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The Challenges of Teaching and Training in Intellectual Property

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Abstract

The article discusses the challenges of teaching Intellectual Property (IP) in the University of Campinas (Unicamp, Brazil), with reference to the data obtained from a large survey and analysis of the disciplines offered in the undergraduate, graduate and university extension courses, and interviews with professors responsible for these courses and disciplines. The results indicate that although Unicamp has a prominent role in promoting innovation, occupying the second position in the ranking of the largest depositors of patent applications in Brazil, the teaching of the subject in the institution still relies on individual initiatives of the professors themselves, being exclusively dependent on the interest and skills of these individuals rather than a more general orientation of the university. The discussion closes with some observations as to how education and training in IP could be improved, in an attempt to convert them into instruments conducive to the promotion of innovation within nations.

Keywords: intellectual property rights; 21st university century; national innovation system; knowledge society.

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Introduction

It has been roundly accepted that knowledge and innovation play an important role in economic growth. However, it is not just the domain of knowledge that distinguishes one nation from another, but mainly, the way that knowledge is perceived, disseminated and, also, the manner in which the results are fed back into society. What we have found is that the broad and varied development of technical and scientific knowledge, and its transformation into products, processes, goods and services, in general, presents itself as a central factor for nations to participate in the rapid displacement of the frontier of technology and innovation, at the risk of being just "imitators" or "modernizers".

Several studies have paid attention to vital issues related to encouraging innovation and the dissemination of information in a world in which knowledge and creativity are also at the heart of economic progress. Inevitably, this increased attention to the importance of the knowledge economy has given prominence to issues such as the study of the determinants of innovation and learning and intellectual property rights (IPRs). In this context, there is a growing body of economic literature that seeks to understand the dynamic effects of the protection of IPRs, as well as the relationship of these rights to competition, their importance in international technology transactions and how these rights relate to the overall economic development strategies of nations (Maskus, 2008).

This context indicates the need for trained human resources and intellectual capital to be considered key elements in innovation strategies of Nation States and businesses, both for the creation, maintenance and consolidation of an appropriate intellectual property regime within countries, and for their participation in international forums for discussion, such as, the World Trade Organization (WTO) and World Intellectual Property Organization (WIPO), so that, among other things, national interests are preserved and defended (Amorim-Borher, 2008).

The adoption of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is a good example, because it forced countries to review their laws and alerted the interest and attention of governments and members of the business community to the increasing importance of IP in the process of economic development. Thus, the increasing use of the IP system has been seen as one of several key factors for a successful economy. These understandings are impacting also on the form of education and choice of content that should be taught in universities and educational institutions, which makes the creation of programs geared to the teaching of intellectual property an issue of increasing relevance. At the same time, the domain of specific intellectual property issues is important to the academic community, regardless of their field of knowledge, or whether technology issues are involved or not (Allman; Takagi and Sinjela, 2008).

However, the establishment of a culture of intellectual property, either at country level, or at the level of educational institutions depends on the level of awareness of the importance of valuing creative ideas, the importance of respecting property rights of third parties, of the possibility of the economic exploitation of research results, as well as the teaching of IP.

Research conducted by Dalmarco et al (2011) points out that although some Brazilian universities are protecting the results of their research through patenting, questions remain which need to be clarified and that relate to higher closer relations with industry, especially in refers to the activities of technology transfer. This is because the authors believe that the offices of technology transfer (OTT) of universities still lack a managerial level able to make the most of all the benefits of the inventive activities performed.

Accordingly, Rojas (2007) argues for the need of institutions to make efforts to establish coherent policies related to the implementation of the management of research results, particularly with regard to the actions of technology transfer. The author believes that it is necessary to establish guidelines for seizing the value of what is generated internally.

It is clear, therefore, that all issues previously raised are necessarily the culture of IP, including the training of human resources for the confrontation of the issue, both within the university (IP policy management of the institution), as outside (preparation of human resources for the market, for example).

Therefore, this article presents the current situation regarding the teaching of intellectual property in one of the most important universities in Brazil, the University of Campinas (Unicamp). This is a research university, given its profile of a university with more graduate than undergraduate courses and students, a fact that suggests a strong leaning to academic research. Moreover, it is the university with the highest number of patent applications, second only in national rankings, to a business in the area of energy, Petróleo Brasileiro (Petrobras). Another interesting aspect is that Unicamp does not offer a Law course. It discusses, therefore, the way in which the institution has contributed to the training of professionals with knowledge about property rights so they may deal with issues related to IP, such as innovation management, especially with regard to intellectual property rights (IPRs), but it also discusses who has taught IP at the university, especially trying to understand what are the mo-

tivations and knowledge of the professors responsible for these disciplines – in reality, the new demands towards the universities, according Etzkowitz et al. (1998).

The picture, in fact, shows that the teaching of IP at Unicamp is still at a very early stage and that its advance requires the creation of lines of action aimed at increasing the provision of disciplines / courses, increasing teaching support for faculty members and the creation of guidelines to establish more coherently and decisively the teaching and culture of intellectual property at the University.

