pro-posições
e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

ARTIGOS

# The social destination of chemistry teacher education and other graduates: a case study on the pre-service teacher education at the micro-sociological level[1]

## *O destino social de licenciandos e bacharéis em Química: um estudo de caso sobre a formação de professores no plano microssociológico*[2] [3]

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**Abstract:**
The "social reproduction", posited by Bourdieu in the 1960s showed that low income class had access to less prestigious opportunities in the school system. Since then, in Brazil, the system has undergone a major qualitative and quantitative expansion that generated hierarchies, according to social classes, even between forms of the same course degree. In this paper we present a case that diverge from this tradition: a Chemistry undergraduate degree offered in the modalities of teacher and professional education. From quantitative, qualitative and longitudinal data we observed that undergraduate teacher education students come from lower social classes, but conclude the course with the same opportunities for professional and academic integration that professional education, altering its likely social destination.
**Keywords:** higher education, sociology of education, Pierre Bourdieu, teacher education

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pro-posições
e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

**Resumo:**
A "teoria da reprodução", enunciada por Bourdieu na década de 1960, sustentava que as classes menos favorecidas tinham acesso a oportunidades de menor prestígio no sistema escolar. No Brasil, desde então o sistema educacional sofreu uma grande ampliação qualitativa e quantitativa, gerando hierarquias de acordo com as classes sociais, inclusive entre modalidades de um mesmo curso de graduação. Neste trabalho, apresentaremos um caso que diverge dessa tradição no plano microssociológico em uma graduação em Química oferecida nas modalidades licenciatura e bacharelado. A partir de dados quantitativos, qualitativos e longitudinais, observamos que os licenciandos são originários de classes sociais menos favorecidas, mas concluem o curso com as mesmas oportunidades de inserção profissional e acadêmica que os bacharéis, de forma a alterar seu destino social mais provável.
**Palavras-chave:** ensino superior, sociologia da educação, Pierre Bourdieu, licenciatura

The studies of Pierre Bourdieu and Jean-Claude Passeron (2012, 2014) published in *The Inheritors: French Students and Their Relations to Culture,* in 1964, and *Reproduction in Education, Society and Culture,* in 1970, showed, based on statistical analysis, the differences of opportunities (or objective probability) to school access to young people from different social classes, finding that the less privileged ones had less access to social mobility through school. Thus, instead of producing justice and equality, as previously thought in the 1960s, school reproduced and legitimized social inequalities (Nogueira & Nogueira, 2002). In Brazil, the use of these works was characterized by a partial reading, focusing on the dichotomy "reproduction *vs* transformation", noticing the reproductive dimension of school (Catani, Catani, & Pereira, 2001) and associating the authors to the so-called "sociology of reproduction".

The pessimist scenario proposed by Bourdieu and Passeron on the French system, which repeated itself in other countries, has been altered through the years. After four decades of its publication, it is undeniable that the access to school and higher education has considerably increased. However, it is also clear that appeared other ways to continue the exclusion of the less privileged in the school system. Duru-Bellat (2006) points to the current

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

'diploma inflation' which led the school system to qualitative distinctions promoting a 'segregated democratization'. That is, the access to public or private higher education, in more or less prestigious courses, and even different modalities in the same course (professional or teaching) are options that carry differences regarding the probability of access, teaching quality, and opportunities in the job market.

The professional or bachelor's degree, for example, is in general more respected and valued than the teaching degree, directly associated to the teaching career which is less prestigious in Brazil. According to Dias-da-Silva and Muzzeti (2006), this distinction can be explained by analyzing the university field and the establishment of excellence levels, in which the bachelor degree assume the place of scientific authority. In fact, the creation of *cursos de licenciatura* (LIC- teaching degrees) becomes " a burden for scientists to consolidate their projects to form bachelors" and, often, is relegated to private universities (Dias-da-Silva & Muzzeti, 2006, p. 14). For the authors, LIC courses in public universities would be "appendixes" in to the *cursos de bacharelado* (BAC- bachelor courses) and "less noble" or "less legitimate" tasks, therefore, "relegated to professors in the area of education, considered as having less political and social capital" (p. 16).

The lack of social and academic prestige of LICs contributed to its higher number of dropouts when compared to the BACs in the same areas. In Chemistry, there is a national estimate of 30% dropout rate in BACs against 70% in LICs (Zucco, 2007). Contrary to these tendencies, in this work we argue that the LIC in Chemistry from the *Instituto de Química* (IQ- Chemistry Institute) of *Univesidade Estadual Paulista* (Unesp) held in the city of Araraquara is a counterexample of the most probable social destinations of its graduates. Though the "reproduction theory" is broad and refers to the "system of relations between the education system and the structure of relations among classes" (Bourdieu & Passeron, 2014, p. 16), in the micro sociological sphere, Nogueira and Nogueira (2002) highlight that " there are significant differences in the way each school and/or teacher participate in this process of social reproduction" and that they " were, in a great measure, neglected by Bourdieu" (p. 34). Thus, from that perspective, we establish a problematizing relation with the "reproduction theory" to analyze the change identified in this specific LIC.

