching practice, supervised internship and curriculum content of a scientific and cultural nature incorporate the various course subjects. A fourth, called complementary studies corresponds to the academic, scientific, and cultural activities that are regulated by the School Council and from which the students can choose freely. The curriculum components have total respective course loads, of 405, 405, 1,905 and 200 hours, giving the course a total of 2,915 hours. According to the academic community, this curriculum matrix

sought to contemplate a new conception of teacher education that emphasizes the dimension of teaching practice as a central focus of the course.

IDENTITIES AND DIFFERENCE: SOCIAL CONSTRUCTS

The concept of identity, according to Laurenti and Barros (2000), involves a multiplicity of meanings and terminologies and has acquired new significations that depend on the particular historical moment and the fields of knowledge that are dedicated to study of the theme. The authors characterize identity “as a historical process linked to all the relationships that pervade everyday life.” (*idem*, p. 1). They maintain that in most cases the concept is used with respect to human individuality and at times to distinguish social groups.

Hall (2009) proposes a concept of a strategic and positional identity in which there is no stable core of the *individual self* that remains identical over time. For Hall, the *collective self* which is “able to stabilize, fix or ensure cultural belonging or a immutable ‘unit’ that overlaps all other—supposedly artificial – differences” ceases to exist (*idem*, p. 108). From the perspective of late modernity, there is no single identity, but various identities that are constantly changing, are never unified and singular, in contrast, they are fractured and constructed multiply by discourses, practices and positions that may be either contrary or in agreement. Hall says (*idem*, p. 109):

It is precisely because identities are constructed inside and not outside discourse that we need to understand them as produced in specific historical and institutional locations within specific educational and discursive practices, for specific strategies and initiatives. In addition, they emerge inside the interplay of specific arrangements of power and are thus more the product of the marking of difference and exclusion than the sign of an identical unity, which is naturally formed, an “identity” in its traditional meaning — that is, a sameness that includes everything, a seamless, rigid identity, without internal differentiation.

Woodward (2009) emphasizes that individual, collective and professional identities are constituted through representation, a cultural process involving signification practices and symbolic systems that produce meanings, name people and have them assume certain positions as subjects when encouraged to do so. That means they would respond: “Yes, that’s me!”, or “Yes, I could be that!”, or still: “Yes, I want to be this!”.

Hall affirms that *identities* are constituted by discourses, that is, “Subjects are thus subjected to discourse and they should thus assume them as individuals, who thus position themselves in this way. The positions we take on and with which we identify constitute our identities.” (*idem*, p. 55). The author distinguishes identity from subjectivity, indicating that the latter is related to the understanding we have of our self and involves thoughts and conscious and unconscious emotions about who we are, however, she emphasizes that subjectivity is exercised in a social context

in which language and culture construct meanings that will only be effective if we consider ourselves as subjects.

The construction of meanings for Woodward is directly linked to power relations established in the social context and with the processes of inclusion and exclusion that arise from them. In theorizing about the constitution of identities, the author also raises the question of marking of difference, affirming that:

Identities are created by the marking of difference. This marking of difference occurs both through symbolic representation systems and through forms of social exclusion. Identity, therefore, is not the opposite of difference: identity depends on difference. (*idem*, p. 39-40).

Rosa and Corradi (2007) bring contributions to the conceptualization of identity as something fragmented, multiply constructed by discourses, practices and positions and in a constant process of transformation. We share with these authors the following concern about the education of teachers and their identities: “When we turn to teachers and courses for their education, it is pertinent to ask: *Old or new identities? What do we know about teachers in these analytical perspectives? I think that we know very little.*” (Marin, 2002 *apud* Rosa; Corradi, 2007, p. 49).

Silva (2009a, p. 74), when problematizing identity and difference as “what it is and what is not”, indicates that from this perspective, both identity and difference would be self-contained and self-sufficient, that is, they simply exist. Thus, “affirmations about difference only make sense if understood in their relation to affirmations about identity.” (*idem*, p. 75). Therefore, when someone makes a statement such as “I am Brazilian” one realizes that it refers to an identity that is not complete by itself, since it only makes sense “because there are other people who are not Brazilian” (*idem, ibidem*) and this generates a long string of expressions of denial: I am not Argentine, I am not Japanese, among many other national identities.

PROFESSIONAL IDENTITY, PROFESSIONALIZATION AND TEACHING PROFESSIONALISM

Dubar (2005) seeks to elucidate forms of socially pertinent identification in a given sphere of action (for example, in an institution), which he calls identity forms. In this approach, he articulates two meanings for the terms socialization and identity, namely, a socialization of activities, or relational socialization of actors who interact in a context of action (identities for the other) and a socialization of individuals, or biographical socialization of these actors who are engaged in the same context of action (identities for the self.)

