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Information Management

Specialization in Survey Methodologies and
Marketing Research

**BRAZILIAN HIGHER EDUCATION ANALYSIS
THROUGH KNOWLEDGE DISCOVERY:
ANNUAL AND TEMPORAL APPROACHES**

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ABSTRACT

This project presents the Ph.D. thesis proposal in the Information Management area and aims to contextualize the scenario of Higher Education Institutions (HEIs) in Brazil, generate new knowledge and provide subsidies to justify the relevance of the problem investigated and its contributions.

It explores the Brazilian Higher Education Census, from 2010 to 2015, and other official and public databases in order to generate new knowledge, based on the fact that knowledge is the main factor of social development in the Age of the Knowledge Society and Economy.

It proposes to answer the following research question: "How does the annual and temporal analysis of the Brazilian Higher Education Census and other public and official databases generate new knowledge and provide strategic information to ensure the Higher Education Institutions mission's accomplishment?"

To achieve its objective, it adopts an inductive research process as a research strategy, divided into two phases: an exploratory study, followed by the knowledge generation phase. It is an interpretative, constructionist, and quantitative study.

As a methodological resource, it uses the Self-Organizing Maps (SOM), a type of neural network that explores hidden patterns in a large volume of data. In this case, specifically, it is used to discover new knowledge in the area of higher education, considering the higher education institutions, their undergraduate courses, teachers, and students.

Besides, and therefore, it assesses the internal dynamics of the higher education institutions and, according to the Resource-Based View (RBV) theory, presents a new approach to identify their internal resources - a gap in the current literature. The proposed approach contributes to fostering new forms of relationship, based on the combination of similar or complementary resources between and among the institutions, which will enable them to become more entrepreneurial and to behave more collaboratively.

The research also contributes to 1) the adoption of an innovative methodology - SOM - for the area of Education, specifically Higher Education and a new typology for grouping the educational institutions, courses, teachers and students; 2) the advancement of the theory of RBV; 3) the area of Education, lacking quantitative studies; and 4) the extension of the concept of the entrepreneurial university – the enhanced triple helices, based on their complementary and similar resources.

This new knowledge plays a significant role in the implementation of competitive responses or decisions to take in a fiercely competitive environment and contributes to the advancement of the theory under study.

Keywords: knowledge discovery, higher education, Self-Organizing Maps - SOM, entrepreneurial university.

RESUMO

Este projeto apresenta a proposta de tese de doutoramento na área de Gestão da Informação e tem como objetivo contextualizar o cenário das Instituições de Ensino Superior (IESs) do Brasil, gerar novos conhecimentos e fornecer subsídios para justificar a relevância do problema investigado e suas contribuições.

Explora o Censo Brasileiro do Ensino Superior, de 2010 a 2015, e outros bancos de dados oficiais e públicos, com o intuito de gerar novos conhecimentos, pautando-se no fato de que o conhecimento é o principal fator de desenvolvimento, tanto social quanto econômico, na Era da Economia e da Sociedade do Conhecimento.

Sendo assim, se propõe a responder à seguinte pergunta de investigação: "Como a análise anual e temporal do Censo Brasileiro de Ensino Superior (IES) e de outros bancos de dados oficiais e públicos geram novos conhecimentos e fornecem informações estratégicas para garantir o cumprimento da missão central das Instituições de Ensino Superior? "

Para alcançar o seu objetivo, adota um processo de investigação indutivo como estratégia de pesquisa, dividido em duas fases: um estudo exploratório, seguido da fase de geração de conhecimento. Trata-se de um estudo interpretativo, construcionista e quantitativo.

Como recurso metodológico utiliza os Self-Organizing Maps (SOM), um tipo de rede neural que lida com um grande volume de dados para explorar padrões ocultos. Neste caso, especificamente, com o intuito de descobrir novos conhecimentos na área da educação superior, em especial, nas instituições de ensino, seus cursos de graduação, professores e estudantes.

Além disso, e como consequência, avalia a dinâmica interna das instituições de ensino estudadas e, de acordo com a teoria da Visão Baseada em Recursos (RBV), apresenta uma nova abordagem para se avaliar os recursos internos institucionais - uma lacuna na literatura atual. Contribui também para fomentar novas formas de relacionamento, baseadas na combinação de recursos similares ou complementares entre as próprias instituições, o que lhes permitirá tornarem-se mais empreendedoras e comportarem-se de forma mais colaborativa.

Como contributos, pode-se assinalar: 1) a adoção de uma metodologia inovadora – os SOM – para a área da Educação, especificamente, da Educação Superior e uma nova tipologia para o agrupamento das instituições de ensino, cursos de graduação, professores e alunos; 2) sua contribuição para o avanço da teoria da RBV, com a proposição de uma nova abordagem para a identificação e a análise dos recursos internos institucionais; 3) a contribuição para a área da Educação, carente de estudos de natureza quantitativa; e 4) a proposição de ampliação do conceito da tripa hélice para um formato aprimorado, com base em seus recursos complementares e similares.

Esse novo conhecimento desempenha um papel significativo na implementação de respostas ou decisões competitivas a serem tomadas, em um ambiente competitivo acirrado, além de contribuir para o avanço das teorias em estudo.

Palavras-chave: descoberta do conhecimento, ensino superior, Self-Organizing Maps - SOM, universidade empreendedora.

SCIENTIFIC PUBLICATION

The results of the studies developed in this doctoral thesis were published in the following journals and conferences proceedings:

Journals:

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2. Campos, S. R. M. d., Henriques, R., & Yanaze, M. H. (2019). Knowledge discovery through higher education census data. **Technological Forecasting & Social Change**, 149 (2019) 119742. <https://doi.org/10.1016/j.techfore.2019.119742>

Conferences:

1. Campos, S. R. M. d., Henriques, R., & Yanaze, M. H. (2016). Governance of Higher Education Institutions in Brazil: An Exploratory Study Based on Supply and Demand Conditions. Paper presented at the **4th World Conference on Information Systems and Technologies (WorldCIST'16)**, Recife, Brazil. DOI 10.1007/978-3-319-31232-3_3.
2. Campos, S. R. M. d., Henriques, R., & Yanaze, M. H. (2016). Digital Humanities, MOOCs and Undergraduate Courses: An analysis of the Brazilian supply conditions. Paper presented at the **11th Iberian Conference on Information Systems and Technologies (CISTI)**, Gran Canarias, Spain. DOI 10.1109/CISTI.2016.7521425.
3. Campos, S. R. M. d., Henriques, R., & Yanaze, M. H. (2016). Online Courses offered in Brazil: Mapping the Latest Years' Context. Paper presented at the **2nd International Conference on Higher Education Advances (HEAd16)**. Valencia, Spain. DOI 10.4995/HEAd16.2016.2675.
4. Campos, S. R. M. d., Henriques, R., & Yanaze, M. H. (2017). Globalization, Internationalization, and Academic Mobility: a conceptual overview and the Brazilian National Higher Education System. Paper presented at the **9th annual International Conference on Education and New Learning Technologies 2017 (EduLEARN17)**. Barcelona, Spain. EDULEARN17 Proceedings. p. 8727-8735.
5. Campos, S. R. M. d., Henriques, R. (2018). The Knowledge Discovery through the Student's Higher Education Census Data. Paper presented at the **13th Iberian Conference on Information Systems and Technologies (CISTI'2018)**. Cáceres, Spain. DOI 10.23919/CISTI.2018.8399164.
6. Campos, S. R. M. d., Henriques, R. (2018). The Brazilian Graduate Courses Under Analysis: an overview of the Education Area. Paper presented at the **10th annual International Conference on Education and New Learning Technologies 2018 (EduLEARN18)**. Palma de Mallorca, Spain. EDULEARN18 Proceedings. p. 5542-5551.

7. Campos, S. R. M. d., Henriques, R. (2019). The Brazilian Higher Education: the undergraduate courses in light of its recent policies. Paper presented at the **International Conference on Education and New Developments 2019 (END 2019)**. Porto, Portugal. Education and New Developments 2019 - Volume II. p.371-377.

DEDICATION

I dedicate this work to my son Guilherme who has abdicated from my presence on many occasions and circumstances, so that I could dedicate myself to my studies.

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“Each one that passes in our life passes alone, but it does not go alone, nor does it leave us alone; take a little of ourselves, leave a little of yourself” (Saint-Exupéry).

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LIST OF ACRONYMS¹

AULP	Association of Portuguese Language Universities	Associação das Universidades de Língua Portuguesa
BOOCs	Big open online courses	
CNE	National Council of Education	Conselho Nacional de Educação
CPC	Preliminary course concept	Conceito preliminar de curso
DOCCs	Distributed open collaborative courses	
ENADE	National Student Perform Examination	Exame Nacional de Desempenho dos Estudantes
ENEM	National examination of secondary education	Exame Nacional do Ensino Médio
FIES	Student Financing Fund Program	Programa de Financiamento Estudantil
GDP	Gross Domestic Product	Produto Interno Bruto
HE	Higher Education	Educação Superior
HEIs	Higher Education Institutions	Instituições de Educação Superior
IGC	General index of evaluated courses	Índice geral de avaliação dos cursos
MoE	Ministry of Education	Ministério da Educação
MOOCs	Massive open online courses	
MoP	Ministry of Planning	Ministério do Planejamento
NAPs	National Education Plans	Planos Nacionais de Educação;
PEC-G	Undergraduate Program	Programa Estudante-Convênio Graduação
PEC-PG	Graduate Program	Programa Estudante-Convênio Pós-Graduação
PET	Tutorial Education Program	Programa de Educação Tutorial
PNAES	The National Student Assistance Program	Programa de Assistência Nacional ao Estudante
PNE	National Education Plan	Plano Nacional da Educação
PROEXT	The University Extension Program	Programa de Extensão Universitária
PROUNI	University-for-all Program	Programa Universidade Para Todos
RBV	Resource-Based View	Visão Baseada em Recursos
REHUF	National program for restructuring federal university hospitals.	Programa de Estruturação dos Hospitais Universitários Federais.
SINAES	National System of Evaluation of Higher Education	Sistema Nacional de Avaliação da Educação Superior
SISU	Unified Selection System	Sistema de Seleção Unificada
SMOCs	Synchronous massive online courses	
SPOCs	Small private online courses	
SUS	Unified health system	Sistema de saúde unificado

¹ For a better comprehension, the acronyms, which come from the Portuguese Language, were translated into English.

1. INTRODUCTION

The educational system of a country is, as a rule, consistent with the governmental system of that country.

Usually, the future welfare and the national purpose and public policies are dependent upon the universities and other kinds of higher education institutions (HEIs). Also, the regulatory and funding systems of higher education are national as a rule (Teichler, 2014). Education is one of the primary foundations of the economic, social, and political development of any nation (Shrivastava & Shrivastava, 2014).

However, in the last decades, around the globe, Higher Education (HE) has been subject to profound changes (Dobbins, 2011; Ramaley, 2016). Some effects faced by HEIs, in various parts of the world and, also in Brazil, are the result of some internal and external factors as the HEIs operate in broader socio-economic systems (Havas, 2009). Some of their recent problems include rising tuition fees, reducing enrolments, cuts in financial aids, and evasion rates (Weerts, 2007).

Other factors that also influence Higher Education development include demographic changes, technological advances, societal trends, new performance metrics, financial and managerial requirements. The reasons range from globalization of the economy and research to emergence of new HE 'service providers' and research performers; changing science–society links and societal demands towards universities; 'massification' of higher education; student 'consumerism'; technological development; tensions in the national or regional budgets financing higher education, the concomitant requirements of the so-called public management (accountability, transparency, efficiency and effectiveness, responsiveness); and the methods, approaches and norms to organize, manage, validate, legitimate and evaluate HE and research activities (Havas, 2009).

The HEIs also confront themselves with a more diverse generation of students (Ward, 2000), identified by a heterogeneous group concerning age, sex, socioeconomic status, race, ethnic, motivation, expectations and personal projects (Ramaley, 2016; Sampaio, 2014a).

As pointed by Teichler (Teichler, 2014), the divide of national and international dimensions, necessary to the comparative studies, note a conflict between 'the internationalization of learning and nationalization of the purposes' as even the most widely terms such as "universities", "professors" and "students" have different meanings from country to country. Even though, in recent years, the interest to investigate countries increased in the domain of higher education research (Teichler, 2014).

As a consequence, the pressures for higher education grew up, and the profit-making educational establishments expanded, creating fierce competition and an imbalanced marketing condition, which hampered the higher education institutions' flexibility and responsiveness and has threatened their financial and economic sustainability (Cucui, Robescu, Stegaroiu, & Petrescu, 2010).

As some previous research has shown, “amid demands for universities ‘to do more with less,’ national education policymakers are designing and embracing new models of governance and frequently transforming HE institutions, the role of the state, as well as the socio-economic role and function of HE” (Dobbins, Knill, & Vögtle, 2011). The higher education institutions are exposed to marketplace pressures in a similar way to other businesses (Cucui et al., 2010). Mainly as private providers, they depend on adequate enrolment growth, quality, cost-effectiveness, and equitable access to a remarkable extent. Add to this, a more “evaluative” role adopted by the state, which puts pressure on HEI's outputs (Carnoy & Dossani, 2013). This new scenery has modified, as in many different countries, the forms and mechanisms of HEIs management and governance (Cucui et al., 2010).

The knowledge economy has a significant influence on 21st-century development. In this context, the Higher Education has been considered of unprecedented relevance when it comes to the effects of globalization on countries as they are responsible for people's training and knowledge generation (Altbach, 2004; McCowan, 2016; Mendivil, 2002).

HEIs cannot avoid the inevitable global environment. They are more exposed to the inequalities among the best-internationalized institutions as part of the world system of Higher Education (Altbach, 2004). Despite this, they continue to be confronted with some challenges as access, equity, quality, and relevance (Gacel-Avila, 2012).

Considering this scenery, this project presents the proposal for the doctoral thesis in the Information Management area and aims to contextualize the landscape of Higher Education Institutions (HEIs) in Brazil, to generate new knowledge to provide subsidies to justify the relevance of the problem investigated and contributions thereunder.

1.1. Data, Information, and Knowledge: keywords

Accompanied by the rapid advances in information technologies, the scenario mentioned above demands a new role from the HEIs in this Knowledge Economy (Steiner, 2006; Weerts, 2007). The HEIs also are impacted by the notions of knowledge and knowledge production which have been intensively discussed, due to the new actors' role of producing, disseminating, using and validating knowledge (Dhamdhere, 2015; Havas, 2009). As a consequence, the HEI's deal with a large amount of data – from the inside and the outside - which allows them to get results in a more precise way; but, on the contrary, require proper methods of data analysis and knowledge synthesis (A.V, 2006; Acker, 2015; Mannoia, 2015) in an environment of enormous demographic, fiscal, political and philosophical challenges.

Over the last years, data mining (Mohamad & Tasir, 2013) and the knowledge discovery field suffered huge transformation (Piatetsky-Shapiro, 2007). The considerable amount of generated data has led to a paradigm shift in scientific research from hypothesis-driven science to a discovery-driven science (Croft, 2014; Kok, 2006). Knowledge discovery is the process of discovering useful and previously unknown knowledge by analyzing large databases by providing visualizations or information that reveal useful patterns in the data. A set of *data* will only constitute *information* if it has some meaning to the individual who receives it (Carvalho & Tavares, 2001; Davenport, 2002; Davenport & Prusak, 1998).

Knowledge, in turn, is part of the human complexity. It derives the information in the same way that the information stems from the data (Davenport & Prusak, 1998). Thus, knowledge is characterized by being valuable information resulting from reflection, synthesis and context, from multiple sources of information, processed by the human mind (Baskarada & Koronios, 2013; Davenport, 2002; Ferraresi, Quandt, Santos, & Frega, 2012). According to Delanty (Cutright, 2003), the *gaps between the creation of information – data, in its rawest form – and knowledge – senses of meaning, purpose, and direction – can revitalize the university’s purpose of critical analysis and discourse.*

The generation of knowledge results from the processing of information, which, in turn, results from the analysis of the data. Thus, knowledge is characterized as being the information of value when it results from reflection, synthesis and context, originating from various sources of information, processed by the human mind (Baskarada & Koronios, 2013; Davenport, 2002; Ferraresi et al., 2012; Innerarity, 2015). Knowledge is, therefore, the result of human activity and complexity, as proposed by Davenport & Prusak (Davenport & Prusak, 1998).

The gap between the in-depth analysis of data, with the identification of hidden or unknown patterns; the creation of useful and strategic information and its consequent generation of knowledge, according to Delanty (Cutright, 2003), if approached correctly, can revitalize the purpose of higher education institutions, generating new knowledge, based on existing official data (such as the case of this proposal) with a view to the sustainability of the HEIs themselves in the current global context.