Our research started from the extremely low dropout rates in LIC, less than those of BAC: 15% *vs* 25%. We will build our argument first presenting the conditions of the

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

undergraduate course from the history of its creation and its main characteristics; after, we will show that the students o LIC have a less privileged socioeconomic profile than those from BAC. However, this series of factors, in fact, gives teaching graduates the possibility of a formation in Chemistry equivalent to the bachelor one and an added formation in humanities, which allow them to change what would be their most probable destination: a less prestigious and legitimated professional path than the bachelor one. We will also discuss the implication of this scenario in teachers' training.

## Data collection and analysis

Following the methodological procedures of a case study, our work is based on data from different sources. According to Yin (1989, p. 20), " the power of the single case study is the ability to deal with a complete variety of evidences- documents, artifacts, interviews, and observations". To reconstruct the history of the institution and determine the characteristics of the course and its research and outreach activities, we held long interviews with the faculty, staff members, and undergraduate students. In this work, we focused on semi directive interviews held with eight professors who participated in the beginning of the course, six professors who are currently active in the institution, and a very staff member from the Academic Technical Director. We also used interviews held with other professors in the course from the *Centro de Documentação e Memória da Unesp* (UNESP Documentation and Memory Center). Many of those professors worked as heads of departments, coordinators and co-coordinators of the course, directors, and vice-director. To analyze the students' profiles, we used the data on the socioeconomic profile of undergraduate students at BAC and LIC from 2004 to 2010 collected by *Fundação Vunesp*, responsible for Unesp's admission exams.

We also analyzed data from the graduate school admission process and from the *Inventário Profissional da Associação dos Ex-Alunos do IQ* (Professional Registry from the IQ Alumni Association). The detailing on the analytical treatment of these instruments is presented in the sections of this text, when we interpret each result. This series of information was also confirmed by long interviews with 27 students of LIC in Chemistry which will not be detailed here but are a key part of our broader research (Massi, 2013).

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

These data were analyzed under the theoretical perspective of Sociology of Education, considering the contributions of Pierre Bourdieu with the classical concepts of habitus, field, and social, economic, symbolic, and economic capitals, and the review of the concept of habitus developed by Bernard Lahire related to the notion of disposition. To Lahire (2004) a disposition, identified through interpretative work, points to the principles that generate and organize the social practices (observed from behaviors, action, opinions, etc.). The dispositions constitute the habitus when they are presented as a coherent set associated to a social class, as stated by Bourdieu. However, to Lahire (2012), not all social contexts imply the existence of habitus and the identification of dispositions is more frequent. In our research context, the notion of institutional dispositions seems more adequate than habitus, though this term is adopted by the international literature (Reay, David, & Ball, 2001; Thomas, 2002). Besides this, dispositions were proposed by Lahire to analyze individual trajectory; therefore, were used in the context with an approximate or analogous use of the concept.

To organize our analysis on the history of the institution, we used some concepts of René Kaës (1997) on the development of groups and institutions, establishing three phases: initial and origins (1961-1973); institutionalization (1974-1990); maturity (1991 until now). Kaës also highlights the presence of "intermediates" in all developmental phases of the institutions; they are responsible for the adequation of the problems to the possibilities of the group and by its overcome, reconciling the elements in conflict. There were many challenges when creating the course and, for each of them, we identified the possible intermediaries in the institution. We believe that they are more directly related to the institutional dispositions, revealing values and believes, and promoting practices among institutional agents, selected withing a set of possible solutions.

## History and characteristics of the teaching degree in Chemistry

The Chemistry undergraduate course in the modalities BAC and LIC was created in the city of Araraquara in 1961, initially in the Department of Chemistry of the School of Philosophy, Sciences, and Letters from the former *Institutos Isolados de Ensino Superior*, becoming the *Instituto de Quimica* (IQ- Chemistry Institute) in the then recently created UNESP, in 1977. In another work (Massi, 2013), we detailed all the developmental phases of the institution, highlighting its

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

institutional dispositions. In this text, we focus and detail the situation of LIC to better interpret the data on alumni trajectories.

The founders' initial objective was to train Chemistry teachers arguing that there was a great demand for these professionals, especially in the countryside of São Paulo. It is important to note that, despite this formative proposal, the professors hired to work in the course had research experience in the industry and foreign universities, with no direct relation to K12 education. Thus, despite this objective, we observed through the history of the institute, a series of events that contributed to transform it into a reference in the research field, far from its role as a place for teacher training, as for more than 10 years it did not offer the modality LIC.

The relation with LIC changes depending on the interests of the institution and the external demands and regulations. According to information given by IQ Undergraduate section, the course was offered together with BAC from 1961 until 1975. However, the emergence of the Resolution nº 30/74 from the Federal Council of Education, determining the offering of a LIC in Sciences with a Chemistry habilitation, ended with the possibility to offer a LIC in Chemistry. However, BAC was kept as the only course in the institution since 1978.