Like Dubar (*idem*), Lopes (s/d) also theorizes from a sociological approach, in which the formation of a professional identity derives from a secondary socialization process in which we acquire specialized knowledge related to a particular field or activity. The author states that the construction of professional identities derive from the articulation between an internal operation of the individual (for the self, subjective or biographical) and an external operation between individuals

and institutions (for the other, objective or relational). Thus Lopes (*idem*) believes that identity is constructed in the articulation between systems of actions and individual trajectories, with the latter bearers of real identities and the first proponents of virtual identities. Thus, the base professional identity would be a new psychosocial identity: “initial education would correspond to a first moment of professional socialization, resulting [...] in the acquisition of a new perspective on the world” (*idem*, p. 4). I agree with the author that initial professional education and subsequent work contexts are some of the action systems that carry proposals of virtual identities that will interact with the real identities of individuals, arising from their trajectories.

Veiga and D’Avila (2008) present reflections on issues related to educational processes, teacher professionalization and professional recognition, as well as basic epistemological questions that the authors affirm are related to these issues. These processes are distinct from each other, although dialectically intertwined, and professionalization is a process for the acquisition of specific skills that begins with initial education but continues as teachers are constituted as professionals. In this process, subjective characteristics inherent to teachers are involved, such as skills, attitudes, values and ways of working.

Veiga (2008, p. 17) affirms that “The construction of the identity of teachers is one of the conditions for their professionalization and involves the identification of the culture of the group of professional belonging, and is integrated to the socio-political context.”. She argues that the construction of teacher identity involves three dimensions: personal, professional and institutional development. The first dimension is linked to the teacher’s life-building processes, the second refers to aspects of teacher professionalization and the third relates to the strategies used by the institution to achieve its educational goals. He concludes that “the identity of the teacher means being part of a profession in a constant process of review of social meanings.” (*idem*, p. 18) and also points out that “it is important to know more deeply how the teacher’s image has been perceived, and consequently, what have been the assumptions underlying the educational projects for their education.” (*idem*, p. 19).

For D’Avila and Sonnevile (2008), since the last decade of the twentieth century, there have been a number of studies that are strengthening the bases for the construction of teaching professionalism. Based on these studies, teaching has been understood as “a situated, complex and socially produced professional practice. [...] It is understood in this perspective that the condition of professionalism is a fundamental basis for the construction of the identity of the teaching profession.” (*idem*, p. 24). According to these authors, the difference between the concepts of professionalism and professionalization is very subtle. Professionalism is constituted by “capabilities, the rationalization of organized knowledge employed in professional practice” (*idem*, p. 27) and its key feature is instability, since it is constructed gradually in certain contexts. As a social construct, professionalism

Is the object of a co-construction between educators and school organization, formalized in a framework of competencies – and therefore a work product of

the educators and their graduates; professionalism is also closely related to the identity construction of teachers. (*idem, ibidem*).

On the other hand, the concept of professionalization refers to the “process that incorporates professionalism – this incessant search for an identity or a professional profile.” (*idem*, p. 26). For the authors, although professionalization includes initial education, it is not limited to it: the skills, attitudes and knowledge (competencies) that students acquire from their initial education evolve and are resignified within the profession, transforming their lives and leading to professionalization.

The cultural studies and sociological approaches to identities, shown above, can be seen as complementary. Both fields emphasize that although things from the natural/social world exist, they do not have intrinsic meanings. Meanings are always produced and shared in a group, as a result of its culture, and are thus seen here as social practice. In this sense, it is understood that in the context of a degree course, regardless of its type, different cultures are produced and students will be summoned to distinct professional identities, since educators have different identity profiles. These multiply summoned students would tend to assume the identities that they can articulate with their life story. What is not considered ethical is that educators, while working in a teacher certification course in chemistry, overemphasize their specific fields of education and seek, in a utilitarian manner, through their practices and discourses, to enlist as many undergraduates as possible to professionalize them as chemists, thus disqualifying the education of chemistry teachers for basic education.

EDUCATIONAL CURRICULA AND IDENTITIES

Silva (2009b) affirms that what is most important in the curricular issue for critical and post-critical theories of education is why certain knowledge, or a certain type of identity should be emphasized and not others, given that the most important relationships are those established between knowledge, identity and power. In another work, Silva emphasized that curriculums “produce the persons to whom we speak, the individuals who are encouraged. The curriculum establishes differences, builds hierarchies, produces identities.” (Silva, 2006, p. 12), i.e. the curriculum creates the objects we speak of: knowledge, skills, success and failure.