1.2. The Problem Statement

This study aims to answer the following research question: "How can the annual and temporal analysis of the Brazilian Higher Education (HEIs) Census and other public official databases generate new knowledge and deliver strategic information to ensure the accomplishment of Higher Education Institutions core mission?"

1.3. Objectives

The **Main Objective** is:

Explore the Brazilian Higher Education Census, from 2010 to 2015, and other correlated official and public databases to generate new knowledge.

The **Specific Objectives** are:

The specific aims of the proposal comprise:

- Review the literature:
 - Identify the most relevant subjects, publications, and authors.
 - Map the existing or similar studies in Brazil and other countries.
 - Determine the variables that make up the Higher Education Systems.
- Explore the Brazilian National System of Higher Education and its Public Policy.

- Identify the Brazilian Higher Education Public Data Sources:
 - Select the relevant data sources to this research, based on the following:
 - Ministry of Education – MEC, and e-MEC
 - National Institute of Educational Studies and Research Anísio Teixeira – INEP
 - National Institute of Geography and Statistics – IBGE
- Identify the variables of the Brazilian Higher Education System.
 - Select the relevant variables that will be used in this research.
 - Define the temporal period for analysis.
 - Compare the selected time-long period variables.
- Raise the data and other related historical information that comprise the study.
- Select, prepare and organize the data.
- Analyze the data, generate new knowledge and discuss the results.
- Develop the conclusions.

1.4. Preliminary Hypothesis

HEIs increasingly have accumulated massive amounts of data due to the proliferation of information systems and technology. However, much of this information is mostly hidden, untapped, or underused. This scenery is highly expanded as we consider the universe of census data and other correlated Higher Education Brazilian public databases, where public data is available but does not generate knowledge.

Besides that, there is already a consecrated taxonomy which groups the Brazilian Higher Education Institutions based on an administrative (public or private) and academic classification (universities, academic centers, faculties, federal technological institutes, and centers) which does not create knowledge nor promotes strategic information.

Thus, we hypothesize that the use of specific techniques will help a better visualizing and understanding of the Brazilian Higher Education scenery, based on the study of the Higher Education Institutions' supply and demand conditions, bringing up hidden patterns among the microdata that will be analyzed through the Higher Education Census, detecting HEIs with similar attributes and identifying important discriminating attributes, thus generating new knowledge which will promote a different perspective of their supply and demand conditions.

Thus, this research proposes the preliminary hypothesis:

H1 – The use of special techniques that promote the visualization and understanding of hidden and unknown patterns through Higher Education public and official data can produce new knowledge.

H2 –The analysis of Higher Education public and official data and the classification of Brazilian Higher Education Institutions generate strategic information.

1.5. Study Relevance

This project proposes to develop a better visualizing and a deeper understanding of the Brazilian Higher Education scenery, bringing up hidden or unknown patterns and identifying important discriminating characteristics, resources or variables, thus generating different and new knowledge among the microdata that will be analyzed, with the purpose of contributing to future planning, to manage and support decisions, to solve common problems already stated, to face fierce competition among HEIs and to propose new ways of cooperating and collaborating.

It may produce insights and understandings for government policy-makers and for senior managers of Higher Education Institutions to identify the strengths and opportunities that could contribute to HEIs achieving competitive advantage and gaining superior institutional performance, as well as to minimize the weaknesses and threats that need to be countered or avoided in a local, regional, national or global level. It intends to promote, also, a greater and more in-depth reflection on the public policy adopted for higher education in the country.

As scholars around the world state the problems faced by the Brazilian Higher Education Institutions as “global”, this will also be a contribution to other Higher Education Institutions, which face similar challenges, from a global perspective.

From the standpoint of Science, it will help to stimulate the advancement of the State-of-the-Art on issues dealing specifically with Knowledge Discovery, concerning supply and demand conditions and correlated subjects as the RBV Theory, from the perspective of Higher Education, focusing on higher education institutions, their undergraduate courses, students and professors, as a consequence of the data analyzed.

It also stands out imminently for its scientific interest because, when addressing themes inherent to Higher Education in Brazil and generating new knowledge, it intends to create qualified scientific publication, promoting a better understanding of higher education in the country, thus identifying trends and challenges, as well as other characteristics that distinguish it from others.

The Brazilian Higher Education System is the largest higher education system and the one who has relied the most on the private for-profit sector among the Latin America countries (Salto 2017), and its university governance has assumed characteristics that are not necessarily seen elsewhere. Because of this, we believe that it can be of interest to the international audience.

Additionally, it addresses significant gaps like the limited studies considering the context of the HEIs in developing countries; and the concern about the expansion, the democratization and the equitable growth of the HEIs which is not limited to the Brazilian policies, as other countries also have the same concerns (Mccowan, 2007).

If, on the one hand, Brazil faces demographic challenges experienced by other countries in other periods, on the other hand, it has some peculiarities, such as the system of course evaluation, most private institutions and the government programs of funding and use of

vacancies, for example, that can contribute with other countries policies development. In addition, this research allows us to identify the current supply conditions to plan the future.

This research focuses on Brazilian Higher Education and is generalized at the national territory level. It may be of interest to other countries that fall under the same conditions, whether they are interested in evaluative policies, have similar public and private policies towards Higher Education, have such socio-economic conditions or are subject to vast territorial dimensions.

However, advancing the state of the science regarding the generation of knowledge that is proposed, based on the gap identified in the literature review, this proposal aims to contribute to different knowledge areas as Education Policies, Administration of Educational Systems or Higher Education Management (specific sectors), Marketing and Information Management. It is also innovative relating to the comprehensiveness in data analysis and the method adoption for the treatment of educational data.

2. LITERATURE REVIEW

2.1. Higher Education

2.1.1. The History of the Universities and the Higher Education

The history of Higher Education is different from all other levels of education, as some universities are among the oldest learning institutions in the world (Roser & Nagdy, 2016).

Universities, like cathedrals and parliaments, are a product of the Middle Ages. The Greeks and the Romans had no universities in the sense in which the word has been used for the past centuries (Haskins, 1957). They had higher education, but the terms were not synonymous, and their instructions in law, rhetoric, and philosophy were not organized in the form of permanent institutions of learning (Haskins, 1957).

In the past, there were very few higher education institutions since a tiny fraction of the population could read or write. During this early period, centers of education mostly had a religious focus and trained clergy. In Western Europe, these centers were called monasteries, while in the Islamic world, these were called the madrasas (Roser & Nagdy, 2016). The development of the HEIs and, consequently, Higher Education, over the last millennium, was closely related to religion (Roser & Nagdy, 2016).

Only in the twelfth and thirteenth centuries, those features of organized education emerged in the world, represented by faculties and colleges and courses of study, examinations, and academic degrees (Haskins, 1957).

Between the end of the first millennium and the 13th century, the center's number proliferated, before coming to a halt and declining. At the same time evolved a new form of higher education institution: the university. These secular institutions began to rise as monasteries slowly started to decline, and the religious powers lost their monopoly on higher education.

Historically, the term university has no connection with the universe or the universality of learning. It denotes only the totality of a group, whether, of barbers, carpenters, or students did not matter (Haskins, 1957). The term itself does not appear in the documents, and it is taken for granted as a group of an organized body of masters (Haskins, 1957).

Another institution that goes back to the twelfth century is the college. Formerly merely an endowed hospice or hall of residence, the college became an established unit of academic life at many universities, founded to secure board and lodging for poor scholars who could not pay for it themselves, and usual centers of life and teaching. Colleges had buildings and endowments if the university had not (Haskins, 1957).

The contrast between the early universities and the ones of nowadays is broad as throughout its origins. The medieval universities did not have any libraries, laboratories, or museums, endowments or buildings of its own and were "built of men" (Haskins, 1957).

It is in institutions that the university tradition is most direct. First, the very name of the university, as an association of masters and scholars leading the typical life of learning. Next, the notion of a curriculum of study, definitively laid down about time and subjects, tested by an examination and leading to a degree, as well as many of the degrees themselves – bachelor, as a stage toward the mastership, master and doctor. Then, the faculties and colleges, wherever the residential college still survives. The essentials of university organizations have lasted for more than seven hundred years, and the medieval university “was the school of the modern spirit” (Haskins, 1957).

In the 15th century, there were 17 universities in Italy and 9 in the Iberian countries. After that, there were no new universities in these two regions and only one new institution in France. However, in the northern countries – especially in Germany and Central Europe – the rise of universities intensified and more universities were founded as time passed by (Roser & Nagdy, 2016).

By the end of the middle ages, at least eighty universities had been founded in different parts of Europe (Haskins, 1957). As late as the 18th century, there were still fewer than 100 universities in Western Europe (Roser & Nagdy, 2016).

2.1.2. Universities in the Contemporary World

The University of the Twentieth Century is the lineal descendant of medieval Paris and Bologna universities. The fundamental organization, the historical continuity, and the university tradition of the modern world are the same (Haskins, 1957).

Despite that, across the world, in the early twenty-first centuries, they find themselves in a paradoxical position, as they have been so numerous and, consequently, never have they suffered from such a lack of confidence or loss of identity. Since their origin, the universities are intellectual, educational, scientific and cultural entities and higher education is considered a public good, not a set of private benefits for those who happen to participate in it (Collini, 2012), not only of economic relevance (Collini, 2012).

But because of the considerable expansion of the recent decades which involved a growth not only in the number of students but also in range of subjects and types of institutions, even the term “university”, depending on the country, is applied to a great variety of forms of post-secondary educational institutions (Collini, 2012) which serve from several essential social functions, from vocational training to technology transfer, from inculcating civic values to enabling social mobility.

Also, universities not only operate within different cultural and intellectual traditions but their relations to their respective states vary enormously, especially their financial relations, added to the fact that governments have respected the principle of the autonomy of the universities, leaving them to determine their internal affairs, including their academic programs.

Three different ideas of University can be distinguished along with their history.

According to Cardinal Newman *apud* (Kerr, 1911), the “idea of University” was “the high protecting power of all knowledge and science, fact and principle, inquiry and discovery, experiment and speculation; it maps out the territory of the intellect, and sees that... There is neither encroachment nor surrender or any side”. Newman’s idea of University has its devotees – chiefly the humanists and the generalists and the undergraduates.

A different perspective was the one proposed by Flexner’s idea of a “Modern University.” “A University,” said Flexner *apud* (Kerr, 1911), “is not outside, but inside the general social fabric of a given era. It is not something apart, something historic, something that yields as little as possible to forces and influences that are new. It is on the contrary an expression of the age, as well an influence operating upon both present and future.”

It was clear, according to (Kerr, 1911), that Universities have changed profoundly and commonly in the direction of the social evolution of which they are part. In the words of Flexner, the university became “an institution consciously devoted to the pursuit of knowledge, the solution of problems, the critical appreciation of achievement and the training of men at a high level.” The Flexner idea still has its supporters – chiefly the scientists and the specialists and the graduate students (Kerr, 1911).

As Flexner was writing about the Modern University, it, in turn, was ceasing to exist, as the universities were becoming too many things simultaneously as, per example, secondary schools, vocational schools, teacher-training schools, research centers, uplift agencies, businesses and so on. Their needs were cheapened, vulgarized, and mechanized and they became service stations for the public.

“The idea of a Multiversity” (Kerr, 1911) capture the huge variety of activities carried on in a major research university, to illustrate these pluralities where the institutions have an extremely diverse existing reality (Collini, 2012) with its practitioners – chiefly the administrators, who number the many of the faculties among them and the leadership groups in society at large. “Multiversity” was the term introduced in 1963, by Clark Kerr (Collini, 2012).

Besides that, and in addition to the above, nowadays, universities have a further peculiar characteristic as they are among the few ones whose rationale includes the selection and shaping of their future staff. The forming of future scholars and scientists is intrinsic to their character (Collini, 2012).

These three several competing visions of the nature and purpose of universities, each relating to different layers of history and forces, cause much of the *malaise* in the university communities (Kerr, 1911).

In Brazil, the emergence of the university begins with the arrival of the Portuguese court in Rio de Janeiro, exactly 308 years after the discovery of the colony by Cabral, which means in 1808.

2.1.3. The Brazilian Education

The Federative Republic of Brazil is the largest country in both South and Latin America. With 8.5 million squares kilometers, with over 210 million people, Brazil is the fifth-largest country by area and the sixth most populous.

The current Brazilian Education System is ruled by (Schwartzman et al. 2015) a) the Constitution of 1988 (Brasil, 1988), which is a result of the re-democratization period occurred in 1985 and considered the education as a universal right promoted and protected by the government (Klein and Schwartzman 1993); b) the Law of Directives and Bases of Education (LDB, Law No. 9.394, Lei de Diretrizes e Bases da Educação, in Portuguese) (Brasil 1996) passed in 1996 and, c) the National System of Higher Education Evaluation (SINAES) (Brasil 2004), approved in 2004, which is responsible for the higher education quality assessment (Amaral and Polidori 1999; Stanek 2013).

Education, in Brazil, is constituted by a system which englobes the municipality, the state, and the federal levels. Early childhood education is regulated and provided by the municipality. The primary, secondary, and tertiary educations are regulated and provided by the state and federal public and by the private institutions. The private institutions also offer education at all levels and are under the approval and regular evaluation of the Ministry of Education (MoE). The primary education (children aged from 6 to 15) is the only level considered compulsory in the country (Amaral and Polidori 1999; Stanek 2013).

Brazilian Education, according to the Federal Constitution of 1988 (Brasil, 1988) and the Law of Directives and Bases of Education – LDB (Brasil, 1996), is organized in the form of the educational system.

A system of education presupposes a set of material elements (educational institutions) and ideals (laws and norms that govern educational institutions) (Oliveira; Morais & Dourado, s/d).

The Brazilian educational legislation uses the term educational system as an administrative criterion, where educational norms and laws interconnect a set of educational institutions.

The LDB, in turn, provides that the Federal Government be responsible for coordinating the national educational policy and for articulating the different levels and systems of education (Brasil, 1996; Oliveira; Morais & Dourado, s/d.)(Article 8 § 1).

The National Educational System is thus organized into three distinct teaching systems, depending on its political-administrative dependence: Federal, State, and Municipal.

Table 1 The National Educational System Responsibilities

System	Responsibilities
Federal	It is under the responsibility of the Federal Government. It refers to the institutions, organs, laws, and norms, concretizing in the states and municipalities, in their educational systems. According to LDB, it includes

educational institutions maintained by the Union; institutions of higher education created and maintained by private initiative; and federal education agencies. It also oversees and inspects various private higher education institutions.

It is responsible for a large part of the students of various degrees and modes of education, teachers, servers, public and private schools, and it exercises control over supplementary education and free courses that occur outside the school.

State

It assumes functions of maintaining education in the state sphere, besides performing normative, deliberative, consultative, and fiscalizing functions in the official and private networks. According to the LDB, the states will oversee organizing, maintaining and developing the official bodies and institutions of their educational systems; and develop and implement educational policies and plans in line with national education guidelines and plans, integrating and coordinating their actions and those of their municipalities.

Municipal

The municipality was recognized as an administrative body in the 1988 Federal Constitution, which enabled it to organize its educational systems in collaboration with the Union and the States. According to the Federal Constitution of 1988, the municipalities mainly work in elementary education, kindergartens and pre-school.

Brazilian Education is organized into two levels: basic education and higher education.

Basic education is organized in kindergarten (nursery and pre-school), elementary school, and high school.

Higher education is organized into courses and programs: undergraduate courses; masters and doctoral programs; and specialization, improvement and updating courses at the postgraduate level; sequential courses of different fields and levels; and other extension courses and programs.

As for the administrative category, educational institutions may be public (maintained and administered by the public authority) or private (maintained and administered by individuals or legal entities under private law).

Each system is responsible for the organization and maintenance of its educational network and the elaboration and execution of its policies and educational plans. At each administrative level, an education council exercises normative, deliberative, supervisory and planning functions.

The National Council (CNE) is a collegial body of the Ministry of Education (MoE) that regulates the federal education system and promotes the articulation between the other systems. In addition, the MoE is the body responsible for the elaboration and implementation of educational policies at the national level.

With the policy of decentralization of education, the Federal Government passed to the states and municipalities many of its attributions.

Despite the fact the Brazilian Educational System englobes both the basic and the higher education levels, this research focuses on the Higher Education System.

2.1.4. The Brazilian Higher Education System

The entrance to Higher Education Institutions (HEIs) in Brazil is based on the completion of the secondary school and on the achievement of some specific exams conducted by the HEIs themselves called “vestibular” (Mccowan, 2007). Despite that, in 1998, the Ministry of Education implemented another exam called National Examination of Secondary Education (Exome Nacional do Ensino Médio, ENEM, in Portuguese) which, since 2009, was the official entrance exam. Since then, lots of HEIs have replaced their proper entry exams by ENEM or used it in addition to theirs (Stanek, 2013). ENEM is not mandatory but has been considered a prerequisite for students who want to enroll themselves or participate in various government scholarship and funding programs.