By federal determination, IQ needed to implement a short LIC in Sciences, nevertheless, this course went against the institutional values which valued a deep and content-based scientific formation, even in teachers' training. Thus, even though the demand for conversion was accepted, the offering of LIC in Science was abandoned as this solution was not institutionally satisfactory.

This instability (activation and deactivation of the LIC course in Sciences[4] shows an ambiguity experienced by the institution that noticed a loss due to the lack of LIC but was not satisfied by the solution proposed by the Rectory. Maybe this ambiguity relates to the debt of the institution towards the training of Chemistry teachers as this was one of the key justifications to create the course.

In its third developmental phase (Massi, 2013), with the rescission of Resolution nº 30/1974 in 1991, the institution accepted to have an undergraduate LIC in Chemistry offered

[4] According to a staff-member who worked for many years in the Academic Technical Directory, even in its coordination, IQ was interested in offering the LIC and the solution found by the Rectory was to reactivate the offering of LIC in Science, with a specific formation in Chemistry. From 1986, (Res. Unesp 17/86), bachelors could ask, using their previous credits, a diploma of teaching graduate in Sciences with formation in Chemistry. However, this alternative was also finished in 1990.

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

during the night with a separate admission process from the BAC. This way, the LIC would not hinder the development of the institution, bringing, on the contrary, extra gains when answering to a mainly external demand to offer night classes. Professor E also highlights the creation of this modality considering the regional demands for professionals in the area: "*the teaching degree absorbed well the repressed regional demand to train teachers that worked during the day and wanted to do Chemistry but had nowhere to do it, as it was the first night course in the region in the Chemistry area*".

This profile was typical of the first classes but changed later, as noted by Professor C. According to some testimonies, there was an idea to create a *Bacharelado em Química Tecnológica* (BQT- Bachelor in Technologic Chemistry) at night, but this has not taken place. Apparently, the justification was the lack of workers and laboratory infrastructure, as well as the large number of credits for BAC. However, professors said that the real problem was the lack of faculty interested on working the night shift. On the other hand, the LIC could count with a small number of dedicated professors, according to Professor J.

Faced by this difficulties and a history of strong tradition in Chemistry research in IQ, which has guaranteed a legitimate space in the scientific field, the LIC curriculum created in 1991 allows graduates to work in the industry, as the *Conselho Regional de Química* (CRQ-Chemistry Regional Council) grants them the same attributions to those graduated in BAC. Several professors pointed this as one of the reasons why the teaching graduates work in different fields after graduation.

In the present phase of the institution, the great development in Chemistry research and outreach projects also contribute to the professional guidance of teaching graduates, which does not mainly target high school teaching. Despite the many curricular changes experienced in its history, the LIC keeps its essential characteristics: it takes place at night time, has a separate admission process from BAC (thus the student has to do another admission exam if wanting a double habilitation), and receives the same attributions as BAC in CRQ (allowing them to work in industries).

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

## Research and outreach activities

During the developmental phases of the institution, we could observe the presence of intermediaries that allowed the overcoming of challenges, among which one of the strongest and most updated was the research. Since the first phase, a distinction of the Chemistry course was the demand to present a monograph to finish the course of BAC and LIC. This measure, besides improving learning, incentivized research development in the Chemistry Department. Initially, there were no adequate laboratories for students to develop experimental researchers.

A possible solution to create the monographies would be the development of research in Chemistry Teaching, as it was predicted by the regulations. However, we did not find registries or testimonies pointing to those type of researchers. Thanks to the collection *Chemical abstracts* in the library, students opted to do bibliographic surveys. Later, the monographies in Chemistry had a more experimental character, within its possibilities.

Thus, in the first phase *research in Chemistry* was the intermediary found by the institution to mark its quality and distinction of professional formation. Even if incipient, it seems to have set the conditions for the course to offer a quality formation that guaranteed competitiveness in the field. The strong connection to Chemistry research seems to be an important institutional disposition that was updated in the other phases, also directly connected to the institutionalization of IQ. The first graduate school in the institution was created only one year after its foundation, thus one of the oldest in Unesp. Currently, it guarantees institutional recognition in the Brazilian and the international field of Chemistry. This strong research presence in the institution allows the participation in projects of undergraduate research with scholarships from the university and funding agencies to all interested students and, often, since their first year. In some cases, the student start in a research project since the beginning of their undergraduate and continue in the same lab until their PhD.

If the research in Chemistry established itself as a constant intermediary throughout the history of IQ, outreach was only fully developed in the maturity phase of the institution, in which it could answer external demands and review issues that were previously "avoided" (Kaës, 1997). In this case, there was a demand by the Rectory, and later by the IQ direction, to develop outreach projects, as it was one of the strong points of Unesp compared to other universities in the state with better research conditions. Besides, investing in outreach, IQ could face one of the problems faced by the institution since the creation of the course: the little integration with

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

the city of Araraquara, as it was created by political motivation and mainly attended a population from outside the city. Finally, professors pointed outreach as a promotion strategy to increase the candidate/place ratio of the course and allow a better selection of incoming students.