Canem and Moreira (2001) understand the curriculum as a selection of the culture and thus conceive it as a set of practices that produce meanings. The concept of culture used is from social anthropology, which has a significant impact on the social sciences and the humanities in general, since it refers to shared meanings. In this view, what is emphasized is the symbolic dimension, what the curriculum as a selection of culture *does* and not what it *is*. From this perspective, we understand that the identities in a undergraduate course can be derived from the sharing of curricular practices and discourses that seek to express different worldviews and social projects of the subjects involved.

According to Ferraço (2006), in spite of attempts to standardize the curriculum, what in fact exists are curricula in action in each school, which are realized

and differentiate themselves, as a permanent becoming, within the dynamics of the relations established in routine school networks. In this view, the characterization of curriculum changes its focus: from documents to teaching practice, that is thinking and discussing curriculum only has meaning when school subjects are empowered to take charge of the routine facts.

Similarly, when addressing sociability networks in the production of daily school life Carvalho (2013) states that the production and reproduction of materials and discourse take place through social relations and practices determining the social formation. That is, teachers and students in the school do not abandon “the myths, beliefs, and ideas of their social group” (*idem*, p. 405) since they carry subjectivation processes “established from a socio-political, economic and cultural system,” (*idem, ibidem*) and cause the everyday school routine to be seen as “an element that is integrated to all the wide networks of social work that are entangled with the production processes of subjectivities in capitalist society.” (*idem*, p. 411).

Like Carvalho, we understand that social formation is established and signified by language and the actions and pedagogical practices carried out by teachers and students in an undergraduate course. Thus, it is believed that from a single prescribed curriculum, distinct professional identities can be constructed in that the active curriculum will reflect the subjectivities of that social group.

Another author who emphasizes the issue of curricular practice is Sacristan (1998), who states that professors and students are not the only agents of the configuration and development of curriculum and believes that to understand what really affects educational content requires considering more than just teaching practices. That is, each course in an institution (an action system, according to Lopes, s/d) is part of a chain of relationships that contributes to the formation of professional identities.

Lopes (1998) calls attention to the fact that we cannot establish a direct relationship between the propositions of the written curriculum and what takes place in the classroom. In another work, Lopes recalls that although schools are not limited to working with cognitive processes, curricular processes focus on knowledge and culture and therefore “the curriculum is essentially a field of cultural policies, a place of agreements and conflicts around the legitimacy or not of different knowledge, which is able to contribute to the formation of individual and social identities.” (Lopes, 1999, p. 18).

We agree with these authors and this study understands that there is an active curriculum in the chemistry teacher accreditation program studied that, more than the hidden curriculum, in addition to influencing learning and guiding behaviors, values and attitudes, establishes identity forms based on daily experience. That is, there are two cultures within the program that are established from different social practices and discourses of educators who dispute power while representing different fields of knowledge and socio-political and economic ideologies, producing different meanings that can be incorporated by students.

METHODOLOGICAL REFERENCES

We have chosen a qualitative approach using the Text and Discourse Analysis method proposed by Moraes and Galiuzzi (2006, 2007), in which categories of analysis are built from similar units of signification that emerge in the discourses of the subjects of the investigation.

Text and discourse analysis was used to organize and analyze the data constructed, identify connections and signify this *corpus*, since it is understood that its purpose is to produce new insights into phenomena (a hermeneutic character), which is consistent with the objectives of this work. We will now provide more detail about this method.

Moraes and Galiuzzi (2007, p. 140) use a metaphor to locate the text and discourse analysis in the same domain as Content Analysis and Discourse Analysis: all are textual analysis or “a single river of speech” in which content analysis follows the river current, discourse analysis flows against the current and text and discourse analysis is situated between these two opposite poles, often allowing itself to be carried away by the current, rarely going against it, but always seeking to reach the depths of the river. These authors affirm that the three analytical methods have common axes of characteristics. The differences in these characteristics are not in quality, but of degree and intensity. To explain this understanding, the authors compare the two analytical methods (content and discourse analysis) in six polarizations and locate text and discourse analysis in relation to each of them.

For Moraes and Galiuzzi, in a polarization between description and interpretation, while discourse analysis primarily aims to conduct a critical interpretation of discourse based on a “strong theory” that is assumed *a priori*, content analysis seeks first to describe what a text expresses to later interpret it in a movement that moves from description to abstraction and theorizing about what is being analyzed in a given textual corpus. For these authors, textual discourse analysis is closer to content analysis in this polarization because it values description and interpretation and aims at the “reconstruction of meanings from the perspectives of a variety of subjects involved in the research.” (Moraes; Galiuzzi, 2007, p. 145).