In addition to this introduction, the article has three parts. The first part briefly presents an overview of the teaching of intellectual property, highlighting a concern about a still rather narrow vision of intellectual property rights (IPRs) and the need to include the protection of knowledge predicated on the possibility of greater economic and, especially, social returns. The second part is devoted to the case of teaching IP at Unicamp: the history and profile of the university are introduced, followed by statistics and indicators gathered from undergraduate, graduate and extension courses, which make it possible to draw up an outline of the teaching of IP at Unicamp. The third part presents the insights, suggestions and views of professors and researchers involved in the teaching of IP at Unicamp. The article concludes with final considerations seeking to indicate ways in which the teaching and training in IP might gain more productive territory and decisively assert themselves as a legitimate concern not only for the universities, but for nations.

1. Teaching of Intellectual Property: the need to go beyond property rights

Surveys carried out by the WIPO indicate that in many countries the teaching of intellectual property has not yet been introduced as a specific discipline in the curriculum of most courses, regardless of the major Area of Knowledge. What we have found is that the teaching of IP is still strongly tied to Law courses, especially Commercial Law. Moreover, there is a lack of professors dedicated full-time, a lack of teaching material and, therefore, little discussion and reflection on this theme (WIPO, 2004). Even in developed countries such as the United States of America, "Intellectual Property is still studied and researched, most frequently in law schools. Although students are admitted with a variety of bachelor degrees, the teaching perspective adopts a predominantly legal approach (Amorim-Borher et al., 2007, p. 287-288) .
However, as mentioned earlier, with the TRIPS agreement, the rights of intellectual property have come to be closely related to issues of trade and competitiveness, which conferred on these rights a more wide-reaching aspect. In this context, new actors such as academia, business, public opinion, non-governmental organizations, among others, began to discuss issues related to the patenting of biodiversity products, stem cells, the repercussions of piracy, among other issues that are not consensual. This new scenario has come to impact, then, on the curricular content of IP teaching programs (Amorim-Borher et al., 2007).

Soetendorp (2008) reinforces this perception and shows that there is an international demand for graduates able to capitalize on knowledge, and that the most frequent questions that academics ask when they begin to think about the inclusion of IP education in the curricula of courses other than law courses, are : Why teach? Who to teach? What to teach? How to teach?

Thus, the incorporation of the teaching of intellectual property at different levels (basic, intermediate or advanced) is intended to provide students not only with a set of specific skills directly related to their future areas of activity, but also in a broader sense, aims to foster a culture of respect and appreciation of the value of creative ideas in the context of the knowledge economy.

Also, it is important to mention that, under Article 26 of the Brazilian Innovation Law (Law No. 10.973/2004) Scientific and Technological Institutions (STIs) "which include teaching among their main activities should associate compulsorily, the application of the provision of this Law to activities involving the training of human resources under their responsibility" (BRAZIL, 2004). Therefore, from the hermeneutics of the legal text it is possible to understand that the experiences developed within ambit of the competencies of Technological Innovation Centers (TICs), in public universities, should "spill over" into the academic area, under the weight of the previously mentioned legal provision. The legal text, then, makes it quite clear that one of the missions of the STIs is an obligation to educate, to develop institutional policies or strategies for the dissemination of experience and knowledge gained from the management of IPRs generated in the institution.

However, in the case of Brazil, Paula Filho and Souza (2009) conducted a study in which they analyzed abstracts of theses and dissertations available in the database of the Coordination of Improvement of Higher Education Personnel (CAPES) and found that 55% of academic production in IP was concentrated in the broad area of Applied Social Sciences. This concentration can be explained by the presence of law courses in the area in question, since they were responsible for 40% of all theses and dissertations on IP retrieved by the research.

In fact, there have been many impediments to the expansion of the teaching of IP education worldwide. A study by Allman, Sinjela and Takagi (2008) involving approximately 20

universities throughout the world, identified the main constraints and challenges faced by academia today, namely:

i. Difficulty in updating the programs so that they can keep up with the dynamic and rapid changes that occur in the laws of intellectual property;
ii. Lack of up-to-date teaching materials that address the emerging uses of intellectual property;
iii. Need to strengthen curricula to make them suitable for an interdisciplinary approach that takes into account the increasing role of intellectual property in areas such as business, trade, science, economics and engineering, and the arts.

In the case of Unicamp it is no different, and a further element may even be added to this picture which is the lack of a more general orientation from the university that would permit the teaching, research and activities focused on intellectual property to be mutually coherent, i.e., for them to be included in a broader policy, even going so far as to promote a concerned interest in course content and in the profile of the faculty members involved in IP and related disciplines.

2. The teaching of IP in a research university – Unicamp, Brazil

It can be seen, from the previous discussions, that there has been a time lag between the understanding of what have currently been considered the driving elements of a Knowledge-based Society, and actual discussions about the process of innovation and policies aimed at its promotion. Among the issues that have not received attention is the teaching of intellectual property in higher education in Brazil and worldwide. In the case of Brazil this can be shown from a study conducted within one of the most vital universities in the country, Unicamp. This study is based on data obtained from the collection and analysis of a considerable volume of documents and also substantial field research, especially (but not exclusively) through interviews with professors of IP and the like. What follows are the main results of the research, as well as the methodological procedures, although prior to that, a brief description of Unicamp is presented.

2.1 Unicamp: a brief history and profile

The University of Campinas was founded in 1966 and despite being considered a young institution, it is already recognized for its strong tradition in teaching, research and its relations with society. In May of 2012 it was featured as one of the best universities of less than 50 years old in the world in the ranking of the Quacquarelli Symonds (QS) company, listing in 22nd place. In the same month the university also appeared in the Times Higher Education ranking (THE), one of the most important institutes of higher education evaluation, ranking among the top 50 universities in the world, occupying the 44th position. A few statistics that may give an idea of what Unicamp is about are presented in Table 1, below.