The HEIs are under specific administrative categorization in Brazil. The public ones are maintained by the government in the form of (1) Federal, (2) State or (3) Municipal institutions. They are financed by the State and do not charge tuition or monthly fees. Private HEIs are managed by individuals or legal entities under private law, whether or not for-profit (Brasil, 1996a).

Regarding the academic classification, HEIs may receive different denominations. (1) The University, according to the LDB, is a multidisciplinary and comprehensive academic institution that has institutionalized intellectual production, besides presenting minimum academic qualification requirements (one-third of masters and doctorates). It is autonomous to create courses and academic and administrative offices, to issue diplomas, to establish curricula and number of vacancies, respecting the current legislation and the constitutional norm. The universities are the only educational institutions obliged to do research.

The University Center is a multicurricular institution, which covers one or more areas of knowledge. It is like the University regarding structure but does not present the requirement for institutionalized research.

The College or Faculty has two connotations. The first is that they do not have the autonomy to confer titles and diplomas. Therefore, they do not have the function of promoting graduate studies. The second connotation refers to specific organic or institutes or similar organizations. The colleges or faculties are concentrated on undergraduate teaching. Some of them can also develop community services.

The Federal Institutes are units focused on technical training, with professional qualification in diverse areas and the Federal Center of Technological Education equates to the university center.

The Brazilian HE offers (1) the undergraduate courses, which are tertiary degree courses, open to candidates who have completed the secondary school or equivalent and have been

classified in an entrance process, conferring the Bachelor, Licentiate (teacher training) or Technology degrees; (2) the *stricto sensu* graduate courses which comprises masters and doctoral programs, which confer diploma to the graduates; (3) the specialization or *lato sensu* graduate courses, which are programs open to undergraduate candidates who meet the requirements of the educational institutions, and confer them certificates; (4) the medical residency, which is a *lato sensu* graduate program, specializing in the medical field; (5) the multi-professional residency in health, which is also a *lato sensu* graduate program in health areas other than medicine; and (6) the extension or service community courses which are a training program, aimed at strengthening the relationship between university and society.

The undergraduate courses can be offered in two distinct modes, the classroom mode, and the e-learning mode. In Brazil, the e-learning mode courses are also less expensive than the classroom ones, can achieve a higher number of students in different geographic areas – as the Brazilian territory is vast - and has increased its offer substantially in the last decade.

2.1.5. The Historical Context of the Brazilian Higher Education

As already mentioned, the Higher Education System in Brazil is the largest higher education system and the one who has relied the most on the private for-profit sector among the Latin America countries (Salto 2017), and its university governance has assumed characteristics that you do not necessarily see elsewhere. Thus, this research addresses significant gaps like the limited studies considering the context of the HEIs in developing countries; and the concern about the expansion, the democratization and the equitable growth of the HEIs which is not limited to the Brazilian policies, as other countries also have the same concerns (Mccowan 2007).

It has also been faced with the same stated factors like the demographic changes, the technological advances, the societal trends, the financial and managerial requirements, added to the globalization and, more recently, the internationalization process of Higher Education, which have been affecting the undergraduate courses' supply and demand conditions. It is important to mention that the graduate courses are also under this scenery, but they will not be the main concern of this study.

Until the '60s, the Higher Education in Brazil was marked by a limited supply. There was a significant number of "surplus" students for places offered which translated into "candidates who obtained the average rate in HEIs entrance exams but could not enroll because the number of approved candidates extrapolated the number of places available" (Braghini, 2014). This condition was due to a significant number of students who concluded secondary school due to promote policies to higher levels and financing of studies (Braghini, 2014). This period was considered to be elitist (Schwartzman, Pinheiro, & (eds.), 2015; Strauss & Borenstein, 2015), as only students with a more privileged social-economic condition could enroll and pass the public HEIs exams (Mccowan, 2007).

At the end of the '60s, this situation begins to revert to the idea of "expanding with restraint," supported by an incipient funding policy to public and religious institutions to partially fill this existing demand (Braghini, 2014; Martins, 2009; Tavares et al., 2014). This period was also

marked by an authoritarian regime (1970-1985), where few actors took part in the decision-making process in the country (Klein & Schwartzman, 1993).

In the '70s, the first expansion of higher education occurred, led by the private sector, to increase the number of educational institutions, courses, places, and enrolled students (Sampaio, 2014a). This period was called the Reform of 1968, where students and teachers' movements started to grow and the Brazilian higher education institutions established their basis of action, focusing on research, teaching and community services altogether (Klein & Schwartzman, 1993). Their focus was to absorb the growing demand of rising students in HE, despite there were very poor criteria concerning the qualification of the courses.

The late '80s and early '90s were marked by periods of growth interspersed with stagnation due to the economic crisis experienced by the country, evidenced by high rates of inflation and unemployment (Martins, 2009). In addition, the government involving two different ministries – the MoE and the Ministry of Planning (MoP), which relied on specialized and professional expertise, according to technical rather than political criteria, created the dual funding system. Only after 1985, with the re-democratization of the HE, there was a focus on courses and institutions evaluation procedures. Important to state that the new constitution of 1988 (Brasil, 2018) was approved in 1987.

From the end of the '90s, a significant increase in places occurred, broadening people's access to higher education. From 1994, private higher education institutions were encouraged to increase the number of places offered. After 2002, also the number of places offered by public higher education institutions increased, due to the REUNI Program, which focused on the expansion and the restructuring of public institutions. This was the so-called democratization period (Martins, 2009) or universalization of higher education (Gomes & Moraes, 2012; Lima, 2013).

Complementarily, to improve the entrance of the lower-income students to the HEIs, in 1999 the government creates the loan scheme called FIES, which funded up to the 100% of the educational fees charged by HEIs, depending on the monthly gross family income and the commitment to monthly tuition costs (Brasil, 2018). FIES is paid to the HEIs directly, and the student's repayment starts after the undergraduate course's conclusion.

As the courses aroused without a proper regulatory framework, their quality was doubtful. Many HEIs focused on the courses, which do not demand investments in infrastructure and staff. Even though, since 2004, with the SINAES legislation, the concern about their quality increased, and a process of regular assessment was implemented (Strauss & Borenstein, 2015).

The Higher Education Institutions in Brazil are evaluated through an indicator called the General Index of Evaluated Courses (IGC). The IGC considers the CPC² of the courses evaluated in the year of calculation and the two previous years, its disclosure always refers

² The CPC is an indicator of quality that evaluates higher education. It is calculated in the year following the completion of the ENADE of each area, based on the performance evaluation of students, faculty, infrastructure, didactic-pedagogical resources and other inputs, according to technical guidance approved by MEC/INEP. ENADE – The National Student Performance Exam - is a mandatory exam that evaluates the performance of undergraduate students in relation to the syllabus contents, skills and competences acquired during their undergraduate course.

to a triennium, thus comprising all areas evaluated or even the whole evaluation cycle. It considers the 1–5 score and the 's/c' (without grade) category (Sílvia Regina Machado de Campos, Henriques, & Yanaze, 2017).

From a social point of view, while the wealth students attended public institutions, the low-income students were confined to the lower quality ones (Klein and Schwartzman 1993; Mccowan 2007).

Until the 80-90 decades, the fees for many courses in the private institutions were out of the reach for most Brazilian students. Recently the HEIs have adopted a lower-fee strategy to enable access to lower-middle-class students, to supply the vacant places, and to assure the HEIs' sustainability (Carnoy et al. 2014).

Concerning the public funding, the government launched one of its most famous programs, the so-called FIES, which was extinguished in 2017 due to the recent economic and politic crisis. Before being extinguished, the FIES allowed many low-income students to enter the HEIs. With its extinction, many students evaded from private institutions, as they were dependent on government funding. Since 2018, the government has proposed a new FIES program (p-FIES), which intended to provide funding to students in non-free higher education courses, with positive evaluation in the processes conducted by the Ministry of Education. The conditions for granting student finance will be defined between the loan operator (bank), the higher education institution, and the student.

In 2004, the government set the PROUNI (University for All) program, where the private institutions offered empty places for free to the low-income students in return to tax exemptions (Carnoy et al. 2014; Mccowan 2007; Schwartzman et al. 2015). In the last years, other kinds of private funding also appeared, offered by banks and specialized enterprises, to deal with the students' monetary restrictions.

Despite the Brazilian Government efforts to improve the student's enrolment in the last decades, there were still unfilled places due to different reasons. The first, because it has a very competitive entrance process, addressed to the wealthy citizens, as occurred in the past, and second, as the HEIs are confronted with a massive number of places already offered at modest prices. This expansion was called the democratization period (Martins 2009) or universalization of higher education (Gomes and Moraes 2012; Lima 2013; Mccowan 2007), despite that, the democratization is still restricted to part of the students (Mccowan 2007).

To deal with this situation, in 2012, Brazil passed the most comprehensive affirmative action law in the history of higher education (Carnoy et al. 2014; Stanek 2013).

Despite being free-of-charge, public institutions continued to be elitist, and inequality continues to exist (Mccowan 2007). However, with the adoption of affirmative laws and policies, they started dealing with other kinds of problems. The enrolled low-income students could not afford the expenses of their studies (Mccowan 2007). This fact also contributed to their evasion from the institutions.

The Brazilian HE still maintains an anomaly, as most primary and secondary well-known institutions are private, but the federal and state public institutions (Mccowan 2007) maintain the most recommended tertiary institutions. From the Latin American countries, Brazil is the one who has relied the most on the private for-profit institutions. This occurrence impacts in the job market, as for the most of low-income youth, the undergraduate diploma is considered an opportunity to improve their life status or getting upward mobility through a more important job or upgrading their present career and achieving better life conditions (Carnoy et al. 2014; Klein and Schwartzman 1993; Schwartzman et al. 2015).

The considerable increase in the number of private institutions and places created a more competitive environment among them in search of students, resources, quality, price, and excellence (Torres and Schugurensky 2002). The installments started to fall aggressively to try to meet the shortage of students or capture new ones to supply the places and available infrastructure and to continue serving the lower-income class. The price policy adopted by lots of private for-profit institutions differed from the policies adopted by non-profit institutions. Besides, it is essential to state that this increase in the number of courses and places created a price war. Courses fees, nowadays, vary from R\$ 50,00 (US\$ 13.30) to R\$ 11.000,00 (US\$ 2,925.54) paid monthly in the private HEIs, but free of charge in the public ones.

Besides, there was an increase in other types of undergraduate courses, such as technologists training courses or those offered in distance or online mode, which increased the programmatic diversity.

The globalization process and the recent market conditions influenced the governance model adopted by the HEIs in Brazil, especially in the way the institutions are founded and managed (Torres and Schugurensky 2002). A considerable number of mergers and acquisitions occurred, with the most prominent for-profit traded domestic and international groups buying the smallest institutions and concentrating the offer (Salto 2017; Schwartzman et al. 2015; Weidman 2014).

In 2017, the Ministry of Education (MoE) published new ordinances (Brasil 2017), decrees and instruments focused on the evaluation processes of the HEIs and their courses, which immediately took effect. (Brasil 2017). At this moment, the HEIs are adapting themselves to the new assessment procedures, which became more subjective, allowing a more creative and innovative behavior.

Concerning the future perspective, the HEIs might still face a different scenery, as the size of the Brazilian youth, especially the one aged from 18 to 24, considered ideal for the Tertiary Education, is not presented in ascending order. Thus, in the near future, the HEIs will deal with the lack of youth students and the ageing of the current population, as already seen in other countries, like USA (Buss et al. 2004; Noorbakhsh and David 2002; Radner and Miller 1970; Savoca 1990; Tierney 1982; Toutkoushian 2001; Wetzel et al. 1998), Canada (Mueller and Rockerbie 2005), Vietnam (Glewwe and Jacoby 2004), Puerto Rico (King 1993), Norway (Canton and de Jong 2005), China (Li et al. 2008), Spain (Rahona López 2009), United Arab Emirates (Wilkins 2010), Turkey (Gölpek 2012), and Germany

(Hübner 2012) which faced, at different periods of their history, similar situations of demand oscillation.

The student's political activism has been a subject of concern amongst developing countries and their HEIs. Although many academics, managers, and politicians see it as a negative aspect, the student movement contributes to the construction of the country and political socialization. In Brazil, traditionally, these movements were concentrated among students of social and human sciences courses (Altbach 1984), and it is still the same way. The student's political activism is not a priority for most of the students, and their engagement was limited, in the last years, to some specific movements (Schwartzman et al. 2015).

Regarding equity, the government has not achieved its goals, maintaining a policy focused on the purposes of the most privileged (Carnoy et al. 2014). Due to the actual economic and political crises, most of the working and low-income students evaded from the private institutions to focus on their working tasks, due to the funding policies restriction and to their own families' budget restrictions. Student and teacher movements are fewer in number than in the past and focused on topics of interest.

With the Brazilian expansion policy of higher education in the two recent decades, as a result, higher education institutions face more significant competitiveness in search of students, resources, quality, and price, in addition to offering other courses modalities, such as technologists training courses or those provided in e-learning or online mode.

This condition also demands from Brazilian HEIs a new approach and posture, as directly reflected in their forms of governance and sustainability.

2.1.6. The Dynamics of the Higher Education Undergraduate Courses

Brazilian Higher Education has some specific characteristics (Schwartzman et al. 2015). The entrance to the public HEIs, at the undergraduate level, is very competitive as the public institutions are considered the best institutions and are tuition-free. Historically, only the students with a higher economic and social status can achieve the scores to study in the best public universities. On the other hand, lower-income students mainly frequent public primary and secondary schools in the country. According to Fischmann (2005), Brazil is still recognized as a 'racial democracy,' although the inequality is at one of the highest levels in the world and, consequently, affects all levels of Education.

2.1.7. The Brazilian Higher Education main Projects and Programs

Increasingly, in a world where the demand for knowledge is in opposition to the availability of resources as a factor of sustainability and competitiveness in the market, the importance of the level of schooling and Higher Education grows.

Given this context, this subchapter presents the National Policy and System of Higher Education, according to the MoE of Brazil (NAPs) (MEC, 2014) and in line with the National Education Plans (NAPs) , approved for the periods 2001-2010; and from 2014 to 2024; and the Higher Education Census (MEC, INEP, 2013, 2014, 2015), especially those that refer to Higher Education.

It is assumed that the term "policy" is used to designate the set of actions aimed at achieving objectives that require the efficient participation of the State to plan and carry out collective actions, as it happens with Education (P. d. Educação, 2013).

According to the MoE, the objectives of the current National Education Plan (PNE) 2014-2024 (MEC, 2014) are to broaden and democratize access to quality higher education by recognizing the strategic role of universities for economic and social development. In addition to providing this level of teaching to a more substantial part of the population as a decisive factor for the reduction of social and regional inequalities; for scientific and technological development; for social inclusion and the generation of work and income.

The programs developed by the Ministry of Education of Brazil and that make up the National Education Policy, in the scope of Higher Education, are:

The National Student Assistance Program (PNAES), which aims to enable equal opportunities for all students and contribute to the improvement of academic performance, providing student housing, food, transportation, health, digital inclusion, culture, sports, day-care, and pedagogical support.

The Include Program: Accessibility in Higher Education aims to foster the creation and consolidation of accessibility centers in federal universities, which are responsible for organizing institutional actions that guarantee the inclusion of disabled people in academic life, eliminating pedagogical, architectural barriers and in communication and information, promoting compliance with legal accessibility requirements.

About the educational qualification, the following are highlighted: **The University Extension Program (ProExt)**. The initiative encompasses university extension programs and projects aimed at encouraging university actions designed to promote public policies and strengthening the institutionalization of the extension within HEIs. In addition, about undergraduate projects, the **Tutorial Education Program (PET)** supports academic activities that integrate teaching, research and extension through learning tutorial groups, consolidating itself as a significant action developed by scholarship students who rely on Mentoring of a Ph.D. professor.

The **Abdias Nascimento Academic Development Program**, aimed at the exchange of black, indigenous and disabled students, global developmental disorders and high skills enrolled in higher education, seeks to offer educational experiences in science, technology, innovation, and teacher training, to complement the training of these students.

The **University for All Program (ProUni)**, established in 2005, extends access to higher education by granting scholarships to low-income students in private institutions in exchange for tax exemptions.

The **Student Financing Fund (Fies)** is one of the most important instruments of the Federal Government to increase access to higher education.

The **Permanency Grant Program** grants financial assistance to undergraduate students enrolled in governmental higher education institutions from public schools, with per capita income of up to 1.5 minimum wages.

The **Unified Selection System (SISU)** is an initiative that allows the selection of students for the higher public education of the country, based on the grades obtained in the ENEM, through a computerized system.