Regarding the polarization between understanding and criticism, Moraes and Galiuzzi (*idem*) locate content analysis in the first category and discourse analysis in the second and consider textual discourse analysis to be closer to content analysis because it intends to build and rebuild social and cultural understandings related to the phenomena being investigated (hermeneutic meaning).

According to these authors, in terms of the polarization of the type of reading to be done on a particular text or discourse, content analysis always begins by what is manifest or explicit and then gradually seeks what is implied. Discourse analysis focuses on what is implicit, which is the object of its interpretation and critique. For the authors, textual discourse analysis begins with the construction of understanding in the most immediate sense of the phenomenon, but advances to produce more in-depth and complex meanings.

Regarding the polarization between internal perspective and external perspective in the examination of phenomena, Moraes and Galiuzzi (2007) place

content analysis among phenomenological, hermeneutic and ethnomethodological approaches and discourse analysis among historical materialism and in the Marxist dialectic. They understand that textual discourse analysis has obvious connections with phenomenology and ethnography.

In terms of how to deal with the whole and its parts, Moraes and Galiazzi (2007) assert that both analytical methods use categorization, which is a form of fragmentation, that is, it is a way to focus on parts of the whole. They explain that at first content analysis suffered from an excessive fragmentation of its *corpus* since categorization is a procedure typical to it, but over time it has made a movement to some forms of analysis in which “the categories constructed in the process interpenetrate themselves. To categorize, rather than focus exclusively on the parts of a system, comes to signify and emphasize a part as a way to improve the understanding of the whole.” (*idem*, p. 155). On the other hand, they understand that discourse analysis “advances significantly towards overcoming the limitations of fragmentation and reductionism.” (*idem*, p. 154). Meanwhile, textual discourse analysis is inserted in an intermediate space between content analysis and discourse analysis on the issue of overcoming the fragmentation of phenomena and tries to capture them in their entirety. It is worth mentioning that the whole is perceived in textual discourse analysis as “collectively constructed and reconstructed discourses.” (*idem*, p. 156).

The last polarization the authors present relates to the use of emerging theories or *a priori* theories. By beginning from a perspective outside discourse analysis, they organize themselves based on marked and strong theories chosen *a priori* to examine the realities under investigation. Nevertheless, content analysis can use these two types of theories, but it has become increasingly common to build theories based on the data. The same is true with textual discourse analysis which, because of its hermeneutic perspective, works with emerging theories. (*idem*).

METHODOLOGICAL PATH

This study was conducted at a chemistry teacher accreditation program in three stages.

In the first step, in August 2010, a questionnaire was randomly given to students (identified as En) in various classrooms, so that the respondents were distributed among different academic semesters, from the first to last years in the program. The number of respondents represented just over 50% of those enrolled in that semester. Despite the observation of some quantitative data, the main purpose of the questionnaires was to qualitatively identify whether student responses revealed some kind of similar unit of signification related to how they perceived (or not) stimulation from educators to achieve the educational objectives of the program.

Once this was identified, in the following year the final two stages took place. They consisted in interviews with six students in their final year, (identified as Ln), and then six students from different years, (identified as EGn).

FIRST DATA: WHAT EMERGES FROM THE QUESTIONNAIRES

One of the survey questions sought to understand if the students felt encouraged by professors to become teachers. Twenty-three students (32.4%) answered affirmatively; 35 students (49.3%) said that they were partially encouraged; 12 students (16.9%) responded that they were not encouraged to become teachers and one student (1.4%) did not answer the question.

The reasons given by those who said they were encouraged by educators to become teachers were generally related to stimulus received from subjective impressions and values that their professors made explicit, such as experience in the classroom; the importance of educators; a taste for and satisfaction with the profession; the reality of teaching in Brazil and a desire for changes; or even from implicit subjective impressions that students preparing to be teachers perceive such as the example of their professors, their professionalism.

The responses provided by nine of the students who said they were partially encouraged to become teachers demonstrate a perception that professors and/or the course encourage the students to also pursue other careers and not only that of teachers of basic education. The following transcripts express some examples:

They (professors) make it clear that we can work in other fields, this ends up making us forget a little about teacher accreditation. (E23).

The incentive is partial because while you have the professor's incentive to become a teacher, the course itself encourages us towards a bachelor's degree. (E51).

Some encourage, but many believe they are educating chemists and not teachers. (E59).