In 2010, 98% out of around 1,750 Unicamp professors held at the least a doctoral qualification and 89% worked full-time exclusively for the university. In 2010 there were around 17,000 undergraduate students and nearly 20,000 graduates, as can be seen in Table 2 below, which presents other statistics.

Another equally relevant fact consolidates Unicamp as a research university and with a technological profile, given that it is the second highest among institutions that deposit the most patent applications with INPI (Brazilian Industrial Property Institute). Data for the period 1999-2003 indicate Unicamp as the main depositor of patents with INPI, ahead of Petrobras. In the latest survey, the university occupies second place, having been overtaken by Petrobras (INPI, 2006, 2011), as shown in Table 3.

In fact, it is considered that one of the factors that contributes to the solid training offered by the institution is precisely the historical relationship between teaching and research maintained by the university. This factor, combined with the high qualifications of almost all its professors and the wide range of courses in exact, technological, biomedical sciences, humanities and arts enables the institution to assume a prominent role in their teaching, research and extension activities. Furthermore, 45% of their graduate courses present an international level of excellence, the best result obtained by a Brazilian university to date (Unicamp, 2011).
Regarding the role played by Unicamp in the national innovation environment, what has been understood is that, with the support of the Unicamp Innovation Agency (Inova), the university is now one of the most successful in the licensing of technologies (Unicamp, 2011), related by the fact that Unicamp is the most important university in the Index of Patents Granting, according Querido et al. (2011) . It is considered that Inova's structure resembles the Offices of Technology Transfer (OTT) of American and European universities. In the last seven years, 51 contracts were established licensing technologies developed at Unicamp, to companies from various Brazilian states. Of this total, seven contracts were signed in 2010. In addition, the university boasts 213 enterprises founded by alumni, faculty members and employees (Inova Unicamp, 2011).
Thus, in addition to its traditional missions of teaching and research, Unicamp has also distinguished itself as an entrepreneurial university. All the data presented previously establishes it as a research university with a technological vocation and strong influence in the national academic and scientific scenario. What follows is how it has been tackling

Items of structure	Number
Campuses	6
Teaching and Research Units	22
Technical Colleges	2
Hospitals	3
Interdisciplinary Centers and Nuclei	22
Libraries	27

Table 1 - Unicamp's structure in numbers. Data from Unicamp's Statistical Year Book (2011).

Indicators	2006	2007	2008	2009	2010
Undergraduate Courses	**58**	**58**	**58**	**66**	**66**
Matriculated students	17,725	6,984	16,422	16,777	17,083
Graduating students	2,688	2,750	2,662	2,276	2,269
Graduate courses	**137**	**135**	**139**	**138**	**144**
Masters	66	66	66	66	66
Doctorate	60	60	60	60	60
Specialization	11	9	13	12	18
Matriculated students	22,044	15,230	15,396	15,995	19,718
Defenses: masters dissertation	**1,150**	**1,140**	**1,141**	**1,221**	**1,245**
Defenses: doctoral theses	**791**	**795**	**748**	**871**	**826**
Number of professors	1,761	1,743	1,727	1,733	1,750
Indexed publications: ISI - Web of Science	**2,112**	**2,222**	**2,752**	**2,812**	**2,771**
Lines of research	**1,070**	**1,097**	**1,049**	**1,049**	**1,040**
Project receiving financial grants	4,322	4,562	4,864	4,951	5,194

Table 2 – General indicators of Unicamp's academic performance, 2006-2010. Data from Unicamp's Statistical Yearbook (2011).

TITULAR	PI	MU	Nº de Pedidos de Patente (2004-2008)
PETROBRAS	385	3	388
UNICAMP	270	2	272
USP	257	7	264
WHIRLPOOL	166	8	174
UFMG	145	9	154
UFRJ	136	5	141
FAPESP	129	0	129
SEMEATO	96	18	114
CNEN	78	5	83
FAPEMIG	60	8	68

Table 3 – List of the 10 main depositors of patents in Brazil, with Brazilian priority, in the period 2004 to 2008. Data from INPI (2011, p. 15).

the teaching of IP in its different courses and areas of expertise. Especially since this is a university that has no law school, in which a concentration of these activities normally exists.

2.2 Survey and analysis of the data on the teaching of IP at Unicamp

A first step towards the realization of the field research focused on the searches of online systems and reports on Unicamp's activities to locate the disciplines and undergraduate, graduate and extension courses on the subject of IP and related areas. The results were used to map the number, profile and course descriptions of the disciplines of the courses and to identify the professors responsible for the disciplines and courses, who would subsequently be interviewed. The goal was to understand the aspects involved in the teaching of property rights, more specifically of intellectual property, and issues related to it, such as contractual issues (licensing), royalties and know-how, trade secrets and unfair competition, entrepreneurship and innovation management.