Despite this justification, the development of outreach in IQ was considered complex, as it was an academic unit focused mainly on Chemistry research. In the beginning of the 1990s, they created new outreach projects which, together to the existing ones, added to more than 10 great projects that continue until today.

Among the outreach actions promoted by the institution, we can identify the fulfillment of different "functions" to attend faculty and institutional needs. First, we highlight the projects that directly connect the service of the external community to the institution and promotion of IQ, having as an indirect result the recruitment of "future scientists" interested in Chemistry: the *Curso Unificado do Campus de Araraquara* (Cuca – preparatory course for the admission exam); the *Palestras nas Escolas* (Lectures in Schools); besides specific projects within other projects, as *Um dia na Universidade* (A Day at the University) promoted by PET (*Programa Especial de Treinamento do Ministério da Ciência e Tecnologia*-Special Training Program by the Ministry of Science and Technology ).

Other projects seemed to have risen in the perspective of support to undergraduate Chemistry teaching and indirectly contribute to promote Chemistry in the community external to IQ, as the *Programa de Ensino* and the *Páginas de Química Geral*. Aiming a broader and more complete formation of undergraduates, we find projects targeting the formation of industry professionals, through experiences in the laboratories, as the in *Centro de Monitoramento e Pesquisa e Ensaio da Qualidade de Combustíveis, Biocombustíveis, Petróleo e Derivados* and the *Laboratório de Solos*; focused on a business perspective, such as *Química Júnior Projetos e Consultoria*; targeting teacher training, as the *Centro de Ciências de Araraquara*; or yet those targeting a more diversified cultural formation that, according to students' testimonies, are a " way to relieve stress" from the intense dedication to the studies demanded by the undergraduate course, such as the *Grupo de Teatro Alquimia* and *Grupo PET*.

Besides the undergraduate credits, the participation of teaching undergrads in Chemistry research and outreach projects seem to have a key role in students' formation, through the direct involvement in the activities and the formation in the classroom, allowing an actual articulation

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

among the actions of teaching-research-outreach (Massi & Villani, 2015). These new formation moments and contexts also establish themselves as opportunities of (re)socialization.

## Students' profiles

A detailed and careful study of these results was published in Massi & Villani (2014). We present here only the results that are directly related to our research questions.

We analyzed the answers given to the socioeconomic questionnaire of Vunesp referring to the time between 2004 and 2010, 2,098 candidates and 194 enrolled in the LIC in Chemistry, which annually offers 30 places, and 5, 822 candidates and 355 enrolled in the BAC in Chemistry, that annually offers 50 places. We selected for analysis 14 questions directly related to our research: marital status, gender, occupation, origin, age, father's and mother's educational level, father's and mother's occupation, family monthly income, foreign language, type of elementary and high school, participation in preparatory course.

To evaluate if there is an association between the groups (bachelor and teaching degree students), we used the Chi-square test with the help of Microsoft Excel. In all tests we considered the level of significance of 5%. Only the variables "marital statues" and "gender" did not have significant differences, that is, they are not different in the profile of both types of students, while all other questions present associations between variables and groups. We sum up those data on table 1.

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

**Table 1 – Questions and percentage average of the answers of candidates and enrolled students in BAC and LIC in Chemistry**

| Questions | Answers | BAC | | LIC | |
|---|---|---|---|---|---|
| | | Enr % | Can % | Enr % | Can % |
| Occupation | Does not work | 92.4 | 83.4 | 70.2 | 62.0 |
| | Works part or full-time | 3.7 | 11.9 | 23.4 | 32.0 |
| Origin | Countryside of São Paulo | 74.4 | 72.5 | 92.0 | 82.5 |
| | Metropolitan area of São Paulo | 19.2 | 20.3 | 4.4 | 12.2 |
| Age | 18 years old or less | 62.9 | 67.0 | 34.2 | 59.2 |
| | 19 or 20 years old | 27.6 | 22.5 | 33.8 | 17.9 |
| | 21 years old or more | 7.1 | 8.7 | 31.5 | 21.5 |
| Father's educational level | Elementary education (complete or incomplete) | 18.6 | 28.1 | 41.3 | 51.9 |
| | High school or higher education | 78.7 | 68.9 | 56.9 | 43.6 |
| Mother's educational level | Elementary education (complete or incomplete) | 16.4 | 27.2 | 38.2 | 51.4 |
| | High school or higher education | 82.8 | 71.1 | 59.9 | 44.5 |
| Mother's occupation | Does not work | 33.5 | 36.6 | 42.2 | 45.5 |
| | Unqualified work | 5.1 | 11.5 | 18.7 | 25.2 |
| | Liberal professional, teacher, or technician | 49.0 | 35.7 | 29.4 | 20.8 |
| Father's occupation | Does not work | 4.5 | 5.5 | 2.7 | 8.2 |
| | Unqualified work | 8.5 | 18.5 | 28.9 | 41.6 |
| | Liberal professional, teacher, or technician | 51.8 | 43.2 | 46.3 | 30.1 |
| Family monthly income | Less than 1.9 minimum wages | 1.7 | 8.9 | 8.0 | 19.1 |
| | 2 to 4.9 minimum wages | 24.2 | 34.4 | 45.8 | 52.9 |
| | 5 to 9.9 minimum wages | 36.0 | 30.0 | 31.1 | 19.8 |
| | More than 10 minimum wages | 37.2 | 25.1 | 14.1 | 6.9 |
| Type of elementary school | Public | 27.3 | 47.5 | 60.9 | 79.9 |
| | Private | 50.7 | 34.1 | 21.3 | 9.0 |
| Type of high school | Public | 14.4 | 38.7 | 44.0 | 74.0 |
| | Private | 79.4 | 52.8 | 45.8 | 17.6 |
| University preparatory school | Has not attended | 30.1 | 43.0 | 20.8 | 53.8 |
| | Attended for less than a year | 8.2 | 13.0 | 8.4 | 12.6 |
| | Attended for a year or more | 59.7 | 42.1 | 69.8 | 31.7 |