We categorized the various justifications in which this unit of meaning was identified as a *bachelor's degree deviation in teacher training*.

Eight other students explained the partial incentive emphasizing that the incentive happens mostly in the classes in chemistry teacher education than in other courses of specific knowledge. Some of these responses are presented below:

The professors from the the hard sciences do not motivate us as much as those from the field of education. (E26).

Professors of "chemistry" do not even remember that it is a teacher accreditation course. Some "education" professors take the course title more seriously. (E69, student quotes).

The incentive is stronger in the education classes. (E71).

It is understood that the various manifestations of this kind carry a similar unit of signification and, therefore, they were categorized as *incentive from the pedagogical field*.

Another nine other students affirmed that the incentive is partial because they have the perception that there is no coherence between the discourse and practice of some professors. The following statements illustrate this unit of meaning that is understood to constitute another category, which was called a *discourse-action dichotomy of educators*.

I think it could be improved a lot, despite the professors' "warning" us that it is a teacher accreditation course. (E3, our quotes).

The course has professors who teach different things about being a professor. A lot of content and very little didactics. (E17).

Some behaviors of the professional educators I would not adopt as a teacher. (E70).

Among the 12 students who said they do not feel encouraged by the professors, three did not justify this statement and another nine justified their answers in some way, as illustrated below.

Their pedagogical practices are not consistent with their discourses. (E53).

The professors of education who are not from the field of chemistry are not committed to the course and those from chemistry encourage a research career. (E45).

They did not encourage me nor "discourage" me, they just recall (occasionally) that this is a teacher accreditation course. (E36, student quotes).

It is noted that the justification given by student E45 can also be categorized as a *bachelor's degree deviation in teacher training*. As for the justification of E36, it is understood that it does not fit into any of the categories identified. It is inferred that E53's justification fits into the category of a *discourse-action dichotomy of professors* demonstrating that both students who say they were partially encouraged towards the teaching career, as well as those who say they were not encouraged to follow it have the same perception of the professors.

Once the similar units of signification in the questionnaires and the emergence of the categories of analysis were identified, we moved on to the second stage of the investigation.

STUDENTS' PERCEPTIONS

In the analysis of interviews with six students in the final year of the teacher accreditation program we found perceptions about the course and the work of professors that corresponded to the three categories already identified among the responses to the questionnaires.

L1, in his interview, commenting on the incentive/motivation to become a teacher of basic education, said that education and chemistry education courses are mainly the ones that emphasize entrance into basic education, because they raise and discuss the problems and characteristics of chemistry education in basic education. This passage from the discourse of L1 refers to the category *incentive from the pedagogical field*. He also affirmed that in the classes in specific fields of knowledge, the focus is on the chemistry content and the professors are not concerned about turning it into content to be applied or used in basic education and this is left to the students themselves, to articulate what is discussed in the classes in education and chemistry education, to apply what they learn in other classes in school settings. It is understood that the *bachelor's degree deviation in teacher education* is clearly explained in this perception of L1.

Asked if the accreditation course encouraged her to become a teacher of basic education, L2 claimed that she realized that the chemistry education and education disciplines were much more focused than the chemistry courses on preparing basic education teachers. She emphasized that the professors prepared them for emotional aspects, performance and confidence in the classroom along with the specific contents, because in these classes, the activities and seminars presented worked with these aspects related to feelings and attitudes and also the explanation of the contents. In the discourse of this student the *incentive from the pedagogical field* category can be identified. As for the classes in the chemistry course, L2 claimed that they “prepare more for a master’s degree, for further study, than actually for secondary education [...] they do not allow, they are not really focused on secondary level (teaching)” (L2). In this excerpt from her discourse we perceive the *bachelor's degree deviation in teacher training* category. This student affirmed, however, that she was not saying that she considered this approach from the professors who teach specific content from the curriculum to be inappropriate since she thinks it is interesting for those who want to pursue advanced studies, like herself. It should be noted from this statement of the student that she had already assumed an identity profile as chemist/researcher.

L3 pointed out that he noted a certain discontent on the part of the professors of the specific areas when a student said that he or she would pursue a teaching career and, in the same way, when a student would tell a professor from the educational field that he or she would pursue a career in the specific scientific field. L3 claimed that the professors most linked to a specific field of science refuse to understand education theorists and that there is a lack of dialogue among the professors, which compromises the course. He stated that some professors say that the course is a bachelor’s degree course disguised as a teacher accreditation course and this affects the practice in some specific chemistry classes. It is understood that this student’s perception is in the category *bachelor's degree deviation in teacher training*.