Initially research was conducted into the disciplines in the university academic systems that cover the three areas of education: undergraduate, graduate and extension. Consultations were carried out covering: (i) the catalogs of undergraduate and graduate courses between 2003 and 2011, (ii) the data from extension activities, covering all active courses in the digital database of the Unicamp Extension School (Extecamp), up to the month of October 2011, and (iii) data on teaching activities of the Unicamp Innovation Agency (Inova Unicamp). For this purpose, two sets of keywords were established to retrieve the records that might contain information on the presence of the theme of intellectual property in the disciplines' course descriptions. The first set deals with terms directly related to IPRs, called specific terms (intellectual property, industrial property, trademark, software, patent, authors, author's copyright, industrial design and cultivar). The second group deals with issues indirectly related to IPRs, called IP-related terms (Innovation, Royalties, Know-how, Technology Transfer, Entrepreneurship and Management). As a result, it was possible to collect the number and profiles of the disciplines of undergraduate, graduate and extension courses that deal with property rights, more specifically of intellectual property, and matters related to them.

It is important to highlight that the research has some limitations with regard to the actual breadth of the results gathered, since the disciplines that deal with IP do not always contain the search terms in their title and / or in the course descriptions. Another limiting factor was the fact that the special courses (called directed reading courses), which potentially deal with new issues, especially in graduate school, have no course descriptions. Furthermore, the database of the extension courses (Extecamp) does not provide information about the periods (years) courses were offered, so that it was only possible to recover the course descriptions of all the courses active at the time of search. Attempts were made to work around these limitations with data obtained from the interviews, since, in some cases, those interviewed indicated colleagues, within Unicamp, whom they thought had experience or dealt with some content related to intellectual property in their teaching activity. Others pointed out that although the course description contained specific terms, the discipline that was actually offered did not deal at all with the topic.

It is also important to comment on the activities of the Unicamp Innovation Agency (Inova Unicamp) relating to the teaching of IP. The data analyzed did not represent all of the courses offered since the creation of the agency, given that some of them concerned the InovaNIT project, whose courses are geared not to the academic community, but to professionals working in Technological Innovation Centers, even though the participation of students from the university was in some cases possible. The fact remains that it was not possible to ascertain how many students or faculty members actually participated in these courses. To circumvent this difficulty, the lines of action selected were only those geared strictly to the academic community and of open access, that is, without a limited number of places or that did not demand the fulfillment of certain prerequisites for participation.

Thus, after the presentation of the methodological procedures described above, what follows are the findings, separated by levels: undergraduate, graduate and extension.

Undergraduate courses

Taking into account only the total number of selected course descriptions, note that there was an increase in general terms, in the number of disciplines that include specific terms of IP (patents, copyrights, trademarks, etc.) during the period analyzed. While in 2003 only 7 course descriptions were discovered with specific terms of IP, in 2011 there were 17 disciplines.

It can be noted that there was a quite a similar pattern of behavior among the disciplines that include in their course descriptions issues related to IP, with the following terms appearing more frequently: innovation, technology transfer, management, competition, entrepreneurship. Due to the multidisciplinary nature of IP it is understood that in the study of these topics it is possible to incorporate discussions related to property rights and contractual issues relating to IPRs. This being the case, for the year 2003, seven

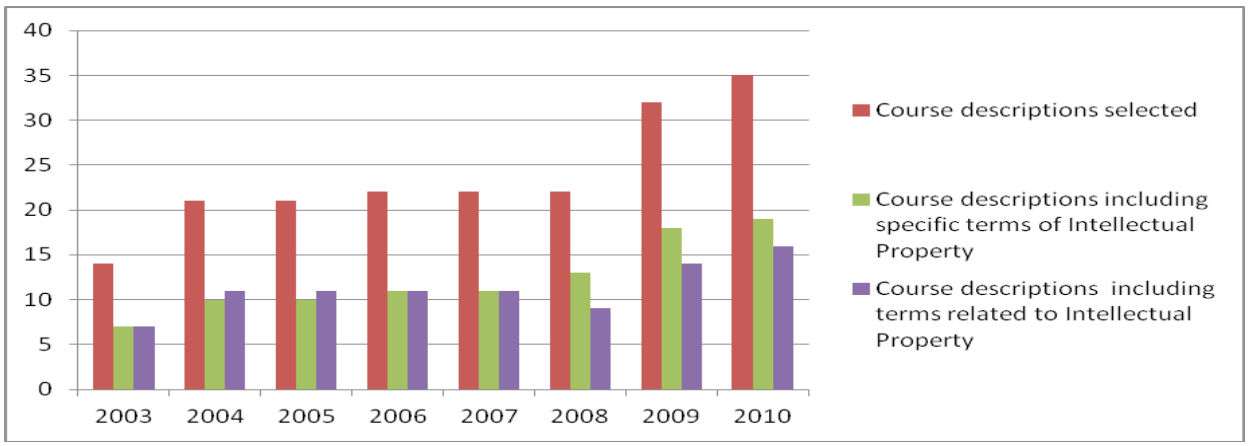
course descriptions were retrieved with terms relating to IP and, in 2011, twenty-two course descriptions.

Thus, Graph 1, below, makes it possible to conclude that, in general, the tendency to introduce the issue of IP is growing, although it is a gradual growth. However, it is important to point out that some of these courses have never been offered (they are elective disciplines and depend on demand) or may even have become extinct (in one case the discipline was offered for the last time in 2011).