Enr: enrolled Can: candidate

Source: adapted from data of *Fundação Vunesp* (2004-2010).

Considering mainly the economic capital and the national context in this historic moment, with no intention to explore the broad and polemic discussion on national social stratification, we initially observed three social classes[5] in this set of data: the candidates of LIC

[5] We know that this classification can be discussed as it is based solely on income, ignoring a broad national sociological production on class stratification (for example the works from Jesse de Souza and Celi Scalon). A methodological rigor would demand using the Bourdieusian definition presented at the work *Distinction: A Social Critique of the Judgement of Taste* (Bourdieu, 2007), that each study of this type would demand "building an *objective*

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http://dx.doi.org/10.1590/1980-6248-2017-0089

have a profile characteristic of low-income classes; those enrolled in LIC (thus, who were admitted in the process) and candidates of BAC have a middle and low- middle class profiles; the students enrolled on BAC have elite characteristics.

Therefore, there is a clear class difference among the students of middle class that are enrolled in LIC and the elite students enrolled in BAC. The identification of these three groups points, on one hand, to the causality of the probable stated by Bourdieu (1998). The students of low-income classes do not even attempt the admission process for the BAC as they cannot see this career as a possibility for their social group. On the other hand, there is a closeness between the profile of BAC candidate and the enrolled in LIC, except in the variables "age" and "attendance to preparatory school". This suggests that the students initially tried the BAC and, faced by failure, did the preparatory course and tried the admission exam the next year for LIC, in which they were approved.

Students' testimonies confirm this statistical data: many candidates of LIC would prefer to do BAC but gave up when were not approved in the admission exam. Thus, 9 among the 27 students interviewed affirmed that they only did LIUC because the course had less candidates and added other justifications to this choice, as the fact that LIC had the same attributions to BAC in CRQ, or that the student had the daytime free for internships. Besides those, other 4 students said they choose LIC "by chance", due to a mistake when filling their inscription. This type of mistake is possibly associated to the fear of not being approved in the BAC, as we saw in different cases. According to Professor M, this is the new profile of teaching undergraduates: "*there was a majority that did not want to give classes, they did the teaching course because it was easier to be admitted, it was at night, among them few ones wanted to teach- three or four in a class of thirty. Some want to teach but at the university*".

*class*, as a set of agents situated in homogenous conditions of existence, imposing homogeneous conditioning and producing systems of homogenous dispositions, specific to engineer similar practices, beyond having a series of common properties" (p. 97). However, faced by the objective of discussion and the available data, we used as a reference the students' *per capita* income, which is used as a parameter by the *Secretaria de Assuntos Estratégicos* of the Federal Government to define social classes, in the period these data were collected, according to this scale: extremely poor, until R$81; poor, between R$81 and R$162; vulnerable, between R$162 and R$291; low middle class, between R$291 and R$441; middle middle class, between R$441 and R$641; high middle class, between R$641 and R$1,019; low high class, between R$1,091 and R$2,480; and high high class, from R$2,480. Thus, we classified the students' groups based in the question at Vunesp about family income and in another question, not presented in this work, about the number of people living with this income. The main answer in all groups was of 4 family members (45% of candidates and 52% enrolled at BAC; and 42% of candidates and enrolled at LIC).

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

Comparing only the enrolled students in both courses, we identified, with considerable differences, a higher number of LIC with 21 years old or more when compared to BAC (31.5% *vs.* 7%), whose fathers (41.3% *vs.* 18.6%) and mothers (38.2% *vs.* 16.4%) have elementary education (complete or incomplete) with unqualified jobs (28.9% *vs.* 8.5%); whose families have a monthly income of 2 to 4.9 minimum wages (45.8% *vs.* 24.2%); and who studied in public elementary school (60.9% *vs.* 27.3%) and high school (44% *vs.* 14.4%).

Despite a less privileged profile, we highlight that those enrolled in LIC are from the middle classes, even if from the lower strata. Therefore, 70% of students do not work, as they do not need to help with family income. Besides this, 92% are from the countryside of São Paulo, thus most move to the city of Araraquara to study. As the course is during the night, they have a great availability to participate in the extracurricular activities offered by the undergraduate course.