In the area of health literacy, we highlight the edition of Law No. 12,871 / 2013 that instituted the **Mais Médicos Program**. The program aims to improve the service to users of the Unified Health System (SUS). The initiative also provides for the reordering of the offer of medical courses and vacancies for a medical residency, prioritizing health regions with a lower ratio of jobs and physicians per inhabitant and with a structure of health services in conditions to offer a sufficient field of practice and quality for the students. With the enactment of this law, new vacancies were created in medical graduation courses in public and private institutions, as well as the pre-selection of municipalities for the installation of private medical courses. Also, under the scope of the Program is the National Policy for the Expansion of Medical Schools of Federal Institutions of Higher Education that provides for the provision of new vacancies until 2017, which includes the creation of new courses.

The **National Program for Restructuring Federal University Hospitals (REHUF)**, implemented in partnership by the Ministries of Education and Health, has as its objective the material and institutional conditions for federal university hospitals to adequately perform their functions about the dimensions of teaching, research and community services (extension), and size of health care.

Regarding the evaluation of higher education, it is worth mentioning the National System of Evaluation of Higher Education (Sinaes), instituted since 2004, by Law No. 10,861, which carries out the national evaluation process of higher education institutions, their undergraduate courses and the academic performance of their students (ENADE), with the purpose of improving the quality and orientation of the expansion of the higher education.

The **National Student Performance Examination (ENADE)** aims to measure student achievement in undergraduate courses about program syllabus, skills, and competencies. It is one of the pillars of the evaluation of Sinaes and is a valuable tool for measuring and promoting quality for undergraduate and higher education policies. Its evaluative cycle is triennial.

In the scope of Development Cooperation, in addition to the traditional **Undergraduate and Graduate Program (PEC-G and PEC-PG)**, the actions developed in Africa and Mercosur deserve special mention. In Africa, the programs drawn up by the Association of Portuguese Language Universities (AULP) range from the scientific training of university students to the implementation of distance higher education, involving the mobility of students, teachers, and researchers. In Mercosur, in turn, the program's objective is to promote mobility programs in higher education, involving students, faculty, and scholars, to provide a qualitative leap in regional cooperation.

In order to better understand the functioning of the Higher Education sector in Brazil, the Higher Education Institutions (HEIs) are classified according to the Higher Education Census (MEC, INEP, 2014) in administrative categories (federal public, state public, private for-profit, private for non-profit, and special); and academic classes (University, University Center, faculty, federal institute of education, science and technology, and federal center of technological education), among others. They are responsible for offering educational services that involve undergraduate courses that confer different academic degrees at the end, such as a bachelor's, licentiate's (teacher's training) or technologist's degree.

In addition to undergraduate courses, some institutions also offer the so-called 'sequential' courses of specific training and higher training courses for technicians. These courses can be offered, observing the regulatory requirements, in classroom or distance (on-line) mode.

Education is an inalienable social right, and it is up to the government to offer it. Thus, the State must organize itself to guarantee the fulfillment of this right, through a National System of Education, currently lacking in Brazil.

2.2. Educational Marketing

The terms 'Supply' and 'Demand' come from the Offer and Demand Law. They are used to identify the relationship between the demand for a product and the amount (of the same product) offered and, also, to describe the consumer's behavior in the purchase of goods and services at certain times, about its amount and price (Miranda, 2012).

In periods when the supply of a product far exceeds its demand, the product's price tends to fall. When the demand for a product begins to outstrip the supply, the trend is the increase in the product's price. The stabilization of the relationship between supply and demand would, in the first instance, lead to a stabilization of the price and a situation of "balance."

Competition could disrupt these relationships, causing price changes. Other factors, besides prices, are included in the conditions of variation between supply and demand. The value of a product can be a positive or negative incentive for consumers to buy the goods or services they need, though not the only one. Thus, other factors have been identified as participants in the variation between supply and demand, such as consumer wants, desires and needs; purchasing power; availability of services; and offering and capacity of institutions (Miranda, 2012).

One can also add to this discussion, dimensions related to the offering, for example, of products and/or services focused on generating knowledge, involving not only the study of their economic value but also its relationship and impact on its social value (Y. J. Kim & Lee, 2015).

When it comes to the Higher Education Area, in Brazil, it is essential to add that only the Private Higher Education Institutions are exposed to market supply and demand conditions, as the undergraduate courses offered by the Public HEIs are free.

Over the past decades, numerous authors have studied the relationship between supply and demand in higher education institutions to identify the demand of students and quantify

it appropriately (Canton & de Jong, 2005; Duchesne & Nonneman, 1998; Robert K Toutkoushian, 2001; Vieira, 2011-2015).

2.2.1. Previous Studies on Supply and Demand Conditions

Researchers have studied the relationship between supply and demand in higher education institutions to identify the factors that influence them.

These studies are categorized according to the data level of aggregation (microlevel and macrolevel) and its type (cross-section or time-series studies) (King, 1993). In addition, these studies have varied significantly in terms of the sources of data, the periods studied, the methods of analysis, and the population considered.

Countries such as The United States (Buss, Parker, & Rivenburg, 2004; Noorbakhsh & David, 2002; Radner & Miller, 1970; Savoca, 1990; Tierney, 1982; Vieira, 2011-2015; J. Wetzel, D. O'Toole, & S. Peterson, 1998a), Canada (Mueller & Rockerbie, 2005), Vietnam (Glewwe and Jacoby, 2004), Puerto Rico (King, 1993), Norway (Canton & de Jong, 2005), China (Li, John Morgan, & Ding, 2008), Spain (Lopez, 2009), United Arab Emirates (Wilkins, 2010), Turkey (Gölpek, 2012) and Germany (Hübner, 2012) faced, at different periods of their history, similar situations of high demand and low supply, interspersed with periods of high supply and low demand.

According to Wetzel, O'Toole, and Peterson (J. Wetzel, D. a. O'Toole, & S. Peterson, 1998b), most of these studies have limitations or restrictions with respect to the definition of the terms used, the characteristics of the studied units (if public or private institutions, and if aggregated or isolated) and how to obtain the data. They are also restricted to the inherent educational policy issues in their respective countries and limited to the use of a small number of variables.

Besides that, methodological shortcomings and bias in the choice and weighting of indicators are also negative consequences, as pointed out by Millot (Millot, 2015). There are difficulties in comparing higher education systems as universities and HE systems in different countries operate at different levels. The national universities function at the micro-level, while the HE system works at the macro-level (Millot, 2015).

The value of comparative studies for higher education is recognized. However there is little consensus about the specific approaches, as the research addressing the phenomena of similar higher education systems deals with more than one culture, society or nation systematically (Reale, 2014b; Teichler, 1996, 2014).

Thus, this kind of research has faced many challenges, as pointed by (Teichler, 1996, 2008, 2014, 2015) due to its complex context; it varies substantially between countries regarding the size and the role it plays. Research on higher education tended mostly to focus in the past on individual countries as it 'forms the basis of analysis or the interpretative framework' (Teichler, 1996).

In this area, international and comparative research is rising, seeming to be most pronounced in Europe (Teichler, 1996).

In Brazil, one of the identified studies is related to the HEIs market and the private higher education sector's analysis. It attempts to explain and quantify its particularities, such as the strategy of some institutions to maintain permanent excess demand and its selectivity. It is also very limited as it considered the data of 39 HEIs and 298 Business Administration Schools (Moita, Lobo e Silva, & Andrade, 2015).

Another study related to long-term planning conducts a scenario analysis, based on a model which generates the dynamic behavior of some performance measures to evaluate policies in HE, such as the number of enrolled students in classroom and e-learning classes in the public and private sectors, tuition fees, the occupation rate, the number of degrees awarded and the dropout rates (Strauss & Borenstein, 2015).

Based on the literature review, the following variables are identified in previous studies by their respective authors, concerning supply and demand conditions (*Table 2*), organized by the author, and according to the categories proposed by Kotler (1998).

Table 2 Summary of variables based on Literature Review

Category	Variable
Demographic	Predicted and reported income (Radner & Miller, 1970); sex (Savoca, 1990); demographic characteristics (Savoca, 1990); parents' income (Savoca, 1990); race (Savoca, 1990).
Economic and financial	Ability to pay (Radner & Miller, 1970); price (Corbucci, 2014; Tierney, 1982; Wetzel et al., 1998a); price elasticity (Noorbakhsh & David, 2002; Savoca, 1990; Tierney, 1982); foregone earnings (Savoca, 1990); financial aid and support (Buss et al., 2004; Canton & de Jong, 2005; King, 1993a; Savoca, 1990); enrollment (Guimbert, Miwa, & Thanh Nguyen, 2008; King, 1993a); potential enrollees (King, 1993a); enrollment rates (Hübner, 2012); cross-tuitions and tuitions fees (Canton & de Jong, 2005; Hübner, 2012; King, 1993a; Wetzel et al., 1998a); cost (Buss et al., 2004); benefit-cost (Hirsch, 1969; King, 1993a); cost of substitutes (Buss et al., 2004); direct cost of attendance (King, 1993a; Savoca, 1990); total cost of education (Noorbakhsh & David, 2002); cost-of-living (King, 1993a; Savoca, 1990); education return (Glewwe & Jacoby, 2004); enrolled students (Buss et al., 2004; Mueller & Rockerbie, 2005); applicants (Buss et al., 2004; Mueller & Rockerbie, 2005); salary (Canton & de Jong, 2005); scholarships (Canton & de Jong, 2005; Hübner, 2012; Wetzel et al., 1998a); investment (Canton & de Jong, 2005); fees (Hübner, 2012); labor choices (Flannery & O'Donoghue, 2013).
Political and Legal	Real credit (King, 1993a), grants (Wetzel et al., 1998a); institutional strategies (Wilkins, 2010).

Sociocultural	Ability score (Radner & Miller, 1970); intellectual affinity (Radner & Miller, 1970; Savoca, 1990); selectivity of the school type (Radner & Miller, 1970; Savoca, 1990); academic ability (Savoca, 1990); probability of admission (Savoca, 1990); parents' educational achievements (Savoca, 1990); quality (Buss et al., 2004; Wilkins, 2010); academic quality of the institution (Savoca, 1990); the quality of the most preferred institution (Savoca, 1990); ethnic and community factors (Guimbert et al., 2008); personal, family and social characteristics (Lopez, 2009); family language (Guimbert et al., 2008); parental education (Guimbert et al., 2008); student's recruitment (Wilkins, 2010); student's experience (Wilkins, 2010).
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2.2.2. A Niche Marketing

The word niche can have different meanings, which came from a wide range of sources. According to (Lindsay 2007) it is derived from the Latin word “nest,” and the dictionaries define it as a specific market (Merriam-Webster 2017) or a small area of trade, which involves specialized products (Press 2017).

Scholars (Schaefers 2014; Toften and Hammervoll 2009; Toften and Hammervoll 2010) agree that there is not an accepted definition of niche marketing. Powell (2017) states that niches are created by “identifying needs, wants and requirements and developing and delivering goods and services” accordingly. It constitutes a demand for a very specialized product or service.

Kotler (Kotler 1998; Schaefers 2014; Toften and Hammervoll 2009; Toften and Hammervoll 2010) complements that it focuses on some specific needs of the customers, which is willing to pay more to those who satisfy their requirements. Additionally, the niches are not likely to attract other competitors and gain economies through specialization and size, profit, and growth potential.

Additionally, niche marketing can be described as relatively small, although they can become more significant markets (McKenna 1988) and appealing to the unique preferences and needs of a well-defined group of buyers (Schaefers 2014).

Niche marketing is a concept also related to strategy, target marketing, and differentiation (Schaefers 2014; Toften and Hammervoll 2009; Toften and Hammervoll 2010). Some synonyms for niche marketing are target marketing, focused marketing, concentrated marketing, and micromarketing even though they are, in practice, different (Dalgic and Leeuw 1994).

On the other hand, segmentation, according to (Kotler 1998; Toften and Hammervoll 2013) is defined as the process of dividing large, heterogeneous markets into smaller parts – segments - that can be reached more efficiently and effectively with products and services that match their needs. Thus, a niche is much more specialized than a segment (Powell 2017).

While segmentation looks for similarities among a diverse group, niching looks for differences within a similar group (Lindsay 2007).

2.2.3. Is there a Niche Market in Higher Education?

The concept of niche marketing has been applied to a variety of contexts over the last decades, which include different industries, products, and services (Toften and Hammervoll 2013).

When it comes to Higher Education, a niche assumes distinct positioning, which involves governmental regulation, competition, and diversity as most of the institutions are not-for-profit, and their environment is highly institutionalized (Fumasoli and Huisman 2013).

Governmental regulation is argued to limit the HEIs' development and decrease diversity. On the other hand, marketing mechanisms, especially competition, would lead or sustain a better level of diversity (Fumasoli and Huisman 2013).

According to Fumasoli and Huisman (2013), some empirical researches conducted by Birnbaum (1983) and Morphew (2009) contradict the expectations, pointing out that a period of considerable growth of the education system, further characterized by fierce competition, did not lead to an increase in the level of diversity. In the same vein, Teichler (1998) and Huisman et al. (2007) also adverted that increasing competition and decreasing governmental control do not automatically raise diversity (Fumasoli and Huisman 2013).

In practice, HEIs act to make their curriculum and courses more appealing to their demand and to be distinguished among their competitors by offering niche programs.

Even though opinions diverge when it comes to this trend, as it is driven mostly by marketing considerations and not by quality assessment, some authors believe that specialization "has become almost the norm" (Schmidt 2009) and will help students achieve their goals (Blackboard 2017).

2.3. Recent Practices in Higher Education

2.3.1. Governance and Management

Governance and Management have different implications. The ISO 38502:2014 (T. I. O. f. S. T. I. E. Commission) – which provides guidance on the nature and mechanisms of governance and management together with the relationships between them, in the context of Information Technology (IT) within an organization – define them as: “*governance* – the system of directing and controlling”; and “*management* –exercise of control and supervision within the authority and accountability established by governance”.

Despite the fact that these definitions are related to the Information Technology (IT) environment, it could also be transposed to the Higher Education Sector, as they did not differ in concept to what other authors (Cucui et al., 2010; Dobbins et al., 2011; Magalhães, Veiga, Ribeiro, Sousa, & Santiago, 2013) propose, as stated below.

2.3.1.1. Governance and Management in the Higher Education Institutions

As the Private Higher Education Institutions have been faced with the presented scenery, this will require them new forms and mechanisms of management and governance to grant its sustainability to the long term. Therefore, it is necessary to distinguish between both terms and their implications.

Concerning the Higher Education, Governance focuses on the rules and mechanisms by which various stakeholders influence decisions, how they are held accountable, and to whom. It englobes organizational and managerial structures, state regulation, inter-institutional competition, and the policies that arrive from this agenda (Magalhães et al., 2013). It refers to “the formal and informal exercise of authority under laws, policies, and rules that articulate the rights and responsibilities of various actors, including the rules by which they interact” (Cucui et al., 2010).

Governance encompasses “the framework in which an institution pursues its goals, objectives, and policies in a coherent and coordinated manner” (Cucui et al., 2010). In other words, it is the analysis of how higher education is governed, including a legislative framework, the characteristics of the institutions and how they relate to the whole system, as well as less formal structures and relationships, which steer and influence behavior.

Dobbins, Knill, and Vögtle (Dobbins et al., 2011) proposed three ideal-type models of governance for higher education institutions, which comprises patterns of control, coordination, and the autonomy allocation among State, professoriate and university management. They are the state-centered model, “where the state directly coordinates all or most aspects of higher education.” The university as a self-governing community of scholars also called the Humboldt model, or Republic of Science or Ivory Towers, “based on a state-university partnership, governed by principles of corporatism and collective agreements.” Moreover, the market-oriented model, “which contends that universities function more effectively when operating as economic enterprises within and for regional or global markets.” The latter defines its policy to increase the quality and variety of services offered, strengthening students’ choice.

In the market-oriented model, HEIs are seen as a commodity, investment, and strategic resource and may offer governments an array of instruments to enhance competition such as regulations on subsidies and instruments affecting pricing structure and enrolment (Dobbins et al., 2011).

Management, on the other hand, refers to the implementation of a set of objectives pursued by a higher education institution based on established rules. It answers the question: ‘How are the rules applied’ and is concerned with the efficiency, effectiveness, and quality of services provided to internal and external stakeholders (Cucui et al., 2010).

Management is part of the governance process and a final stage of a more complex activity because it refers to the process of implementation of the decisions, the day-to-day activities to ensure the achievement of the strategies and goals (Cucui et al., 2010).

2.3.2. The Digital Humanities and MOOCs

The Human Sciences are, by nature, an interpretive and historical science, engaged in reflection on the present about tradition and human experience. Digital technology has been the focus of its attention, especially in what concerns the transformation of writing, thinking, and teaching, thus constituting the so-called Digital Human Sciences (Dalbello, 2010), also known as Humanities Computing (Kirschenbaum, 2010).

Digital Humanities is a field of study, research, teaching, and innovation concerned with the intersection of computing and the disciplines of the Human Sciences. It is methodological in nature and interdisciplinary in scope. They involve research, analysis, synthesis, and presentation of information in electronic format. They study how the media affect the disciplines that use them and what these disciplines have to contribute to the knowledge of computation (Kirschenbaum, 2010).