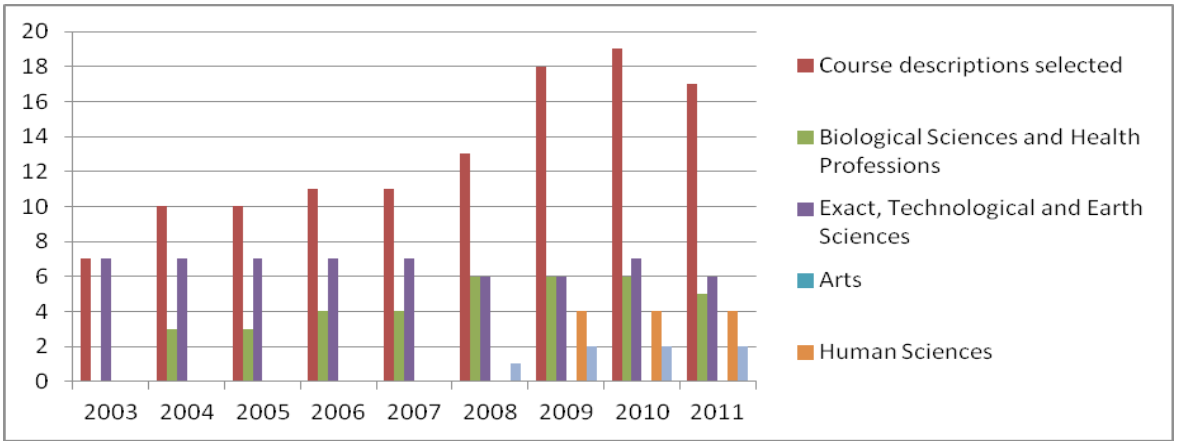
When one considers the number of subjects by area of knowledge, as well as those disciplines under the responsibility of the Rectory / Inova, from the statistics it may be observed that, in the period analyzed (2003 to 2011), there was an increase in the number of specific disciplines on IP, with two stand-out areas of the Biological Sciences and Health Professions, and the Exact, Technological and Earth Sciences. Moreover, since 2009, the area of Human Science began to offer disciplines addressing IP, as shown in Graph 2 below.

Note: The presence of the Rectory is justified because this body is responsible for some extracurricular courses that are offered to the academic community.

Taking into account only the year 2010, it can be seen in Graph 3 that the area with the highest incidence of disciplines, in percentage terms, whose course descriptions include specific terms of IP, was the area of Exact, Technological and Earth Sciences, with 36.84%. Second, is the area of Biological Sciences and Health Professions, with 31.58%. Thirdly comes the area of Human Sciences with 21.05% occurrences. In Exact, Technological and Earth Sciences, the disciplines are concentrated primarily in the following courses: Chemical Engineering, Chemical Technology, Computer Science, Architecture and Urban Planning, Geography and Geology. In the area of Biological Sciences it is in the course descriptions of Pharmacy and Biology that specific IP terms are to be found. The disciplines of the Geology and Geography courses do not include specific IP terms in their course descriptions, but through the interviews it was



Graph 1 – Undergraduate disciplines related to intellectual property directly (specific terms) or indirectly (related terms). Unicamp, 2003-2011



Graph 2 - Undergraduate disciplines that deal with IP (specific terms) according to area of knowledge and the Rectory. Unicamp, 2003-2011, in figures.

possible to establish that intellectual property is addressed. Thus, as a matter of organization, these disciplines were also incorporated into the sample.

It is known that the Institute of Geosciences houses the Geology and Geography courses, and that one of its departments, that of Scientific and Technological Policy, is responsible for disciplines (undergraduate, graduate, extension and even along with Inova) on IP. One of these disciplines, GN101 (Science, Technology and Society), for example, is mandatory for students on the Institute of Geosciences undergraduate courses. Another information is that the discipline GT001, is also offered by the DPCT (Department of Scientific and Technological Policy) for all undergraduate courses at Unicamp, and now also for students on the Interdisciplinary Higher Education Program (ProFIS) , catering for around five sets of students per semester, a fact that demonstrates that specific and related IP issues have a wider dissemination than might be deduced from a simple observation of the list of courses offered by the units of Unicamp.

It is important to mention that the numbers in the area of the Human Sciences relate, exclusively, to participation of the management courses at the Faculty of Applied Sciences (FCA), since the research did not uncover any discipline with specific terms from other units. However, in 2011, a considerable part of these disciplines had not been offered, since the courses commenced in 2009 and these disciplines would be offered in 2012.

Considering all disciplines located, whether those with specific terms or related terms, and even those identified during the interviews, it is possible to have a notion of the potential offering of IP-related content at Unicamp. Considering all courses offered by the university and based only on the course catalog for the year 2011, it appears that out of a total of 71 courses, in 39% of these courses there is room for teaching IP in disciplines offered in 2011 or those to be offered in 2012, in the new courses of the FCA (Faculty of Applied Sciences). In the area of human sciences, almost half of the courses have disciplines with potential content for dealing with IP. The area of exact, technological and earth sciences is the one that has the lowest percentage of courses with such disciplines, only 34% (see Table below).
There are four disciplines that are offered for all courses that address issues of IP. Of these, three are offered by the Rectory and Unicamp Innovation Agency, responsible for the dissemination of the culture of IP in the academic community , and one by the Department of Science and Technology Policy (DPCT), of the Institute of Geosciences.
This has very interesting potential, since it indicates that space already exists to teach IP content effectively. However, as will be discussed later, this potential is not fully exploited due to the lack of training of the professors or, in some cases, the option of the professor not to tackle this topic.