## Assembling the analyzed factors: students' profile and characteristics of the LIC

Assembling the teaching undergraduate and the characteristics of the course helps the participation of these students in research and outreach projects. Professors' testimonies highlighted the importance of outreach activities and their formation role. According to Professor G *" the outreach brings the Community to the university environment, it takes the researcher and the student to the reality of the community*", so that the graduates can leave "with their feet on the ground" marketwise. For the staff member N, most students are very involved with the projects, culminating in *"behavioral changes…, commitment, awareness, citizenship, ultimately, the importance of the university for society*". Professor M adds that the pedagogical subjects and the time teaching undergraduates have to study and do an internship allow a growth in communication and make them have "*an ability to think, argue, better than those in the bachelor….The bachelor stays 8 hours a day in the classroom, how can one think? How can you reason*?"

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

From the interviews of LIC students and some talks with those in BAC, it seems that the interest in research is higher among the LIC. For the bachelors the main goal is to work on industries and graduate school is seen as a possibility only when there are few job openings in the industry. Besides this, professors prefer LIC students because they have more time dedicate to the research in the Chemistry labs, as highlighted by Professor C: *the BAC students who worked with me in research got very angry, because they would say they were been harmed by those in teaching because the professors would prefer the later to develop research, because they have availability of time.*

In some interviews, we noticed that the outreach projects seemed to compensate some academic formation shortcomings, as the low articulation of LIC with teacher training, in a context that strongly values and invests in research (Massi & Villani, 2015). In this sense, some projects contradicted the general institutional tendency of training the teaching undergrad to research and industry, offering a direct contact with teaching and allowing a more positive perspective on this activity.

This perception is confirmed in the interviews with students. According to Professor C, "it was a dream, when the teaching course was created, as it would train teachers, but who ended up serving this purpose was more Cuca than the teaching degree in Chemistry". In our understanding, this contradiction allowed the institution to keep the support discourse of teacher training without the need to change its curriculum nor reduce the participation of teaching students in the Chemistry research labs.

## The most probable change in the social destination of teaching graduates

In this section, we intend to show, based on the significant volume of longitudinal data on the graduates of Unesp, that the teaching graduates have opportunities to broaden their professional destinations, normally less privileged in Brazil, when compared to bachelor students. This argument is supported by two main hypotheses that will be developed in this section: (i) regarding the scientific formation received, there are no differences between LIC and BAC, as graduates from both courses have the same opportunities to be admitted in the Chemistry graduate school; (ii) regarding professional destination, the teaching graduate can choose, almost equitably, among industry, teaching, and Chemistry grad school, while the

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http://dx.doi.org/10.1590/1980-6248-2017-0089

bachelor cannot teach high school, choosing mainly graduate school or the industry, alternating these options depending on the market availability.

To analyze the first aspect- the quality of Chemistry formation offered in the courses – we based ourselves in the data provided by the *Seção de Pós-Graduação do IQ* ( IQ Graduate School Section) collected in the system *Curriculo Lates* from *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq- National Council for Scientific and Technological Development). We analyzed the result from IQ selection process for the master's degree between 2004 and 2010, which happens twice a year, accepting a maximum of 15 students each time. In two semesters researched less than 15 students were approved, therefore, we analyzed a total of 201 students. From those 201 students we selected only IQ graduates: 68 from BAC and BQT and 33 from LIC, the other 100 students came from other institutions. The selection process consists of an open-ended test on Chemistry contents and the analysis of candidates' curricula. Our aim was to observe the chances that LIC students had to be admitted when compared to BAC and BQT students from IQ. BQT students were admitted via BAC exam and chose this modality in the middle of the course, therefore, they were included in the BAC category. Besides this, this course is the farthest one from LIC as it represents an option from BAC students, which is not always more attractive but more specifically focused on industry work. The few episodes of course change (exclusively through the participation in a new admission process) are restricted to BAC and BQT, with no exchange with LIC.

Considering the proportional difference of graduates in both courses- 50 graduates in BQ and BQT and 30 in LIC - , LIC students have a considerable insertion in the master selection in the institution. From the 201 freshmen, they represented 16.4% of those approved *vs* the 33.8% of those from BQ and BQT, proving the interviews with professors and students' impression on the quality of the formation in Chemistry and the development of extracurricular activities to improve students' curricula.

Calculating the same data in a different way, it is still evident the equality of opportunities in the graduate school admission process. Considering the average quantity of graduates between 2004 and 2010 at LIC and BAC, those approved in the master's represented 15.7% (33/210) of graduates at LIC and 19.4% (69/350) of BAC graduates. It is also important to remember that many students follow their graduate studies in Chemistry in other institutions and that the places of IQ/Unesp are also used by students from other Brazilian institutions.

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To analyze the professional destination of graduates, we accessed the *Inventário Profissional disponibilizado pela Associação dos Ex-Alunos do IQ* (Professional Registry from the IQ Alumni Association). The registry is produced through online questionnaires sent to the alumni and updated with information on their professional activities. The access to different versions of this publication allowed us to see changes in the how the information is filled by the graduates, highlighting the longitudinal character of this data. The access to the *Currículo Lattes* of some graduates also shown the trustworthiness of the information given.