It is defined by the opportunities and challenges that arise from the conjunction of the two - digital and humanities, forming a new singular collective, coming from the encounter between humanities and computational methods (Burdick, 2012).

The Digital Humanities represent, therefore, an expansion of the Human Sciences because they bring values, interpretative and representational practices, strategies of construction of meaning, complexities, and ambiguities of Being Human in each experience. They have a global, trans-historical and trans-mediatic approach to knowledge and meaning construction.

One of the questions that emerges from the reflection on the use of technologies applied to the area of Human Sciences, thus Higher Education included, proposed by the Digital Humanities, involves the offering of distance courses, especially the Massive Open Online Courses (Bates, 2015; Godwin-Jones, 2014), called MOOCs, with the use of specialized platforms, such as Coursera (Coursera, 2015) and Veduca (Veduca, 2015), aimed at a "new" form of offering.

Some issues involve the offering of MOOCs, ranging from pedagogical and political (Chun, 2014; Godwin-Jones, 2014; Thille, 2014); of infrastructure availability and its relations with price and costs (Chun, 2014; Godwin-Jones, 2014) but the opinions among the scholars diverge.

Critics point to their "standardized" and "universal" form of offering, to the detriment of local pedagogical and cultural issues, assuming that everyone would learn in the same way. On the other hand, for its advocates, there is high idealism and optimism about the availability of information to a large contingent of people, whose access would otherwise not be possible (Godwin-Jones, 2014).

2.3.2.1. The MOOCs and the E-learning Mode in Brazil

Distance learning (on-line) courses were never new, as some offerings by London University date from the year 1858.

The prominence of the MOOCs is a result of the increasing number of enrolments, of the aggressive stance by prestigious universities, of increased financial investment by foundations and other interested groups (Thille, 2014).

In Brazil, the first distance courses were offered by correspondence, on television or through other primitive forms of e-learning. The first MOOC initiative was launched by the Paulista State University "Júlio de Mesquita Filho" in 2012 and entitled Unesp Aberta (UNESP, 2015b). In 2013, MOOCs with certification by the University of São Paulo (USP, 2015) was launched in partnership with the Brazilian portal Veduca (Veduca, 2015).

The Massive Open Online Courses, called MOOCs, have their characteristics. Its model allows the enrolment of a vast number of students. The courses are free, and do not offer a diploma, only a certificate; and vary in their pedagogical purposes, philosophies and technological resources used (Thille, 2014).

However, this model has been modified, more recently, allowing variations such as BOOCs³, DOCCs⁴, SMOCS⁵, SPOCS⁶ (Ed); In addition to the payment of a fee or registration or even the recognition or accreditation of courses (M. Commission, 2013).

Unlike the MOOCs that, at the beginning of their offer, were considered free courses and did not provide certification, undergraduate distance (on-line) courses in Brazil can be offered by public or private educational institutions, characterizing themselves as unpaid or paid. They may involve a higher number of enrolled students, whether or not they are in "mass education." However, its nature is also virtual and remote. With the difference that, in Brazil, distance courses are subject to their proper legislation (M. d. Educação, 2007), which regulates, supervises, and evaluates higher education institutions and undergraduate courses.

2.3.3. The Globalization, Internationalization and Academic Mobility

Internationalization has become one of the top priorities of universities worldwide (Izabel Cristina de Araujo, 2012; Renate Roga, 2015). It is a process that a high number of HEIs have experienced in the first decade of this century as the world is becoming more interconnected due to globalization (Juris Ijinsa, 2014). It is also described as an essential part of Higher Education (Roman V. Deniko, 2015). Internationalization is the hallmark of relations between universities (Morosini, 2006).

"Governments fund large numbers of international students; universities recruit foreign students, build alliances to enhance their global reach, build offshore campuses with the purpose of reaching foreign markets and expand their global brand name recognition" (Rivas, 2016).

Therefore, the process involving higher education is a social phenomenon that builds relationships among a different community of learners (Rivas, 2016) and stakeholders. Consequently, a new epistemology of Higher Education emerges in the XXI century. It

³ Big open online courses

⁴ Distributed open collaborative courses

⁵ Synchronous massive online courses

⁶ Small private online courses

underpins the reasons why universities should traverse global and international paths, redraw their profile toward markets, and develop modes of academic capitalism (Genro, 2012). It also justifies the arguments used for the evaluation, accreditation, classification, rankings, and typologies of university institutions.

Despite the importance of the subject and its impact on the HEIs strategy and sustainability, there is a great misunderstanding related to the word meaning, its interpretation, and utilization in the Higher Education (Becker & Sanders, 2006; Fenoll-Brunet, 2016) and also due to the activity-oriented or instrumental (effective) approach adopted by the HEIs (Becker & Sanders, 2006).

Also, due to the fierce competition amongst HEIs, the relevance of the subject can be depicted as, according to previous studies (Elena Nechita, 2014; Juris Iljinsa, 2014), in the last decade, one of the most important reasons for HEIs changes in strategy and their learning process (Roman V. Deniko, 2015); playing a significant role for the attractiveness of foreign staff, professors, and students for higher education systems (Juris Iljinsa, 2014; Renate Roga, 2015). It is also believed that there will be, in the following decade, an increase of 100% in the number of students who are partly or wholly completing undergraduate or graduate studies abroad (Claisy Maria Marinho-Araujo, 2015).

Many documents treat the theoretical conceptions of internationalization, considering academic and non-academic activities as the “development of curricula, scholar and student exchange, technological assistance, intercultural teaching, and joint research activities” ((Org). 2016). Some of them approach the relationship between the University and Knowledge, while others discuss specific points of view as globalization, internationalization, transactionalization, and mobility to mention some examples (Morosini, 2006, 2011). Internationalization of Higher Education is a very complex concept. It includes a diversity of related terms with different stages of development like a) International Dimension which was used in the XX century and represented an incidental phase of internationalization; b) International Education, which was an organized activity prevalent in the United States between the Second World War and the end of the Cold War; and c) Higher Education Internationalization, which started after the Cold War and was related to the globalization and regionalization process of the society and their impact on the Higher Education (Morosini, 2006).

Globalization, in general, is defined as the integration of countries into the world economy or the global market. Such integration involves the removal of all trade barriers between countries. It is the process of internationalization of products, markets, technologies, capital, human resources, information, and cultures. Globalization refers to the free flow of goods and services, capital, technology, and labor among different countries ((n.d.), 2015). Globalization is also defined as the integration of countries along political, economic, technological, socio-cultural, and ecological lines (Ronald Martin Rivas, 2016).

It differs from localization, which is the process of responding to country-specific political, regulatory, and cultural conditions. It manifests itself in a limited regional integration comprising neighboring countries or countries with a common geographic domain. Regions,

on the other hand, are defined by national agreements, celebrated to regulate neighboring countries or to reduce conflicts.

Bartell (2003) *apud* (Morosini, 2006) conceptualizes globalization as an advanced stage in the process involving internationalization. Therefore, Globalization has a different effect when it comes to Higher Education (Ronald Martin Rivas, 2016; Wit, 2011). According to Altbach (2002), *apud* (Morosini, 2006), the world is moving in the direction of the internationalization of Higher Education using the academic structure to respond to market conditions.

The basis of **internationalization**, according to (Juris Ilijinsa, 2014), is the global economic processes, but the activities that have been developed by the institutions have led to a broader understanding of the term. In economics is understood as the increasing involvement of enterprises in international markets (Susman, 2007; Welch & Luostarinen, 1988) *apud* (Juris Ilijinsa, 2014). In the scientific literature, it is used since 1776, with Adam Smith's theory of "Absolute cost advantage." An absolute cost advantage existed when the country could produce a commodity with fewer costs per unit produced than could its trading partner, so landing to the basics of Internationalization of the enterprises (Ingham, 2004) *apud* (Juris Ilijinsa, 2014). For the authors, the term internationalization is related to the HEIs process to become more international externally and internally. Externally when there is a collaboration with other international partners, projects and recruitment of international students; and internally when the changes are related to structural and cultural factors.

Scholars describe it as the process of integrating an international, intercultural and global dimension into the purpose, function, and delivery of higher education at the institutional and national level, as (Roman V. Deniko, 2015), aimed both domestic and international students through internationalization at home and internationalization abroad. Internationalization at home helps students to develop their international role and acquire necessary intercultural communication skills. In addition, in this condition, most students and staff are not mobile, and thus the opportunities for developing cultural capability will not be obtained through travel to other countries for studying or working. The internationalization abroad takes the forms of education across the borders and mobility (Elena Nechita, 2014; Roman V. Deniko, 2015).

For (Becker & Sanders, 2006; Fenoll-Brunet, 2016), the internationalization is a process aimed at introducing intercultural, international and global dimensions to improve goals, functions, and delivery of higher education (Fenoll-Brunet, 2016), thus improving its quality and its research. It is also an integrating process of international, intercultural, and global dimensions, with the teaching, research and service functions' integration process of the institution (Fenoll-Brunet, 2016).

Bartell (2003) *apud* (Morosini, 2006) considers internationalization as international exchanges related to education. He points out some examples of the realization of internationalization: "presence of foreigners and student-covenants on a particular campus; number and magnitude of international research grants; cooperative international research projects; international associations involving consultors for foreign universities and other institutions; sectors of private universities with international goals; international cooperation

and collaboration among schools, councils and colleges at the university, and the degree of international immersion in the curriculum”, among others.

Marginson e Rhoades (2002) *apud* (Morosini, 2006) consider internationalization as a globalization process of higher education, the development of increased integrated educational systems, and the university relations beyond the nation. They also mention what is called academic capitalism, which identifies an overall trend of privatization in higher education, with several characteristics inherent to the process, including profit.

There are different kinds of internationalization, depending on the sector, occurrence, organizational, or individual level (Juris Ilijnsa, 2014). The most important modalities which compose the higher education internationalization, considered by (Palma, 2013), are individual internationalization; institutional internationalization; regional, sub-regional or among regional internationalization; and external providers of higher education.

The internationalization gives a real opening towards the exchange of best practices and leads to opportunities for both teaching and research process. The most common internationalization modalities, according to (Elena Nechita, 2014), used in higher education institutions are mobility (both for students and academic staff); international cooperation in teaching and research through international consortia; cooperative programs; and joint universities.

“Internationalization transformed the world of higher education, and globalization changed the world of internationalization” (Knight, 2007).

The **mobility** is a subject with defined limits (Palma, 2013). It takes part in the internationalization of the higher education process in the individual and regional modalities (Palma, 2013). Mobility plays a significant role in complementing the training of students, as it urges the development of a particular regional identity; facilitates labor and cultural integration; makes it possible to contact different and enriching forms of academic work and cultural expression; fosters the exchange of ideas and knowledge; makes it possible to carry out joint projects that can result in the formulation of solutions to common problems of citizens in different countries, thereby promoting the formation of more tolerant and supportive people (Palma, 2013). Besides that, academic mobility programs allow students to explore new areas of personal development and broaden their perspectives on academic, work, and personal growth (Palma, 2013).

National and international academic mobility is also a direct exponent of educational cooperation that combines efforts and resources from diverse sources and is an opportunity for current educational systems.

2.4. Grounded Theories

2.4.1. The Resource-Based View (RBV) Theory: why choose it?

According to Whittington (Whittington, 1993), “a good strategy rarely means doing the same thing that everyone else does.” This concept of strategy is linked to the notion that sustainable competitive advantage is hold up on "difference." It is what Hung (Hung, 2002)

called the source of uniqueness and Wernerfelt (Wernerfelt, 1984) called unusual resource or resource position, arguing that its resource-based position (Jacobsen, 2013), based on RBV⁷ Theory, directly or indirectly, creates difficulties for others to copy or to achieve a competitive advantage. Wernerfelt (M. Kim, Song, & Triche, 2015; Wernerfelt, 1984) referred to a resource as "anything which could be thought of as a strength or weakness of a given firm." His examples of resources include capital, processes, equipment, personnel, brand names, in-house knowledge of technology and trade contracts.

Within this context of "difference", "uniqueness", "unusual resource" and "dissimilarity", the RBV (Jay B. Barney, 2001; Peteraf, 1993; Wernerfelt, 1984, 1995), based on Penrose's seminal work (Jacobsen, 2013), makes a valuable contribution to the interpretation of the concept of strategy linked to how a sustained competitive advantage can be built at first within each company or organization. It is a vision from the inside-out based on their resources (human, financial, technological and organizational) which can be tangible or intangible (Jay B. Barney & Hesterly, 2011), and their capacities (Jay B. Barney & Jay, 2011; Christiano, Gohr, & Gomes, 2016). The RBV also emphasizes tacit skills, patterns of cooperation, and intangible goods that need time and learning to develop. These features cannot be easily traded, changed, or imitated. According to the RBV, the competitive advantage of a company will be in what is unique, peculiar, and exclusive; and is embedded in its resources. Resources that enable a sustainable competitive advantage will be found in the organization's internal *capacity* to explore and renew distinct resources.

According to Hitt et al. (Hitt, Ireland, & Hoskisson, 2002; Josefy, Kuban, Ireland, & Hitt, 2015), the RBV-based strategy can be expanded, focusing on building *essential competencies*, not running after opportunities or positioning the company in a given market. Thus, human and technological resources together would form the essential competence (s) of the organization. However, an essential competence will only exist effectively if the company's differentiating capacity is both valuable, rare, difficult to imitate and irreplaceable (Hitt et al., 2002; Josefy et al., 2015), which means, exclusive, singular.

In the last decades, there has been a significant proliferation of voluntary strategic arrangements among firms to exchange or share resources and engage in the development of products, services or technologies in a collective way (Adegbesan & Higgins, 2010; Gulati, 1998). This occurs because each firm has, according to the RBV (Barney, 2008), *n* resources with a positive, neutral, or negative impact on their competitive advantage. For RBV, each company has its combination of distinct resources and capabilities that others do not have. Thus, "resources are the source of the company's capabilities, which, in turn, are the source of the company's core competencies; on them, the competitive advantages are based (Hitt et al., 2002).

According to (Hitt et al., 2002) "resources are sources of capacity, some of which lead to the development of core business skills." It is this obsession to develop and use knowledge together with broader core competencies that will characterize companies that can compete effectively in a globalized competitive environment. Thus, the emphasis on core competencies when formulating strategies is the way in which companies learn to compete based on their specific differences (Wernerfelt, 1995). In addition, "the strategic value of

⁷ Resource-Based View Theory

resources increases even more if they are influenced by the interactions, combinations, and complementarities between its resources or integrated or combined" (Hitt et al., 2002) with resources from other stakeholders, and may be the accumulation of value and rarity (Barney, 2008) of resources of several stakeholders that interact with each other. Therefore, it is their synergistic combination or bundle of resources that distinguish them (Kraaijenbrink, Spender, & Groen, 2009).

Lavie (Lavie, 2006) considers that each company has a set of *shareable* and *non-shareable* resources that together form the organization's resources. When the intersection between the resources of two companies is large, this refers to *similar resources* that are aggregated to scale up and increase their competitive position. When the intersection between two groups is small, we are referring to *complementary resources* in which companies seek to achieve synergies, accumulating different resources, which would be difficult to obtain in isolation (Figure 1). In this case the idea of the singularity, of what is peculiar to each unit, expands itself to the idea of collectively, achieving competitive advantage through cooperation.

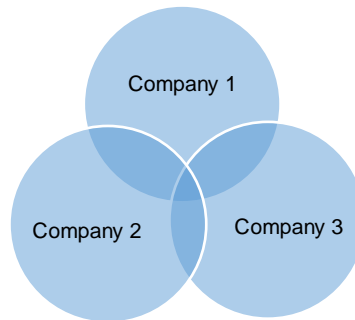


Fig. 1 Similar and complementary resources according to RBV Theory

2.4.1.1. The RBV applied to Higher Education

Although the resource-based view was developed to explain for-profit organization performance, its application to higher education institutions is possible due to the increasingly competitive environment in which colleges and universities are currently inserted (Powers, 2004).

Daft (2000) realized the importance of a variety of financial, physical, human capital, and organization resources that are often sources of competitive advantage for an organization.

Powers (2004) depicted that the resource-based view of the firm (J. B. Barney, 1991; Jacobsen, 2013) offers a useful understanding of the resource impact on university technology transfer performance.

Guerrero and Urbano (2012) provided the first statistical insights into the environmental and internal factors involved in the development of entrepreneurial universities in Spain. Based on the institution's resources, which they considered the internal factors of the central constructs of the Entrepreneurial University (Guerrero & Urbano, 2012), they adopted the following variables: human, financial, physical and commercial resources.