Graduate courses

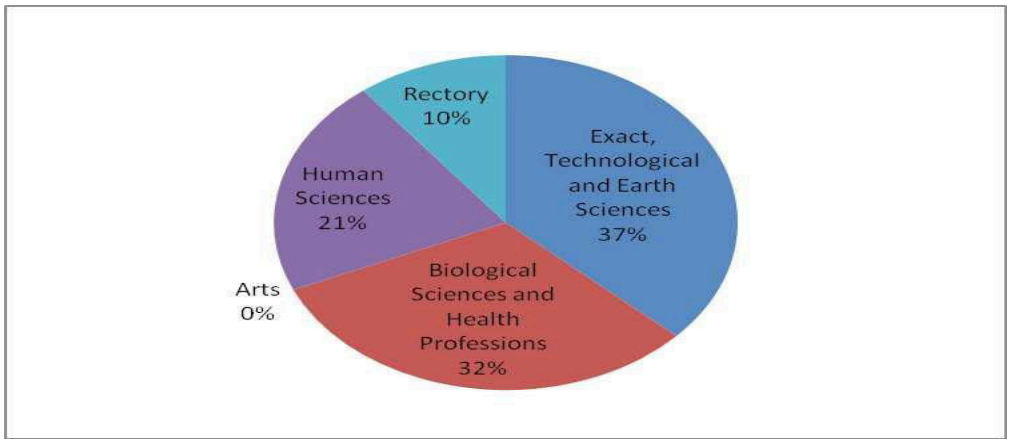
Observing the total number of course descriptions selected in the graduate catalogs, it was revealed that the number of disciplines (7 disciplines), whose course descriptions included terms directly related to the subject of intellectual property (patents, trademarks, copyright, among others), grew slightly in the years 2003 and 2004 and then remained stable during the period between 2005 and 2011. In addition, during the same period (2007-2011), six course descriptions were identified which related indirectly to IP (innovation, competition, entrepreneurship etc.), as can be seen in Graph 4, below and in Figure 1.

Taking into consideration all the course descriptions selected, with specific terms, what we see is that in the period analyzed (2003-2011), the area of Biological and Health Sciences was the one that most presented disciplines involving the direct approach to IP, with 3 course descriptions in 2011. They are disciplines taught in the Masters and Doctoral programs in Pharmacology and in the Masters program in Genetics and Molecular Biology and whose course descriptions feature the following terms: "patent" (Pharmacology); "intellectual property and economic viability" (Genetics and Molecular Biology), a fact that places the area of Biology and Health ahead of other areas of knowledge in the treatment of IP at Unicamp, during the period analyzed.

Grouping Unicamp's masters and doctoral programs according to the course catalog for 2011, it may be perceived that the potential space for teaching IP in graduate school is much smaller than in undergraduate courses. Of the seventy courses, there are disciplines with IP-related content (identified by specific or related terms) in only ten of them, i.e. only 14% of the total. Excepting the interdisciplinary courses of which there are only two, the highest concentration is in the area of exact, technological and earth sciences, with 19% of courses with at least one discipline with potential IP content. As in the case of undergraduate courses, not all disciplines located in the catalog search actually address IP issues, for the same reasons, as will be discussed below.

Extension courses

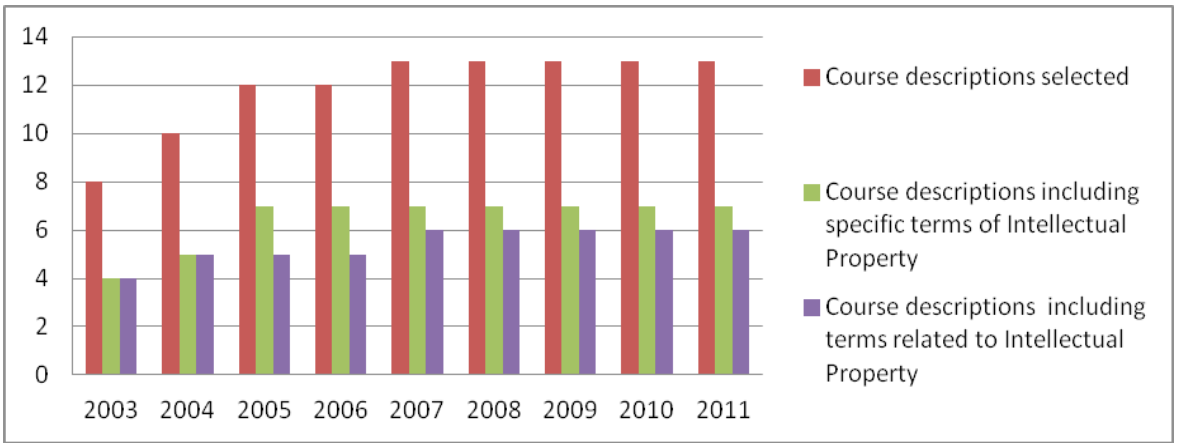
Twenty-nine disciplines/courses relating to IP were located in the Extecamp database and which represent all the disciplines available through to the month of October 2012. The Institute of Geosciences (IG) is the academic unit in Unicamp that has offered the most disciplines/courses on intellectual property. In percentage terms, the institute was responsible for almost 80% of the offerings (23 of the 29 disciplines/courses selected). This percentage relates solely



Graph 3 - Occurrence of undergraduate disciplines that deal with intellectual property (specific terms) according to area of knowledge and Rectory - Unicamp, 2010, in %.