L3 claimed that in the curriculum practiced the educational disciplines encourage the students to become teachers (*incentive from the pedagogical field*) and the chemistry disciplines, at times, do so as well, but he said that what provides the most stimulous is the teaching practice itself, when you are lucky to find a group of students that is open to learning.

Evaluating the practiced curriculum in relation to the prescribed curriculum, L4 said professors of chemistry disciplines go far beyond the syllabus and “give more of a performance” (L4). He complained about the disciplines of education, particularly of didactics and educational psychology that, in his opinion, offered less of what is on the syllabus, which forced him to learn on his own. As for the chemistry education disciplines he said he noticed the effort and dedication of the professors to follow the syllabus, but said they did not go beyond it. It is noticed in L4’s discourse that he values more the professors who teach the chemistry content and identifies with them, which reinforces the existence of the *bachelor’s degree deviation in teacher training* category.

L5 said that none of the chemistry classes encourage students to become teachers of basic education and that didactic transposition is never studied in these classes. However, he said that the education classes all encourage, for example, didactics and educational psychology, but that the chemistry education courses are those that more directly encourage the students to teach. The discourse of this student points out two categories: at first he confirms the *bachelor’s degree deviation in teacher training* and at the end he talks about the *incentive from the pedagogical field*.

Asked if the course professors encourage students to become teachers, L6 said that besides the fact that some professors do not understand the purpose of the course, there are still some who maintain the posture observed in the hard sciences courses that the teacher is there solely to deliver the content and that the learning depends on the student’s own effort. This student understands that these professors still do not understand that professors have to mediate the teaching-learning process.

As for chemistry education professors, L6 said many strongly encouraged her teaching career and she even got involved in their projects and knows what they are working on. She said she sees as positive aspects of the course the quality of the chemistry education professors and the closeness that professors and students generally have on the School Council, where they all help each other.

L6 shows a concern for the disunity among students due to the influence of the separation of professors in the fields of chemistry and chemistry education, just as L3 had already pointed out.

In fact, this concern that appeared in the discourses of these students is related to Woodward’s understanding (2009) that identities are relational, produced by the marking of difference. For Woodward, identity is not the opposite of difference, but depends on it, and both are established symbolically and socially, at least in part, through classificatory systems that, by organizing and establishing order produce meanings, distinguish what is from what is not, that is, they produce binary oppositions in a given group or in culture.

We identified in the concerns of L6 and L3 the tacit perception of the existence of a binary opposition within the course, which separates both professors and students according to their fields of interest. We agree with Woodward’s argument (*idem*, p. 50) that “the relationship between the two terms of a binary opposition involves a necessary imbalance of power between them.”. In fact, in Brazil, *to be a chemist is not to be a chemistry teacher in basic education*, and that makes all the differ-

ence in the representation that the latter identity has in the public image: low wages, hard work, the effort to keep children and youth in school who do not know why they are there, because they have no dreams or fantasies, they are passing through, wasting their lives with no prospects for a change. Thus, we note that the educators try to overvalue the chemical components of the course because the chemistry career is considered to have higher social status, forgetting that they entered the university to work as professors in an undergraduate teacher accreditation course and, although they also work as researchers in chemistry, they should not devalue the accreditation of chemistry teachers in basic education.

After identifying these categories emerging in the discourse of the undergraduate students interviewed, we conducted interviews with graduates.

THE PERCEPTION OF GRADUATES

As for the interviews with six graduates, it was possible to identify a single emerging category in their discourses: the *bachelor's degree deviation in teacher education* promoted by the curriculum practiced in the course.

For example, EG1, when evaluating the course, described its curriculum as technical, which prepared for research in chemistry, and that practical classes were restricted to the application of the technique for the sake of the technique itself and that they did not make much sense to him. On the other hand, he said that the pedagogical discussions were more about concepts and did not meet his needs as a teacher.

EG2, with regard to the specific chemistry subjects, clearly stated that the profile of the course graduate is a bachelor. In assessing the pedagogical aspects of the curriculum he said there were few professors from the field of chemistry education when he took the course, and for this reason many different classes were taught by the same professors who, although they were good, always presented the same points of views and experiences. He also pointed out, as did EG1, that the education classes had a very theoretical approach and failed to explain their application in practice, so that when he reached the supervised teaching internship he did know how to put into practice the theories he had studied.

In her account of the course curriculum, EG3 said that the classes with educational content should be modified in the course practice, because "there are schools that are completely different, classrooms, students, and there are many variables that affect daily school routines, things change and teachers must have some preparation to be able to meet the perspective of the student who is in the classroom." (EG3). She also said that, during the course she believed that the teaching components of the course were good, but today, after having her own experience as a teacher, she thinks it was not adequate because they did not meet the professional needs of the teacher, corroborating perceptions of EG1 and EG2.