Studies are diversified when concerning the application of RBV to the HEIs. Christiano, Gohr, and Gomes (Christiano et al., 2016) developed a research focused on knowledge management and how knowledge contributes to leverage the competitive advantage. Ribeiro (Ribeiro, 2016) studied the relationship between department affiliation and interdisciplinarity regarding knowledge creation, fostering, or hindering interdisciplinarity within Intra organizational contexts. He focused on the researcher's relationships to identify what aspects of the researcher's affiliation influence their networks and the interdisciplinarity of research. Huggins and Prokop (Huggins & Prokop, 2016) explored the structure of knowledge networks stemming from ties between universities and other actors, to explain patterns of regional innovation and development. Guerrero, Cunningham, and Urbano (Guerrero, Cunningham, & Urbano, 2015) proposed a conceptual framework for the Entrepreneurial University, where they pointed out that the resources and capabilities, so-called inputs, were not tested.

These scholars focused on the identification of resources to leverage their institutions' competitive advantage, based on intra and inter-organizational contexts, but their research is still limited in their extensions.

2.4.2. The Entrepreneurial University

Entrepreneurship, in general, has been considered a key determinant of economic growth. In an entrepreneurial economy, knowledge remains a core factor of production, and the value of knowledge-based activities are more explicitly becoming essential to the development of the economy (A.V, 2006; Mohamad, 2013; Lara, 2014). Thus, entrepreneurship has become the object of renewed interest (A.V, 2006; Boyd, 2011).

The literature about entrepreneurship involving universities has increased in the last decade, as universities have encompassed what was considered their Third Mission – production of knowledge with economic development - and are encouraged to realize their broader socioeconomic potential through knowledge exchange and partnerships, having not only a commercial but also a more social function.

Scholars *apud* Nelles and Vorley (A.V, 2006; Nelles, 2010; Nelles, 2011) identify three models of universities: 1) Academic Capitalism, which refers to the “market and market-like” behavior of universities; 2) the Enterprise University, which favors business values and income generation, proposing a change in terms of the nature of university governance and management, and 3) the Entrepreneurial University, a hybrid organization that incorporates the third mission of economic development alongside scientific research and higher education.

Nelles and Vorley (Nelles, 2010; Nelles, 2011) also identify different definitions and contexts concerning entrepreneurial firms. For example, Milles (1993) *apud* George and Marino (George, 2011) defined entrepreneurial firms as proactive, risk-taking, and innovative.

Rhoades and Stensaker (Rhoades, 2017) understand entrepreneurial firms as a more in-depth structural and cultural phenomenon that is embedded within and operates throughout the organization.

To Sam and Sijde (Sam, 2014), it means, "Universities should be able to be more financially independent (of the government) as they are expected to seek funds from the external sources through their knowledge exploitation." Moreover, the Entrepreneurial University is the one that can take on several roles in society and the innovation (eco) system.

According to Etzkowitz and Viale (Etzkowitz, 2010), the Entrepreneurial University is embedded in a triple helix university-industry-government relation which represents the "next great transformation," the "third academic revolution," where they become the center for economic development, knowledge creation and diffusion in both advanced industrial and developing societies.

To Aldridge and Audretsch (Aldridge, 2011), the emergence of the entrepreneurial university gave the universities a dual mandate: to create knowledge and to alter its activities and values to facilitate the transfer of technology and knowledge in the entrepreneurial society, contributing and providing leadership for creating entrepreneurial thinking, actions, institutions to enhance entrepreneurship capital.

Grimaldi, Kenney, Siegeld, and Wright (Grimaldi, 2011) have pointed out that academic entrepreneurship can be developed through the development of some capabilities or competencies by the universities to transfer knowledge and technology which include opportunity refinement, leveraging, championing, and networking competencies. To the authors, these competencies can be considered at three levels: a) system-level specificities (government actions, institutional configurations, local-context characteristics); b) University-level internal support mechanisms; and c) individual scientist level factor. In their study, they pointed out the relevance of the intangible factors in the encouragement for university entrepreneurship.

To Grimaldi, Kenney, Siegeld, and Wright (Grimaldi, 2011), complementary assets have also been linked to variation in the rates of entrepreneurial activity across universities. Universities that provide scientists with important complementary resources in the form of pro-entrepreneurial structures (technological transfer offices, social networks, and infrastructure) policies (licensing and rent appropriation; leaves of absence), and culture (academic attitudes toward commercialization, entrepreneurial role models) are more likely to have higher rates of entrepreneurship. Finally, scholars have highlighted complementary capabilities within the scientists themselves as critical to the success of academic founded firms: social networks, prior board experience, industry collaborations, access to venture capital financing, and ability to recruit other personnel who have marketing and operational knowledge are all essential complementary capabilities for academic entrepreneurs (Romero, 2007).

2.4.3. The Data Mining Techniques and Knowledge Discovery

Data mining also called knowledge discovery in databases (KDD) is nowadays used in the field of Education. The term is coined as Educational Data Mining (Hussain & Hazarika, 2014; Mohamad & Tasir, 2013). DM is a computer-based information system devoted to scanning substantial data repositories, generate information, and discover knowledge.

Educational data mining (EDM) is an area that uses statistical techniques, machine learning, and data mining to analyse educational data to improve the teaching/learning processes involving students and instructors. Educational data are complex and come in many different formats, which require the use of particular data interpretation and processing techniques (Lara, Lizcano, Martínez, Pazos, & Riera, 2014). EDM seeks to find out patterns and make predictions concerning learners' behaviors and achievements, knowledge content, assessments, educational functionalities, and applications (Peña-Ayala, 2014). Educational data mining (EDM) related literature is extensive and varied (C. Romero; Kenan Zengina; Liao, Chu, & Hsiao, 2012; Liñán & Pérez, 2015; Peña-Ayala, 2014; Romero & Ventura, 2010).

As Peña-Ayala (2014) stated in his research, 60% of the approaches in Education depicts predictive models, and 40% shapes descriptive models. After some method and technique are chosen to solve a specific DM task, an algorithm, equation, or frame is implemented to mine the source data. To the author, the most common algorithms used in EDM approaches are: *K*-means, expectation-maximization (EM), J48 and *Naive-Bayes*; mathematical equations, including descriptive, are the most used; several versions of Bayesian networks are the most popular frames.

Data mining techniques (tasks) which have been applied to educational data to address the teaching/learning problems are clustering (Liang & Vaishnavi, 2006; Park, Yu, & Jo, 2016), association rule analysis (Nájera, Calleja, & Medina, 2017; Wang, 2016) and correlation analysis which produce descriptive models and classification (Ali Buldua; Hussain & Hazarika, 2014; Lara et al., 2014; Wang, 2016); regression/prediction (Allen, 1999; Handa & Skolnik, 1975; Hussain & Hazarika, 2014; Oprea, Popescu, Petrescu, & Barbu, 2017), categorization, and time series analysis (Silvia Regina Machado de Campos, Henriques, & Yanaze, 2016a, 2016b, 2016c; Silvia Regina Machado de Campos et al., 2017) which generate predictive models. Many approaches can be applied to each of these categories to solve its problems as decision trees, Bayesian networks (HersHKovitz, Baker, Gobert, Wixon, & Pedro, 2013), *k*-means (Nájera et al., 2017), logistic regression (Peña-Ayala, 2014), factor analysis and structural equation modeling (SEM) (Kuzhabekova, 2015).

However, the existing proposals in the Education area tackle the above problems separately, through a more traditional methodological approach, based on outputting models that study the curriculum, domain of knowledge, sequencing, teacher support, student's behavior and performance, support and feedback procedures, assessment and student modeling (Peña-Ayala, 2014). They used tools for improving student performance in specific fields. Some qualitative methodologies are also depicted as comparative content analysis (Bleiklie, 2014), a case study (Cucui et al., 2010; Wilkins, 2010), social network, and document analysis (Kuzhabekova, 2015).

3. MATERIALS AND METHODS

3.1. Methodology Approach

Concerning the **Research Design**, this study has an inductive process as a research strategy, from which it involves drawing generalizable inferences out of the data observations and findings, with the purpose of generating theories or improving the existing ones. It adopts the *Middle-range theories* as a conductive process as it falls somewhere between *Grand Theories* and empirical findings (Bryman, 2012; Garson, 2016), representing attempts to understand and explain some aspects of social life, in this case, especially involving the higher education.

From the epistemological position - which deals with the study of Knowledge and its limits and methods by which reality can be known, it is **interpretive**⁸. Moreover, based on the ontological considerations - which deals with the study of being, of what reality is, it is **constructionist** (Bryman, 2012; Garson, 2016), looking for meaning from the researcher's discoveries and perceptions.

From the **Research Approach**, this study is a **Quantitative Research**, as it will address the problem from a quantitative point of view, and it is based on resources and specific statistical techniques, dealing with the analysis and measurement of predetermined variables, which quantify its potential, through the identification of hidden and unknown patterns among the data analyzed.

According to Hair *et al.* (2005), from its nature, it is basic (fundamental) research, as it is motivated by the desire to generate Knowledge.

Based on its objectives, it is an exploratory⁹, cross-sectional/temporal¹⁰ and longitudinal¹¹ study, as it aims to examine the literature and, besides that, to identify the data and the most relevant variables which impact in the Brazilian Higher Education offer and demand conditions, from the 2010 to 2015 period, englobing different components from the official public databases like the Higher Education Institutions, their Students, Undergraduate Courses and Professors.

As the *Data collection method*, it will analyze the existing statistical and official records, provided by different public databases like the Higher Education Census and the Demographic Census, which are secondary sources, identifying data and relevant variables. It will use the microdata in its raw form.

The *data analysis method* will be promoted through Self-Organizing Maps (SOMs), a particular type of neural network, which deals with a massive volume of data, to explore hidden and unknown patterns among a large amount of data, contributing to generate new

⁸ The opposite to the Positivist paradigm. It is more subjectivist.

⁹ As it is a preliminary and descriptive study.

¹⁰ Evaluates the same set of variables in a different group of subjects.

¹¹ Follows the behaviour of the variables in the same group of HEIs, in the studied period.

Knowledge. Descriptive statistics will be used in a complementary way to present additional data in the exploratory phase.

Figure 2 illustrates the Research Methodology approach.

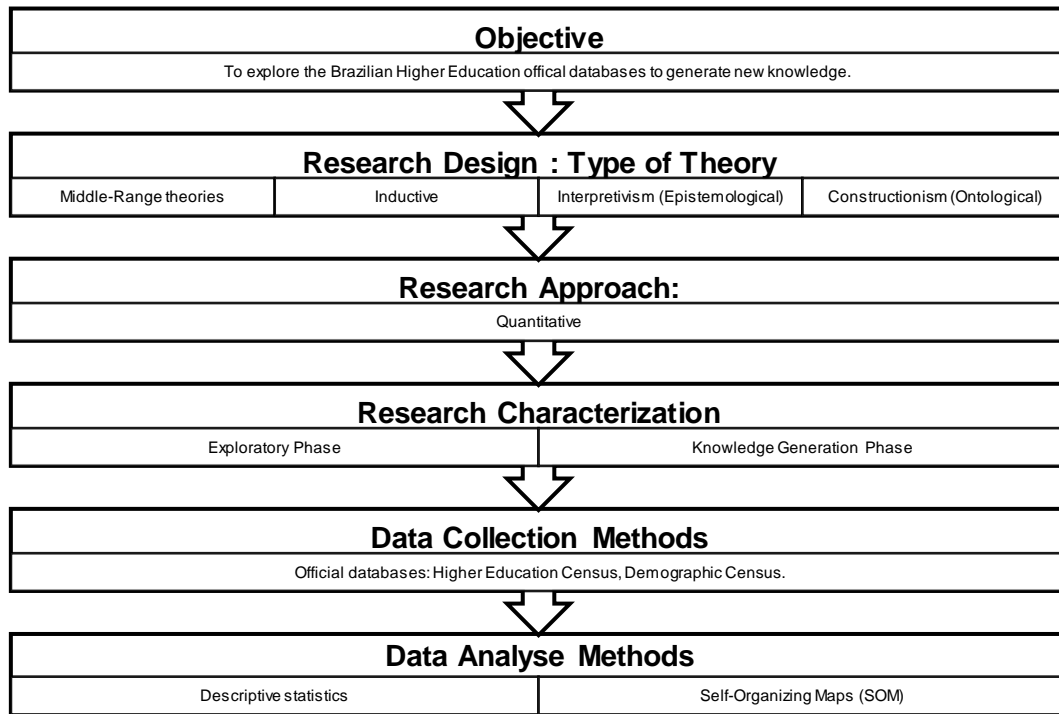


Fig. 2 Research Methodology. Based on (Bryman, 2012; Garson, 2016; Turabian, 2013)

3.2. Research Characterization

In order to answer the research problem statement "How can the annual and temporal analysis of the Brazilian Higher Education (HEIs) Census and other public official databases generate new knowledge and deliver strategic information to ensure the accomplishment of Higher Education Institutions core mission?", this research will be divided into the following phases:

3.2.1. The Exploratory Phase

The *Exploratory Phase* considers the analysis of the public data delivered by the INEP and the IBGE under different perspectives: a) *temporal*, as it will consider the periods from 2008 till 2015, depending on the case; b) *longitudinal*, when the same group of Higher Education Institutions will be analyzed under the temporal timeline; c) *cross-sectional*, as it will consider all selected variables or different groups of them, depending on the study which will be conducted.

The exploratory studies use descriptive statistics as a data analyzing method and will contribute to a better understanding of the context of Private Brazilian Higher Education Institutions comparing their supply and demand conditions, concerning the classroom and e-learning courses, and to investigate some special topics, along the studied period.

The studies, which will be developed under this category, are:

- 3.2.1.1. An *exploratory* and *descriptive* study, of quantitative nature, which will aim to assess the general context of Private Brazilian Higher Education Institutions comparing their supply and demand conditions. It will adopt an inductive and exploratory methodological approach through the longitudinal and temporal analysis of data provided by the Higher Education Census, between the years of 2008 and 2013, and the Demographic Census of 2010, in order to map its scenario. It shall enable higher education institutions (HEI) to identify new target groups as potential entrants, enhance the discussion of forms and mechanisms of governance models, and deliver strategic information.
- 3.2.1.2. An *exploratory* and *descriptive* study, of quantitative nature, based on an inductive research strategy, to map the MOOCs offered by Coursera and Veduca portals, and the ones delivered by the higher education institutions (HEIs). Moreover, to compare the evolution of a different category of online courses, other than MOOCs: the accredited online undergraduate courses offered by HEIs, through the longitudinal analysis of data from the Higher Education Census, between the years 2008 and 2013. It shall enable us to map the supply of MOOCs in Brazil.
- 3.2.1.3. An *exploratory* and *descriptive* study, of quantitative nature and strategy of inductive research, to identify the main areas of knowledge that prevail against the present offer conditions in the country, in both modalities of courses, and their relationship with the subject of Digital Humanities.
- 3.2.1.4. An *exploratory* and *descriptive* study, of quantitative nature, to present the most important concepts involving the globalization, internationalization, and mobility in light of its interpretation by the Brazilian Higher Education System, to visualize the scenery of the internationalization among the HEIs, their students and professors and its evolution through the 2014-2015 period.
- 3.2.1.5. An *exploratory*, *descriptive* and *inductive* study through the temporal analysis of data provided by the Coordination for the Improvement of Higher Education Personnel (CAPES), between the years of 2010 and 2015, to map the offering conditions and to give an overview of all Education Graduate Courses offered in the country.

3.2.2. The Knowledge Generation Phase

The *Knowledge Generation Phase* will take into account the results from the exploratory phase. It will consider the public and official data delivered by INEP and IBGE, into the same temporal, longitudinal and cross-sectional perspectives, considering some previous-selected variables, which will be presented in section 3.5.

The Knowledge Generation Phase will use the Self-Organizing Maps (SOM), which is a neural network, as a data analyze method, to explore and identify unknown and hidden

patterns across huge volumes of data. The SOM method will be better explained in subchapter 3.6.

The studies that will be developed under this category are:

- 3.2.2.1. A study with an *inductive* approach through a quantitative research strategy focusing on knowledge discovery among data from Brazilian Higher Education Census – HEIs, undergraduate courses, professors, and students, from 2010 to 2015, to explore hidden patterns in the data and to contribute to advance the RBV Theory.
- 3.2.2.2. A study which focuses on the temporal analysis of all undergraduate courses provided by the Higher Education Institutions in Brazil, along the period of 2010 to 2015, to identify if there is a group of institutions which stands out in a specific area of knowledge, the so-called *niche institutions*; and, if so, to evaluate their courses' quality considering the Undergraduate Courses Index (IGC). This study aims to contribute to a more prospective and strategic view concerning the offer conditions of the Higher Education Institutions.
- 3.2.2.3. A study that focuses on the analyze of the professors' and students data from the Brazilian Higher Education Census to visualize their profiles, based on the OECD main areas of preference, dependence on financial funding, genre and academic status (entrant, enrolled and undergraduate).