Course area	Total courses	Courses with IP disciplines	%
Arts	5	2	40%
Biological Sciences and Health Professions	11	5	45%
Exact, Technological and Earth Sciences	38	13	34%
Human Sciences	17	8	47%
Total	**71**	**28**	**39%**

Table 4 – Unicamp undergraduate courses according to area of knowledge and offering of disciplines related to IP, 2011 and 2012
Note: Grouping together the entrance options, Unicamp offers 66 undergraduate courses.



Graph 4 – Graduate disciplines directly related to intellectual property, Unicamp, 2003-2011

Program	Title of Discipline	Area
Masters and Doctorate in Pharmacology	Ethical Use of Animals in Research	Biological and Health Sciences
Masters in Genetics and Molecular Biology	Molecular Biotechnology	Biological and Health Sciences
Masters and Doctorate in Food Technology	Topics in Technology and Advanced Chemistry of Cereals	Exact, Technological and Earth Sciences
Masters and Doctorate in Scientific and Technological Policy	Instruments of Policy and Management of S,T&I	Exact, Technological and Earth Sciences
Masters and Doctorate in Cellular and Structural Biology	The Writing and Presentation of Scientific Papers	Biological and Health Sciences
Masters and Doctorate in Sociology	Sociology of Technology	Human and Social Sciences and Arts
Masters in Scientific and Cultural dissemination	Science, Technology and Society	Human and Social Sciences and Arts

Figure 1 – Disciplines with specific terms of IP according to Program and area, Unicamp, 2011

to courses offered by the DPCT, whose research topics are very tightly linked to the context of innovation and technology management, heavily involving issues related directly and indirectly to IP. In addition, the DPCT also collaborates with the Laboratory for Advanced Journalism Studies (Labjor) offering a discipline that addresses the issue of IP in the specialization course in Science Journalism. This information is contained in Graph 5 below.
According to data in the Unicamp 2011 Yearbook (Unicamp, 2011), the IG offered 38 extension courses / disciplines since 2010. Given that in 23 of these IP-related content was offered, about 60% of the courses / disciplines covered the topic of IP. In this way, the potential coverage of IP in extension is very concentrated in one of the institutes of Unicamp, even taking into account the limits of the search undertaken in the extension database . In total, 1085 disciplines / subjects were offered by all units at Unicamp.

Observing the results of research conducted in the three areas of teaching at Unicamp (undergraduate, graduate and extension), the undergraduate area presents itself as the broadest space for teaching IP, because there are potentially more opportunities for the students to have some contact with the contents of IP. Coverage in the graduate ambit is small and in the ambit of extension insignificant, considering the total number of courses in each area. The challenges facing the teaching of IP at university, based on the results of interviews with professors responsible for the disciplines in the three ambits are discussed below.

Challenges and opportunities of teaching IP at Unicamp

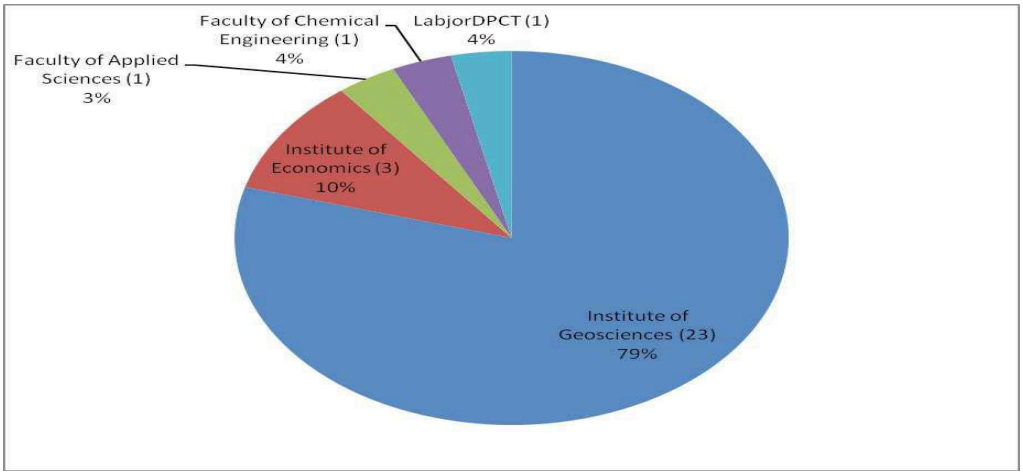
After researching and analyzing the data on course descriptions of disciplines, the professors responsible were identified with a view to conducting interviews to learn about their own training on the topic of IP and how they addressed the subject in their disciplines. We identified thirty-six professors, eighteen of whom agreed to participate and were interviewed.

With regard to the competence or training of professors to work with the theme of the IP, some interviewees claimed that one of the obstacles to the approach of IP in their disciplines is precisely the lack of more specific or deeper knowledge on the topic. Several professors claimed that they still do not have the familiarity necessary to tackle the subject at a level consistent with international standards of IP education, because they do not have sufficient expertise for this venture, so that they often need to resort to specialists, which is not always possible. The main difficulty is in dealing with legal-judicial matters.