Despite this, we understand that there is no direct control of the Association as to update dates and the type of information given, thus, we restricted our analysis to the period of 1995, graduation of the first LIC classes, until 2004, year in which the amount of answers was still considerable[6]. From this data, we counted the graduates that went to the industry, teaching, and research, including businesspeople in teaching and industry. In the research, we only included those that developed this activity professionally in industries and research institutions; we also counted those who pursued graduate studies (master, doctorate, and post-doctorate) in Chemistry.

We present the result of this analysis on Table 2. In it, besides LIC and BAC, we pointed the results regarding BQT graduates, faced by the objective of this work, we discuss the two modalities together. We considered only the data of graduates that gave information to the Registry, even if partial – only academic formation, for example – and that have not changed their field of activity: 206 graduates of BAC, 147 of BQT, and 136 of LIC. A small number of graduates worked simultaneously in two fields: industry and teaching. Thus, when analyzing and comparing their destinations and formation, we calculated the percentages, indicated on Table 2, from the total of people who answered (indicated above).

[6] Despite these weaknesses in our data source, we believe that these results still offer important evidences on the graduates' destinations. .

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http://dx.doi.org/10.1590/1980-6248-2017-0089

**Table 2 – Professional path and academic formation of IQ graduates in Unesp from 1995 and 2004**

| | Professional path | | | Academic formation | | |
|---|---|---|---|---|---|---|
| Graduates | Industry | Teaching | Research | Master | Doctorate | Postdoctorate |
| BAC (206) | 63 (30.6%) | 25 (12.1%) | 16 (7.8%) | 154 (74.8%) | 84 (40.8%) | 18 (8.7%) |
| BQT (147) | 68 (46.3%) | 11 (7.5%) | 6 (3.4%) | 84 (55.6%) | 42 (28.6%) | 7 (4.8%) |
| LIC (136) | 32 (23.5%) | 46 (33.8%) | 8 (5.9%) | 60 (44.1%) | 40 (29.4%) | 6 (4.4%) |

Source: adapted from the data of *Associação dos Ex-Alunos do IQ* (1995-2004).

As to their professional path, the results show that the option of research, that is, mainly the academic career at the university is a minority among graduates in all modalities. BQT graduates, whose formation is specific to the industry, mostly go to this area (46.3%). LIC graduates opt, in similar proportions, between teaching (33.8%) and industry (23.5%). BAC graduates go more for the industry (30.6%) than teaching (12.1%), though the option for teaching is higher than among BQT graduates.

We understand that these data point to advantages (or, at least, similarities) of LIC graduates, from middle and low-middle classes, compared to BAC graduates, from higher classes: (i) they have more diversity of choices compared to BAC, presenting relatively close proportions in the industry and teaching, besides this, bachelor graduates do not have the diploma that allows them to teach stably in the public system ( except in higher education, when the job offer considers this possibility or if he/she takes part in another teaching degree); (ii) they also do not seem to suffer great disadvantages compared to BAC graduates when opting for the industry instead of teaching, as the number of bachelors in the industry is only 7% higher than teaching graduates, far from an exclusion of this option as a professional path; (iii) the university career of teaching graduates is higher than the bachelor graduates, what is interesting as, traditionally, this option is restricted to Brazilian elite – as shown by Hey (2008) regarding the higher education field – and continues as an option of relative social prestige.

In all three modalities, there is a high number of students who pursue a graduate level formation (74.8% at BAC, 55.6% at BQT, and 44.1% at LIC), reinforcing the important role held by research in this institution. The significant number of bachelors (74.8%) that pursue a

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

master's degree is almost half compared to the doctorate (40.8%) and decreases drastically when observing the percentage of graduates that work professionally in academic research (7.8%). This data seems coherent with professors' indications that the continuity of studies is seen as an alternative to the industry at times with few job openings. This does not seem to happen with LIC and BQT graduates that search the master's degree in relatively similar proportions (55.6% and 44.1, respectively).

Besides this, we have shown that the smaller number of LIC graduates in the master degree compared to BAC is not justified by the inability of teaching graduates to be approved in the admission process, therefore it can indicate a higher possibility to work in the market, thus not considering graduate school as an option.

Thus, we understand that this set of data directly points to the same objective probabilities to academic and professionally insertion of LIC and BAC graduates, based in two findings: (i) faced by the admission process of Chemistry graduate school in IQ/Unesp, BAC and LIC graduates have the same chances of approval; (ii) regarding professional path, LIC graduates have more diversity of professional choice and basically the same chances of activity as BAC graduates. This data represents a change in the social destinations of teaching graduates from a less-privileged social class than the bachelor one who, as a tendency, would have less legitimate opportunities when finishing the LIC compared to BAC, as pointed out by the "reproduction theory" in the macro sociological perspective.

If on one hand, this modification is positive to the social rise of graduates regarding more prestigious professional paths, we see a contradictory relation with the formative objectives of the course: we see in all areas of analysis a total lack of valorization and a detour on the project of teacher training.