Figure 3 indicates the studies which were developed considering the Higher Education Census from 2008 to 2015, their phases (if exploratory or knowledge generation) and their interconnectedness.

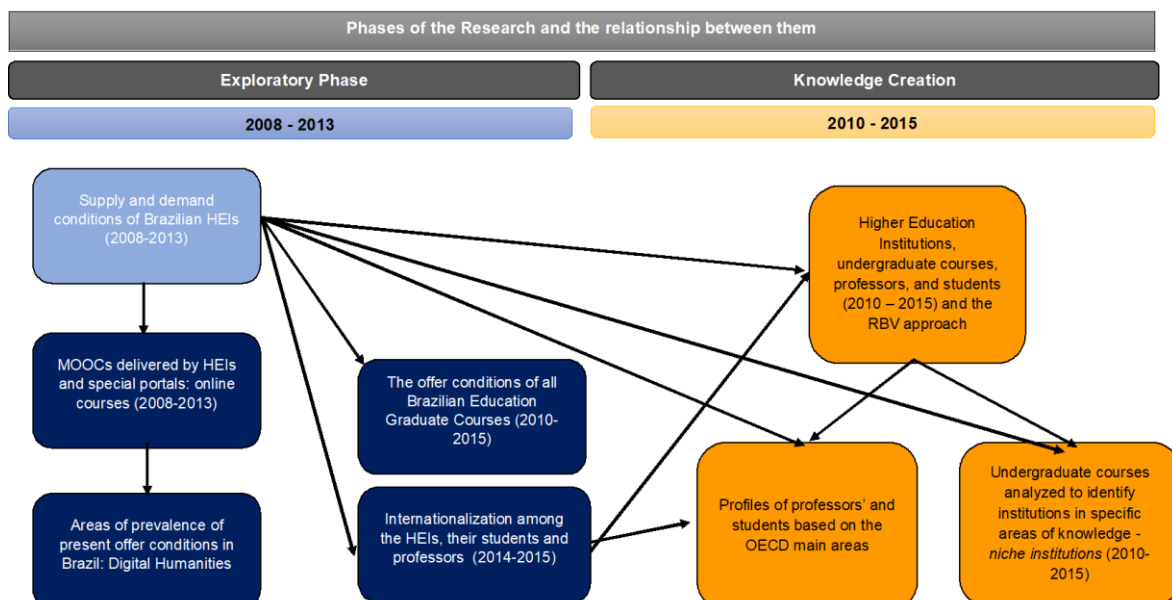


Fig. 3 Phases of the Research

3.3. Database Selection

The public and official data are collected by the Brazilian Ministry of Education (MoE) and by the Brazilian Institute of Geography and Statistics (IBGE). They constitute *Higher Education Census* and the *Demographic Census* data, respectively. Both are secondary sources. All the data will be used in its raw form called *microdata*.

The National Institute of Educational Studies and Research Anísio Teixeira (INEP), which is an agency connected to the Brazilian Ministry of Education, in charge of evaluating educational systems and the quality of education in Brazil provides the Higher Education Census. Each year, INEP conducts the census of higher education, which involves all Brazilian HEIs.

Through the collection of data that occurs at the end of each school year, INEP organizes and makes available, at the end of the subsequent year, the raw data for consultation.

The Brazilian Institute of Geography and Statistics (IBGE) is the agency responsible for the official collection of statistical, geographic, cartographic and environmental information in Brazil.

IBGE collects the data every ten years, but some datasets are updated annually. It also organizes and makes the raw data available for consultation at the end of the subsequent year after its collection.

3.4. Data Scope

It will not be necessary to define a sample or a sampling plan since the research will adopt the entire universe of Higher Education Institutions in Brazil as an object. All Brazilian Higher Education Institutions (HEIs) will be considered as units of analysis, especially those whose data is included in the Higher Education Census from the years 2010 to 2015. Thus, it will adopt a national level of analysis, considering the completely Brazilian territory.

The data in its raw form is organized in different bases – Higher Education Institutions (HEI), Undergraduate Courses (UC), Professors, Students, and Place of Offer. For this research, the first four bases of each census will be considered, from 2010 to 2015.

Each Higher Education Census aggregates the microdata, according to a set of variables. For this research, the selection of variables will have a hybrid approach, as some of them will be based on the literature review and some of them will be proposed by the author - the *ratios*.

Table 3 illustrates the records from the Brazilian Higher Education Census' databases, from 2010 to 2015, which will be used.

Table 3 Records among Brazilian Higher Education Census databases, 2010-2015

	HEIs	Courses	Enrolled Students	Professors
2010 ¹²	2,378	28,577	5,449,120	366,882
2011 ¹³	2,365	30,420	6,739,689	378,257
2012	2,416	31,866	7,037,688	378,939
2013	2,391	32,049	7,305,977	383,683
2014	2,368	32,878	7,828,013	396,595
2015	2,365	33,501	8,027,297	401,299

Source: MEC, INEP, 2010-2015

For the extraction of the microdata, made available in its raw form, the SQL Server 2014 - Management Studio will be used, and specific queries will be elaborated to allow, therefore, a better organization. The extracted data will then be exported to an Excel spreadsheet and then parsed according to its intended purpose. The queries, which were used to aggregate all the selected variables data for different datasets, are in APPENDIX G.

The spreadsheet, with the data extracted and adequately organized, will allow a temporal and longitudinal analysis of the Brazilian HEIs, for the period under study (2010-2015). The examples of the spreadsheets used to organize the data are in APPENDIX B until F.

3.5. The Selection of Variables

Table 4 indicates the number of variables for each Brazilian Higher Education Census database, from 2010 to 2015, which was enlarged through the period.

Table 4 Variables of the Brazilian *Higher Education Census*, Brazil, 2010-2015

Database	2010	2011	2012	2013	2014	2015
Student	85	93	102	110	117	119
Course	63	73	74	84	95	95
Professor	48	48	49	49	50	50
HEI	40	40	41	42	42	50
TOTAL ¹⁴	236	254	266	285	304	314

Each database of the Brazilian Higher Education Census contains a group of variables that identify and describe their proper dimension. *Table 5* illustrates these variables, based on the 2015 census, which was the last available.

Table 5 Variables description for each database, The Higher Education Census, 2015

Database	Variables description
Student	Name, code and course pole; course name according to the OECD table, shift, level and academic degree, teaching modality, student ID course code, race, genre, date of birth, age, nationality, country of birth, disability, developmental disorder or high skills / giftedness; link to the course; workload, date and form

¹² Considers only classroom mode courses and students.

¹³ Considers classroom and e-learning mode courses and students.

¹⁴ Does not include the e-learning place of offer dataset variables.

	of entrance; student funding; scholarship; academic mobility (national or international); country and receiving institution; year of admission; if it is entrant, enrolled or graduate in the course.
Course	Offering place, municipality, unit of the federation, geographical region, course code and name, name according to OECD table, situation, academic degree awarded to the student, teaching modality, academic level, workload, start date of the course, course authorization date, accessibility conditions, minimum course completion time, infrastructure (laboratories), number of places offered, number of entrants, number of enrolled and of graduate students.
Professor	Code, teacher's situation, degree, work regime, genre, date of birth, age, race, nationality, municipality and unit of the Federation of birth, if it is a disabled person, type of activity in which it operates (undergraduate and/or postgraduate education, research, extension, management or planning), classroom or e-learning mode, teacher scholarship, visiting professor.
HEIs	name, acronym, maintainer's name, localization (city, federation unit, geographic region), administrative categories, academic categories, number of employees, number of technical and administrative staff by sex, number of technical and administrative staff by training, infrastructure and financial information (revenue, transfer, investment, expense).

First, a Pearson correlation coefficient analysis was executed and based on its analysis, from a total of 304 variables (the year of 2014 as a reference) which composed the original database (N=100%), there were 132 (n=43,42%) selected, the ones with a strong or unyielding correlation coefficient (r), which means: $0.70 \leq r \leq 0.90$ or $0.90 \leq r \leq 1.00$.

Second, based on the literature review (Buss et al., 2004; Canton & de Jong, 2005; Glewwe & Jacoby, 2004; Gölpek, 2012; Hübner, 2012; King, 1993a; Li et al., 2008; Mueller & Rockerbie, 2005; Noorbakhsh & David, 2002; Radner & Miller, 1970; Rahona López, 2009; Ruben, 1999; Savoca, 1990; Tierney, 1982; Robert K. Toutkoushian, 2001; Wetzell et al., 1998b; Wilkins, 2010), from 132 selected variables, there were 32 (n= 24,24%) indicated as more relevant which are shown in *Table 6*. The data from these variables were submitted to a *min-max* normalization process considering the [0,1] interval, min = 0 and max = 1.

As a result, we proposed an integrated approach, as indicated in *Table 6*, which considers some official variables (from x_1 - x_8) and a group of new variables (from x_9 to x_{32}), proposed exclusively for this study. All the variables were analyzed in order to aggregate the data at the Higher Education Institution's level.

Table 6 Selected variables

Variable name	Description	Source
HEIs		
x_1 QT_TEC_TOTAL	Number of administrative staffs	Faculty staff (Ruben, 1999)
x_2 VL_RECEITA_PROPRIA	Incomes	Financial aid and support (Buss et al., 2004; Canton & de Jong, 2005; King, 1993a; Savoca, 1990)
x_3 VL_TRANSFERENCIA	Financial transferred values	
x_4 VL_OUTRA_RECEITA	Other incomes	Revenues (Ruben, 1999)
x_5 VL_DES_INVESTIMENTO	Investment expenses	
x_6 VL_DES_PESQUISA	Research and development expenses	Proposed by the author
x_7 VL_DES_PESSOAL_REM_DOCENTE	Remuneration of active teachers	

X₈	VL_DES_PESSOAL_REM_TECNICO	Remuneration of technical-administrative / pedagogical personnel		
COURSES				
X₉	NCO_OCDE1_Edu_prop	Number of courses in Education		
X₁₀	NCO_OCDE2_HumArt_prop	Number of courses in Humanities and Arts		
X₁₁	NCO_OCDE3_CSocNegDir_prop	Number of courses in Social Sciences, Business, and Law		
X₁₂	NCO_OCDE4_CienMatComp_prop	Number of courses in Science, Mathematics, and Computing		
X₁₃	NCO_OCDE5_EngProdConst_prop	Number of courses in Engineering, Production, and Construction	Student preferences (Ruben, 1999)	Outcomes/ (Ruben, 1999)
X₁₄	NCO_OCDE6_AgricVet_prop	Number of courses in Agriculture and Veterinary		
X₁₅	NCO_OCDE7_Saude_prop	Number of courses in Health and Welfare		
X₁₆	NCO_OCDE8_Serv_prop	Number of courses in the Services area		
X₁₇	NCursosPresencial	Number of classroom courses		
X₁₈	NCurso	Total number of courses		
STUDENTS				
X₁₉	TotalAlunos	Total number of enrolled HEIs students	Enrollment (Guimbert et al., 2008; King, 1993b); enrollment rates (Hübner, 2012); enrolled students (Buss et al., 2004; Mueller & Rockerbie, 2005)	
X₂₀	NIngressantesTotalIES/TotalAlunos	Total number of HEIs entrants by the total number of students	Potential enrollees (King, 1993b);	
X₂₁	NConduintesTotaisIES/TotalAlunos	Total number of HEIs undergraduates by the total number of students	Graduating students (Strauss & Borenstein, 2015)	
X₂₂	TotalAlunos/NCursos	Average number of students per institution course	Enrollment (Guimbert et al., 2008; King, 1993b); enrollment rates (Hübner, 2012); enrolled students (Buss et al., 2004; Mueller & Rockerbie, 2005)	
X₂₃	NumTOTALAlunFinancEst/TotalAlunos	Number of students with public funding by the total number of students	Scholarships (Canton & de Jong, 2005; Hübner, 2012; Wetzel et al., 1998b); Real credit (King, 1993b), grants (Wetzel et al., 1998b);	
X₂₄	SexoFemAlunosTotal/TotalAlunos	Number of female students by the total number of students	Sex, age (Savoca, 1990); demographic characteristics (Savoca, 1990).	
PROFESSORS				
X₂₅	NCurso	Total number of courses	Student preferences (Ruben, 1999)	Outcomes/ (Ruben, 1999)
X₂₆	NumDocentes	Total number of professors by HEIs		
X₂₇	NumDocEscolaridade4_prop	Number of teachers with master's degrees relative the total number of teachers		
X₂₈	NumDocEscolaridade5_prop	Number of teachers with a doctorate about the total number of teachers		
X₂₉	NumDocDout/numDoc	Teachers with a doctorate by the total number of teachers	Proposed by the author (ratios)	
X₃₀	DocFem/numDoc	Number of female professors about the total number of professors		
X₃₁	DocMasc/numDoc	Number of male professors about the total number of professors		
X₃₂	NumDocAfast/numDoc	Number of out of work professors about the total number of professors		

3.6. Self-Organizing Maps: the selected technique

After exporting and organizing the data, they will be submitted to GeoSOM_v201. Through this tool, the Self-Organizing Maps (SOM) technique will be applied as a way of visualizing the data under study, to identify new patterns that are not always visible in large volumes, thus generating new knowledge. The parameters used by SOM are described in *Table 7*.

Table 7 Parameters used in the SOM analysis

Parameters	The 1st training phase	The 2nd training phase
Type of training	Batch	Batch
Size of the map	15x10	15x10
Epochs	200	400
Initial neighborhood radius r	8	4

Self-Organizing Maps (SOMs), or Self-organizing feature maps (SOFMs) were first proposed by Tuevo Kohonen at the beginning of the 1980s (R. A. P. Henriques, 2010; T. Kohonen, 1982), and constitute the product of his work on associative memory and vector quantization. SOM's basic idea is to map high-dimensional data onto a one, two, or three-dimensional discrete feature map, maintaining the relations between data patterns. SOM's main objective is to "extract and illustrate" the essential structures in a dataset, through a map resulting from an unsupervised learning process (R. A. P. Henriques, 2010; S. Kaski & Kohonen, 1996; S. Kaski, Nikkilä, & Kohonen, 1998).

Each unit of the SOM is represented by a vector $w_i = [w_{i1}, w_{i2}, \dots, w_{in}]$ of dimension n , where n equals the dimension of the input space and $i = 1, 2, \dots, N$ denotes the index of the unit in the SOM. SOM is adaptive, meaning that the weights of each unit will change in order to minimize the distance between the units and input patterns. This process is called a training phase. In this process, a given training pattern x is presented to the network, and the closest unit is selected. This unit is called the best-matching unit (BMU). The unit's vector values (synaptic weights in neural network jargon) and those of its neighbors are then modified to get closer to the data pattern x :

$$w_i(t+1) = w_i(t) + \alpha(t)h_{ci}(t)(x - w_i(t)), \quad (1)$$

Where $\alpha(t)$ is the learning rate at time t , and $h_{ci}(t)$ is the neighborhood function centered in unit c , and i identifies each unit. Both $\alpha(t)$ and $h_{ci}(t)$ decrease with time during the learning phase.

To SOM converge to a stable solution, both the learning rate and the neighborhood radius should converge to zero. Usually, these parameters decrease linearly, but other functions can be used. Additionally, the update of both parameters can be done after each individual data pattern is presented to the network (iteration) or after all the data patterns have been presented (epoch). The former case is known as sequential training, and the latter is usually known as batch training.

This research will use the GeoSOM Suite tool (R. Henriques, Bacao, & Lobo, 2012) and follow five steps: data preparation, data loading, initializing, map training and interpretation of the results, which will be further presented. The GeoSOM Suite tool (R. Henriques et

al., 2012) is proposed and, although it presents a few variants to the original SOM algorithm (spatial and hierarchical variants), the core SOM algorithm was used. This tool uses the SOM Toolbox code as the backbone, which was developed by Kohonen research team.

One of the SOM characteristics is that the results are usually affected by initial training parameters. Thus, to minimize that impact it is common to perform a sensitivity analysis to those parameters including the SOM structure (size, topology, shape, and initialization of the map used) and the training parameters (number of iterations, initial learning rate and decrease function and initial neighborhood radius and decreased function). In the analysis, usually, all parameters are left constant except one, which is tested, with several values. From the analysis, it is possible to achieve the optimal values for each of the parameters.

3.6.1. Visualization of SOM

After the use of the SOM technique, the results obtained through its maps visualization will be analyzed and will be presented throughout this thesis.

There are several ways to visualize the SOM and improve the understanding of the data patterns (Vesanto, 1999). Two of the most important visualization tools are component planes (Teuvo Kohonen, 2001) and the U-matrix (Ultsch & Siemon, 1990).

In a component plane, each unit is colored according to the weight of each variable in the SOM. Through the analysis of the component planes, data distribution can be evaluated. For instance, it is quite simple to identify variables that are correlated (their component planes will have the same shape), and it is also possible to have an improved understanding of the contributions of each variable to the SOM. By comparing two or more component planes, one can visually identify correlations between variables, both globally and at a local scale.