Three strategies were identified to deal with these shortcomings. The first is for them to train themselves, i.e. many professors consider themselves self-taught on the subject, since they seek out knowledge on their own initiative, usually in specialized texts, in news reports, and elsewhere. The second is to use experts whenever possible, usually lawyers or technical advisers from INPI, so that more specific and in-depth contents can be offered to the student. In such cases, it is the professor who leads the discipline and the specialists are responsible for the conduct of lectures or workshops. A third strategy used by some course coordinators is to

Table 5 – Unicamp Graduate programs according to area of knowledge and offering of disciplines related to IP, 2011
Note: The masters and doctoral programs were grouped together, when considered separately they constitute 126 programs. Specialization programs were not counted.

Area of Program	Total number of courses	Courses with IP disciplines	%
Human and Social Sciences and Arts Area	20	2	10%
Biological and Health Sciences	27	3	11%
Exact, Technological and Earth Sciences	21	4	19%
Interdisciplinary Courses	2	1	50%
Total	**70**	**10**	**14%**



Graph 5 – Extension courses/disciplines that deal with intellectual property, according to teaching unit, Unicamp, 2011

leave the discipline to the care of specialists, usually career researchers, from Unicamp itself, who somehow have experience due to their involvement with IP issues in Unicamp or outside.

It also appeared that some interviewees feel the lack of more opportunities to participate in courses offered by Inova, since there are few places available to the academic community when courses are scheduled, given that most of the courses are designed specifically for professionals connected to NITs within the INOVANIT project.
Asked about the reasons that led to the introduction of the theme of intellectual property in their disciplines, faculty members pointed out two major motivations. The first, more directly related to IPRs, was to offer undergraduate and graduate students a better understanding of the legal aspects of intellectual property, such as the major fields of protection and some essential questions for each field, to know how to differentiate between the holder of a patent and its inventor and recognize the rights and duties of each. The second motivation was clarification about the economic importance of intellectual property and how the legislation may affect the economic sphere and vice versa, as well as about innovation management. During the interviews, the professors suggested recommendations for the promotion of the culture of intellectual property and improving its teaching, at Unicamp. In general, these are as follows:

- Creation of compulsory disciplines that cover the topic of IP, or at least offering of elective disciplines;
- Increased advertising of courses, seminars and extracurricular disciplines offered on the topic;
- Increase in the offer of places on courses offered to the academic community, as well as the thematic content, especially covering issues that go beyond industrial property: copyright, protection of plant cultivars, among others;
- Implementation of "awareness campaigns" on the importance of IP along with graduate programs, especially in those courses in which research can generate patentable technologies and technology transfer;
- Updating of the course descriptions, of courses in all areas, to include topics related to intellectual property.

Thus, it is possible to perceive that the development of continuous lines of action aimed at the training of professors for the teaching of IP, by offering training courses, through the production of teaching materials, by offering support for the preparation of course descriptions and the design of disciplines, through lectures, and other means, taking advantage of the technical team and expertise of Unicamp's Inova, are issues that should be considered for the expansion of IP education at the university.

Final Considerations

Universities have been considered important protagonists in social and economic development, seen as a key element in National Innovation Systems (NIS) and called upon to engage more with society. This has occurred because in the light of the new paradigm of IP, what has come to be understood is that the competencies developed are very much in demand in business, in government, and also in the universities, which have begun to assume a new mission, that of fostering entrepreneurship and innovation, that is to say, they have been called to participate more actively in the promotion of innovation policies in National Innovation Systems.

It appears that the need for protection of IP assets has grown along with knowledge, and the financial benefits that derive from it are going to occupy an increasingly prominent place in the economy. Understanding these issues is essential, not only so that the IPRs can be acquired, but also so they may be exploited to greater advantage. Given these findings, what may be noted is that the incorporation of the teaching of intellectual property in the curricula of universities has been seen as one of the great challenges for the consolidation of the culture of respect for IPRs in society and even for the promotion of national ST&I policies.

The findings of the present study confirm the diagnosis made by the WIPO, in several countries, and the views expressed by scholars, that intellectual property, at Unicamp also (a research university), is not yet widespread in the curriculum of undergraduate courses and much less on graduate and extension courses. Although the culture of IP has grown and public policies have broadened on this theme, it still does not figure as something consolidated, far from it. According to the understanding of most those interviewed, the treatment given to the teaching of intellectual property at Unicamp still needs to evolve in many ways, especially with regard to decision-making, on the part of the university leadership, to organize more effective actions around this issue. It is understood that this should occur not only through the raising of consciousness within the academic community and through support for teaching, but also by structuring a specific curriculum unit with an offering that is consistent with the needs that the subject requires.

The main argument is that there should be more consistency in the teaching of IP at Unicamp, starting with the creation of guidelines, a directed curriculum and the possibility "to refine" the competence of those who teach. On the demand side, it is necessary to give more consistency to Unicamp Inova's initiatives to disseminate the central elements of the appropriation of knowledge, stimulating and strengthening the culture of IP in the university.

The establishment of these guidelines does not mean imposing a single and standardized treatment, because the issue of intellectual property has always been and will always be polemical. It is understood that the various courses should have the necessary openness to discuss and criticize the very basic principles of IP. However, even for this type of approach it is necessary to be acquainted not only with the more legal aspects of the topic, but also the social and economic aspects.

Therefore, the empirical data obtained in the ambit of the present study served to conduct an observation and analysis of what has been done in teaching intellectual property, both from a perspective of the areas knowledge, of the courses and disciplines, as well as of those who are in the forefront in this respect. The intent is to foster a debate that may be useful and perhaps culminate in initiatives aimed at improving the current situation teaching of IP, not only at Unicamp, but at other universities in the country.

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