Analyzing the data on the professional activity of these students, based on the Professional Registry of IQ Alumni Association, we have perceived that only 33.8% work as teachers. According to students' testimonies, outreach activities connected to scientific promotion and Chemistry teaching seem to be responsible for this path. These activities assumed the role to give teaching students a professional perspective during undergraduate, reducing their discomfort with the curriculum and official teaching, often distant from their abilities and understanding (Massi & Villani, 2015). Thus, the criticisms to Chemistry teaching, presented in the curricular structure distant from the reality, seem to be compensated by the

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

involvement in activities that approach students to basic education. Besides this, the participation of teaching undergraduates in the institutional project guided towards Chemistry research Chemistry strongly reduced a professorial discrimination towards them, due to their limited cultural capital when entering the institution.

## Final remarks

At IQ, LIC was implemented as a way to "pay a debt" with its origins and offering a relatively "second-category" option to form a profile differently from those of BAC: students who could not study full-time, but that should receive a solid formation in Chemistry, following the principles of the institution. However, a group of circumstances modified this project, making the "option of the poorest" into a path to professional success and social advancement of teaching undergraduates. This modification took place due to a series of matches and mismatches, institutional and political practices, institutional and students' initiatives.

The testimonies on the creation of LIC point to a "bachelor lobby" that took care of its internal and external valorization and had as an effective result a curriculum extremely charged in Chemistry content. Therefore, students had little space to invest in their formation, that was increasingly stuck. On the other hand, LIC course, offered by night and not having the weight of the "bachelor" title, allowed a lighter charge of credits but with the same quality. On its turn, teaching students, since the first year of course, could have outreach and research scholarships in Chemistry in the institution, and did not have to work to continue at the university. The political pressions, which wanted IQ to promote local well-being, and the institutional strategies of Unesp, that wanted to stand out among the public universities of São Paulo, guaranteed the abundance and continuity of scholarships, including for outreach projects. Thus, teaching students, who studied at night, could have a free day to work in projects that offered a great number and variety of opportunities, complementing their formation (formal and informal) and allowing for a better adjustment to individual needs.

Also considering that there are multiple ways to transmit cultural capital and that, in fact, this capital is transmitted by taking part in multiple activities, teaching students would have the opportunity to reconvert their initially poorer formation in terms of cultural capital. It is important to notice that, for IQ, the series of research and outreach Chemistry projects

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e-ISSN 1980-6248
http://dx.doi.org/10.1590/1980-6248-2017-0089

established a central core of its "institutional marketing" to stand out in the state, national, and international scenario, while for teaching students it was the core of a more enhanced and powerful formation, able to revert their initial handicap compared to bachelor students. This scenario did not alter the formation and symbolic valued of BAC, however it allowed teaching students to have concrete chances to enter in graduate school and the job market, seen its broader array of activities, amplifying, and enriching their most probable social destination.

The institutional dispositions, marked by the almost absolute valorization of academic research and the lack of a deeper educational reflection on the real needs and possibilities of bachelor and teaching students, hamper the decision-making involving a deeper investment in teaching, showing the ambiguity of this unique process. The fact that teaching and bachelor students can easily find work after graduation and can supply the needs of the Chemistry graduate school at the institution becomes an argument to not invest in radical changes in the undergraduate and graduate programs. However, our research show that this scenario is the result of contingencies and not of structural investments, as the institution offers a quality formation to all – proven by national governmental assessments as *Exame Nacional de Desempenho dos Estudantes* (Enade), by private assessements as *Guia do Estudante,* and the assessment of the graduate school by *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Capes), which indirectly impacts undergraduate program–, amplifying the professional perspectives of teaching graduates without hampering the other advantages shown by the changes in their most probable social destinations.

In this sense, it seems that the institution should also include the possibility of research in Chemistry Education favoring the formation of research groups, introducing junior researches on the topics, promoting researchers and formative actions on the teaching practice at the university itself. Therefore, the institutional strategy can overcome the objectives of Chemistry research and marketing becoming consciously empowering and able to maximize the professional perspectives of bachelor and teaching graduates.

The fact that Unesp has one of the best graduate programs in the area– the Program of Education for Science, in the city of Bauru–, though in another city close to Araraquara, is an important path to open, even more, the professional perspectives of teaching students, opening to them the doors for public and private universities, education secretaries and organizations, while continuing their graduate studies in the same institution.

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We understand that this opening could lead to a more systematic operation of IQ in Chemistry Teaching, improving the official curriculum of teaching (and bachelor) students. Besides this, it would be a great example for all universities who train Chemistry teachers on how to articulate research, teaching, and outreach with the participation of students and teachers. Obviously, we are not saying that the improvement in how the institution works with teaching training would solve the valorization problem of public (and private) high school teachers, as this depends on other initiatives, mainly establishing a teaching career and a significative salary increase.

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*Submitted for evaluation in May 3rd, 2017; revised in November 22nd 2018; accepted for publication in February 27th, 2019.*