EG4 considered that his training was more for a bachelor's degree than teacher accreditation, confirming the discourses of EG1 and EG2.

EG5 claimed that the impression she had of the curriculum was that it was for a bachelor's degree course with some classes to support teacher accreditation,

because specific knowledge about chemistry was prioritized, reinforcing what the other graduates said. She also affirmed that she did not see much interaction between the disciplines of chemistry and education, since the experiments that were conducted in the laboratories and the lectures were not aimed at teaching. She said professors never bothered to tell students how they should approach a certain content when teaching in a high school setting. As for the educational area, she said it had much to be desired, since there were no practices focused on basic education and theoretical and practical classes were not related, once again confirming the perceptions of her fellow graduates. She reported, however, that one of the few elective courses sought to present experiments that could be adapted to classrooms, and was helpful during her supervised teacher internship.

In EG6's interview, similar complaints about the curriculum were noted. He said that he particularly had problems with the educational components of the course because he realized that certain subjects such as didactics did not meet what was in the syllabus, and much less the expectations he had for his teacher education.

It is worth noting that respondents who spontaneously volunteered to participate in the research, were mostly graduates who coincidentally had attended the course prior to 2004, when the last reformulations in the prescribed curriculum were made and this may be why only the *bachelor's degree deviation in teacher training* perspective of the course appeared in their discourses. This view is associated to the undergraduate programs known as 3+1 that originated in the 1930s when the first teacher accreditation courses were implemented in Brazil. In these courses, the classes in specific fields of knowledge were taught for three years and they were juxtaposed with the pedagogical disciplines that were completed in one year. The educational concept embedded in this model, which was called "technical rationality", presupposed that teachers are technicians who should apply in their practice the rules derived from both scientific knowledge and pedagogical knowledge. In other words, theoretical training in specific knowledge was emphasized at the expense of teaching practice, which was treated only as a space for the application of theory (Pereira, 1999).

It is observed that the curricula in some teacher accreditation courses still have remnants of this model, despite efforts to modify them through spontaneous reformulations or those induced by norms from the Ministry of Education and Culture to comply with national laws. These remnants are found not only in the prescribed curriculum but mainly in the active curriculum. This fact is explained by considering the historical perspective mentioned by Goodson (2007, 2008) that curriculum development and practice are processes by which tradition is invented and are the result of a struggle to establish the belief that a particular type of school or course is "good", according to sociopolitical priorities and intellectual discourses.

IDENTITIES CONSTITUTED BY THE ACTIVE CURRICULUM OF THE COURSE

We identified three similar units of signification in the discourses of undergraduates and graduates. These units of signification that emerged were used as analytical categories, namely: *bachelor's degree deviation in teacher training*; *incentive from the pedagogical field*; and a *dichotomy in discourse-action of professors*. These categories correspond to the perceptions that students have of the curriculum that is practiced in the program, that is, the active curriculum, institutionalized based on the prescribed curriculum, which determines two different identities of undergraduate students and graduates.

When students enter the course they become participants in this active curriculum to the degree that they are encouraged by the discourses and practices of educators and senior students and identify and assume one of the two identities found in the course: bachelor's degree candidate/researcher in chemistry and teacher of basic education/researcher in chemistry education.

This binary opposition between two distinct identities, soon perceived by the incoming students, makes a difference in the education of future professionals. Some, according to their subjectivities (biographic identities/for the /individual I) quickly assume one or the other of these collective identities (relational /objective/ for the other). Other students realize that there is a *dichotomy in the discourse-action of professors* and will take longer to assume one of the two socio-cultural identities in the course, or will avoid them because they were not enthusiastic about any of these identities.

According to the statements of many undergraduate students and graduates, we noted a preponderance of the *bachelor's degree deviation in teacher training* character of the teacher accreditation program studied, which induces education and professionalization to prepare students to conduct research in the field of chemistry, deviating from the proposal to prepare students to teach chemistry at the basic education level.

This finding is in keeping with the work of Kasseboehmer and Ferreira (2008) who realized that chemists (who had bachelor's degrees in chemistry) when working in undergraduate programs, seek to educate more chemists and lose sight of the objectives and the specific need to educate teachers. Dutra and Terrazan (2008) reached a similar conclusion after analyzing curricular configurations of teacher accreditation courses. They found that the professional profiles that appeared in pedagogical projects contributed to the formation of the identity of a teacher, but acknowledged that there are limitations to the formation of a professional identity that distinguishes the teacher of basic education from the recipient of a bachelor's degree who is active in that field of knowledge.

FINAL CONSIDERATIONS

Research has shown that the curricular practice in the school analyzed still has remnants of the historic tradition of teacher accreditation programs (the 3+1

model). In this curricular practice, the subjectivity of educators, particularly those who teach the chemistry disciplines, over emphasize this field of knowledge and do not give due importance to pedagogy and the teaching of chemistry, reproducing the social devaluation of the teaching profession. This culture underlying the course's active curriculum can contribute to a representation of the profession as an activity of secondary importance, which certainly reinforces the social image of teachers, and contributes to the low interest of undergraduates to accept an identity as a chemistry teacher.

The identity formation of the accredited chemistry teacher is the result of an ongoing struggle between different interests of social actors, as was evident in the data analysis, in which professors who teach chemistry courses emphasize a *bachelor's* identity that diverts the students from a teaching career, while professors of chemistry education emphasize the identity of teachers.

These findings cannot be generalized to other similar degree courses, but are associated with structural problems afflicting Brazilian basic education and teacher education. They represent an additional mechanism, one that is internal to the course, which can decrease the adhesion of undergraduate students to the teaching profession, establishing a local shortage of chemistry teachers. The study of chemistry teacher accreditation courses in different regions of Brazil would be interesting to reveal other factors that lead to the widespread shortage of teachers of this science in the country.

In this course in particular, discussions may be necessary among educators and students about why conditions unfavorable to the teaching profession in basic education still prevail. Undergraduate students must be aware that, unlike teaching in higher education, teachers in basic education are still socially represented as mere deliverers of content in class and not as independent professionals, who are creative, reflexive, constructors of knowledge and practice. It is necessary to strengthen within the course that the professional identities of teachers will be enhanced, as teachers of basic education battle for space in schools and strive to promote the idea that their activities constitute intellectual work similar to many others, that is of fundamental social importance and therefore should be recognized.

The data constructed in this study indicate that suggestions made by Canen and Moreira (2001) are pertinent to the development of curricula. These authors suggested that the constituent elements of the identities of teachers should be discussed as part of accreditation courses, and that personal reflections be conducted about their own identity and about how different aspects of identity influence their experiences and the ways of signifying them.

It is understood that the way that the curriculum prescribed in the school investigated, was organized after the 2004 reformulation, with 400 hours of supervised internship and 400 hours of teaching practice meets the educational needs of teachers in training, since these curriculum components, taught from the beginning of the course, are the privileged spaces for discussing the identities of basic education teachers, the aspects related to their professionalization and for fully developing chemistry education. What is missing in the course is a transformation in its active curriculum: professors/researchers from the various subfields of

chemistry need to change their practices, thinking and discourses so that the classes that they teach dialogue with the other subjects in the accreditation program to achieve the objectives proposed by the Pedagogical Project of the chemistry teacher accreditation program.

Several studies about the education of science and chemistry teachers (Galiazzi *et al.*, 2007; Rosa, 2004; Santos; Maldaner, 2010) have recommended the introduction of research as an educational principle in undergraduate programs to improve their curricula. We agree with the authors that the education of teachers is a continuous, ongoing process and that technical rationality can be overcome by the participation of these professionals in groups that conduct research and reflection and in learning communities, along with professors and undergraduate, masters and doctoral students. This would allow all participants to revise their theories and practices and make it possible to transform the curriculums in their respective educational settings.

The growth of research in the chemistry education field shows that there has been a great effort by chemistry educators in the country to improve the accreditation courses and resolve the shortage of teachers in the field but these efforts need to be supported by public actions that can make a profound change in the current social representation of the basic education teachers in Brazil. Changing this representation requires: that the salaries of these teachers be equivalent to the salaries of other careers that require higher education; a specific career plan and incentives to continuing education; the creation of decent working conditions, including exclusive dedication to a single school, with time given in the workload for study and reflection on their practice, and to planning and development activities as well as evaluations and learning assessments; fewer hours in the classroom and fewer students per class; and safe, organized, and comfortable school environments, in short, a place where faculty, staff and students are happy and where they can develop their full potential.

We also conclude that the results show the central role of the chemistry education professors in achieving the educational objectives of the Chemistry Teacher Accreditation Course. It is understood that the increase in the number of these educators is critical to the development of teaching, research and extension in these accreditation courses, since they are the professionals most qualified to reveal the identities of teaching professionals, demonstrating to the students that it is possible to bridge the gap between knowledge of chemistry and knowledge of pedagogy.

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