U-matrix is one of the most used methods to visualize SOM (Ultsch & Siemon, 1990). U-matrices are computed by finding the distances in the input space of neighboring units in the output space. There are two ways to visualize a U-matrix. The most common is to use a color code to depict distances, corresponding to the values of the U-matrix. Usually, a greyscale is used, with the highest value being represented with black and the lowest with white. Darker color regions on the U-matrix represent sets of units that are like each other while the lighter color regions represent sets of units that are dissimilar. However, darker regions represent clusters while lighter regions represent the clusters' frontiers.

3.6.2. Benefits and constraints of using SOM

In this study, SOM will be used to assess the potential relationship among Higher Education (HE) components – Higher Education Institutions, Undergraduate Courses, Students and Professors; and, further, to investigate the relationships between HEIs components. The specific advantages of the SOM algorithm and its classification and visualization ability for large Higher Education data are to detect, not only the hidden factors responsible for the data structure observation, but to find some HE specific features.

3.7. Research Framework

The *research framework* for the development of this approach will be held in seven steps, which include data preparation, data loading, initializing, map training, and interpretation of the results as described in *Table 8*.

Table 8 Research Framework

Steps		SOM Phases
1	Design of variables and components	Data preparation
2	Data collection	Data loading
3	Data pre-processing	Initializing
4	SOM for individual components	Map training
5	Finding the optimum number of clusters through the Davies-Bouldin <i>index</i> and clustering SOM using <i>k-means</i> algorithm	Map training
6	Visualization of SOM components for each dimension proposed	Map training
7	Data analysis for SOM components	Interpretation of the results

In our data set, each data item is associated with a variable. The variables x_1-x_{32} , disposed of in *Table 6* will be used for the analysis and visualization of each proposed dimension of SOM attributes, independently and globally, mapping the input vector into a 2-dimensional output space (grid).

Additionally, it will use some quantitative auxiliary tools, as the *Davies-Bouldin index* to find the optimal number of clusters for each U-matrix and the *k-means* algorithm applied to SOM units. The clusters from these two operations will be then mapped for each U-matrix.

3.8. Research Quality Assessment

Considering the nature of this study, the scientific quality criteria will be based on its 1) Validity and Subjective reliability; and 2) Authenticity.

This project adopts the following tactics to assess its quality through the results or conclusions of the research:

- 1) *External validity* considering the analysis of the whole universe under study (HEI, courses, students, and teachers), adopting a specific technique (classification and clusterization) for the generalization purpose.
- 2) *Internal validity*, it will try to demonstrate through proper analysis` methods that the relationship between data, information, and generation of knowledge can be potentialized through the identification of unknown patterns hidden between the data available but underutilized.
- 3) *Subjective validity and reliability (trustworthiness)* will be guaranteed through an accurate description of the research methodology, ensuring that the study will obtain the same results if it is reproduced or repeated. However, promoting the advancement

of the state of the science regarding the generation of knowledge, based on the gap identified through literature review, as well as the innovation regarding methodological adoption for the treatment of educational data; and

- 4) *Authenticity*: it can be ascertained by means of research or audits trail in repositories or research bases on the subject of investigation, as to their authenticity, making sure of their innovation regarding comprehensiveness in data analysis, the generation of knowledge and the methodological adoption for the analysis of educational data.

3.9. Study limitations

This project is restricted to the analysis of the data of the Brazilian Higher Education Institutions, its students, teachers, and undergraduate courses. It is also limited to the analysis of the Brazilian Educational Policy for Higher Education.

The literature review includes the most relevant references for the study in question but represents a sample of all the streams that could be covered.

The methodology of analysis selected for this research, called Self-Organizing Map (SOM), is an option, among others, for providing identification of unknown and hidden patterns between the huge volumes of data.

The adoption of a secondary data source is, in turn, justified. If, on the one hand, it can be configured as a limitation because it does not have the option to collect the data in the source itself, on the contrary, it will approach the whole universe of Higher Education Institutions in Brazil; and it will allow evaluating all HEIs according to the same data collection procedures and variables.

4. HIGHER EDUCATION EXPLORATORY PHASE

This chapter presents the results of the studies realized under the above 3.2. Subchapter, Research Characterization. The results are divided into two groups: a) the findings of the Exploratory Phase, and b) the Knowledge Generation Phase, which, in turn, are divided into the presentation of the discovered patterns, and c) the advancement of RBV Theory.

4.1. The Supply and Demand Conditions in Brazil

This result came from the *exploratory and descriptive study*, of quantitative nature, and assessed the general context of Private Brazilian Higher Education Institutions comparing their supply and demand conditions and the demographic perspectives (see 3.2.1.1). It presents the analyses of supply and demand conditions for the Higher Education Institutions (HEIs), the undergraduate courses, and the students, based on the Higher Education Census.

4.1.1. The Higher Education Institutions – HEI's

In Brazil, one of the identified studies concerned the subject is related to the HEIs market and the private higher education sector's analysis. It attempts to explain and quantify its particularities, such as the strategy of some institutions to maintain permanent excess demand and its selectivity. It is very limited as it considered the data of 39 HEIs and 298 Business Administration Schools (Moita et al., 2015).

Another study related to long-term planning conducts a scenario analysis, based on a model which generates the dynamic behavior of some performance measures to evaluate policies in HE, such as the number of enrolled students in classroom and e-learning classes in the public and private sectors, tuition fees, the occupation rate, the number of degrees awarded and the dropout rates (Strauss & Borenstein, 2015).

Throughout the 1980-2014 period, an increase in the number of higher educational institutions can be observed from data provided by the Higher Education Census, from 882 (eight hundred and eighty-two) in 1980 to 2368 (two thousand, three hundred and sixty-eight) in 2014, representing a growth of 268.5% in number of HEIs. If we consider the period under study, this percentage is around 105% between 2008 and 2014 (*Fig. 4*).

In 2014, private HEIs accounted for about 87.4% of all universities in Brazil, while public higher education institutions accounted for 12.6% of the total. From 2012 to 2014, there was a decrease in the number of HEIs of the two categories in order of 2.02%. There is a predominance in the number of private higher education institutions on the public.

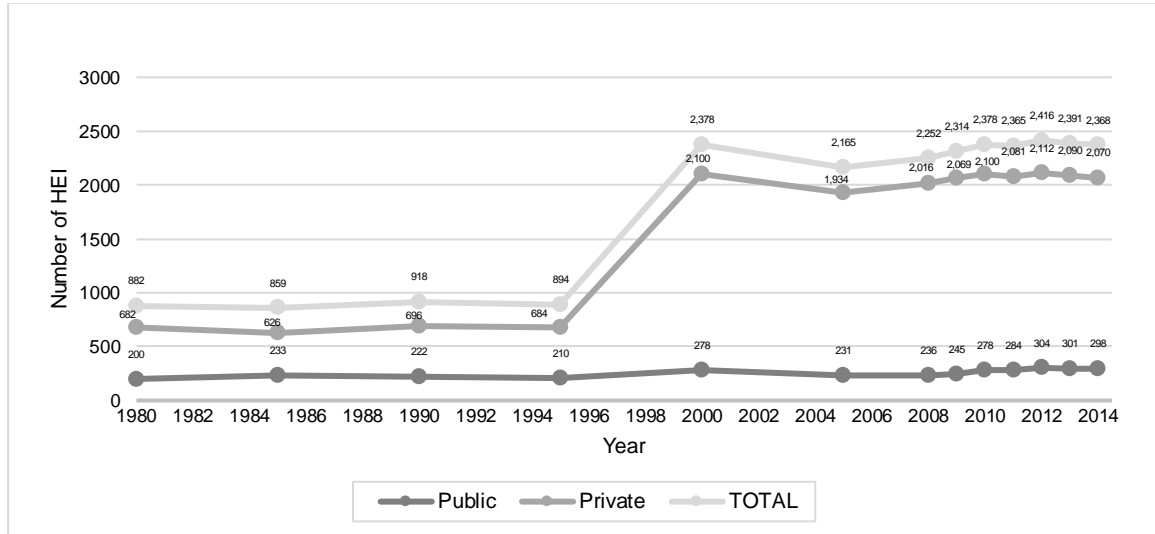


Fig. 4 Higher Education Institutions, 1980-2014, Brazil. Source: MEC/INEP

The change in the total number of higher education institutions, between the years 2008 and 2014 (Fig. 4), has minor modifications (increases or decreases), though their distribution throughout the country and the degree of participation of the five regions (Fig. 5), composed of their states and municipalities (Fig. 6), proved to be different.

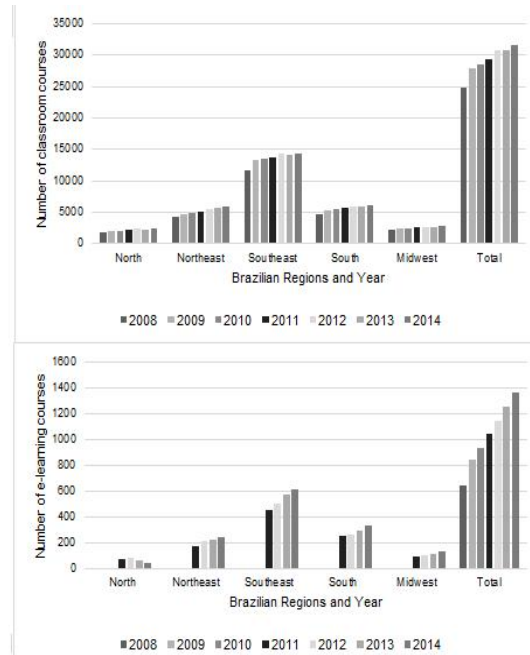


Fig. 5 Public and Private number of HEIs in Brazil, 2008-2014. Source: MEC/ INEP

In a longitudinal analysis, concerning the public and private HEIs (Fig. 5), a change in the selectivity of the regions to meet potential demands is evident. While the Southeast

region¹⁵ continues to be the most "attractive" due to its market share, with the highest number of HEIs (*Fig. 5*). From the data analyzed, for both kinds of institutions, the focus of the Private HEIs in the last two years is in the Northeast and Midwest regions while the focus of the Public HEIs has been in the North and Northeast areas where the number of HEIs has increased (*Fig. 5*). Both situations corroborate with the literature when it mentions the process of expansion of higher education and its internalization to other areas of the country (Silva, Quinteiros, & Araújo, 2013; Tavares et al., 2014).

The distribution of HEIs by state and municipality is illustrated in *Figure 6*. It is also observed that most of the HEIs are concentrated in specific areas, the capitals of the states or the metropolitan region areas, and that they are present in the completely Brazilian territory.

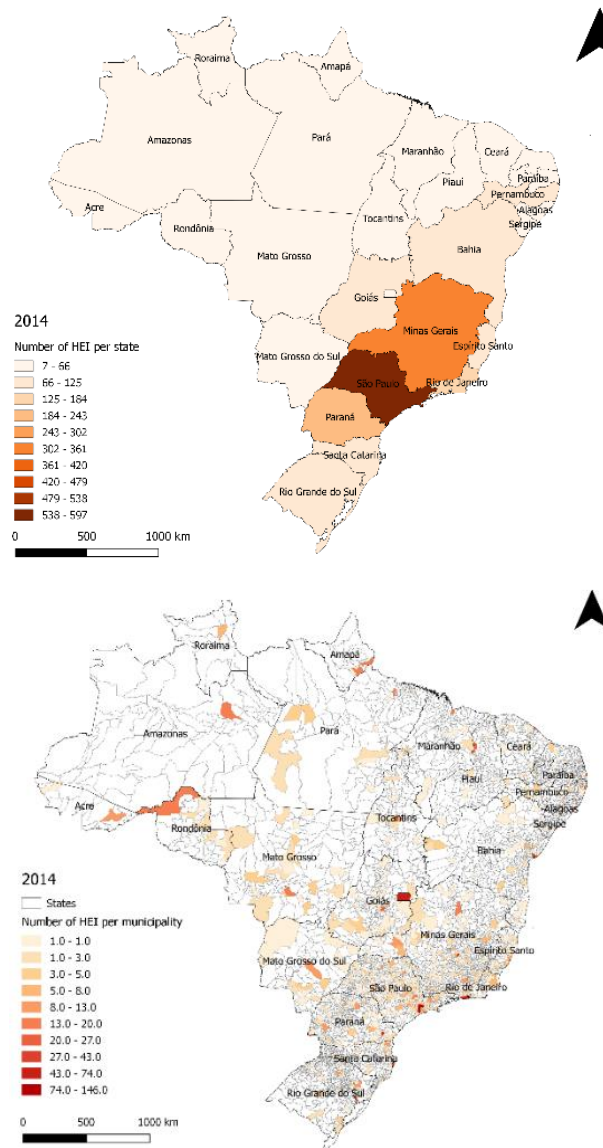


Fig. 6 Number of HEIs per state and municipality, Brazil, 2014. Source: MEC/INEP and IBGE.

¹⁵ The Southeast Region is composed by the States of São Paulo, Minas Gerais, Espírito Santo and Rio de Janeiro

4.1.2. The Undergraduate Courses

When it comes to the offered undergraduate courses (*Table 9*), there is an increase in their number, contrary to what happened with the number of higher education institutions (HEIs).

Table 9 Number of Undergraduate Courses, Brazil, 2008-2014

Year	Undergraduate Courses	Undergraduate E-learning Courses
2008	24,719	643
2009	27,827	844
2010	28,577	930
2011	29,376	1,044
2012	30,718	1,148
2013	30,791	1,258
2014	31,513	1,365

Source: MEC/ INEP

The number of undergraduate courses and the number of vacancies (empty places) has grown substantially over the same period, reaching about 27.5% of undergraduate classroom courses and 112.3% for undergraduate e-learning courses; and around 106.5% for undergraduate classroom courses and approximately 64.8% for undergraduate e-learning courses, respectively. This means an increase of 6,794 courses and around 1,829,300 places for undergraduate classroom courses and 1,100,869 places for undergraduate e-learning courses since 2008 (*Tables 10 and 11*).

It is argued that HEIs are providing a larger list of options (a wider range of course possibilities) since there is a small change in the absolute number of HEIs. Both the number of undergraduate classroom courses and the number of undergraduate e-learning courses (*Tables 10 and 11*) increased during the period.

Concerning the evolution of the number of places offered, candidates, entrants, enrolled and undergraduate students, data demonstrate an imbalance between supply conditions, represented by the number of places offered, and demand conditions, "translated" by the number of candidates, entrants, enrollments, and undergraduates for both modalities – classroom and e-learning courses.

Regarding the undergraduate classroom courses, it is observed that the number of places offered, which has been growing since 2008, is superior to the number of entrants, which sets up an unstable market condition with supply greater than demand. In the data analyzed (*Table 10*), while this condition was already present in 2008, the number of empty places expanded in subsequent years. In contrast, it is observed that the number of candidates, places, and enrolled students increases, although in very different proportions. The only exception is the number of undergraduate students that do not follow the same ratio of students enrolled.

Table 10 Number of places, candidates, entrants, enrolled and undergraduate students in classroom courses, 2008 - 2014

	2008	2009	2010	2011	2012	2013	2014
Places Offered	1,715,994	3,164,679	3,120,192	3,228,671	3,324,407	3,429,715	3,545,294
Candidates	5,534,689	6,223,430	6,698,902	9,166,587	10,927,775	11,945,079	13,245,796
Entrants	1,505,819	1,511,388	1,590,212	1,686,854	1,970,392	1,951,696	2,110,766
Enrolled	5,080,056	5,115,896	5,449,120	5,746,762	5,923,838	6,152,405	6,486,171
Undergraduate	800,318	826,928	829,286	865,161	876,091	829,938	837,304

Source: MEC/ INEP

When it comes to undergraduate e-learning courses, a similar condition is identified. The number of places offered is higher to the number of entrants, though also higher than the number of candidates and enrolled students (*Table 11*).

Table 11 Number of places, candidates, entrants, enrolled and undergraduate students in e-learning courses, 2008-2014

	2008	2009	2010	2011	2012	2013	2014
Places Offered	1,699,489	1,561,715	1,634,118	1,224,760	1,329,407	1,638,427	2,800,358
Candidates	708,784	665,839	690,921	797,176	1,029,981	1,429,360	2,112,930
Entrants	430,259	307,231	332,028	406,514	508,268	474,120	691,731
Enrolled	727,961	836,594	930,179	992,927	1,113,850	1,153,572	1,341,842
Undergraduate	70,068	132,187	144,553	151,552	174,322	161,072	189,788

Source: MEC/ INEP

The courses' distribution among the regions of Brazil is distinct for both modalities of undergraduate courses. The undergraduate classroom courses (*Fig. 7*) are predominantly concentrated in the Southeast, followed by the South, Northeast, Midwest, and North regions, respectively. Small variations are observed over the period, as well as a trend of change in the scenario, and a supply shift to other areas, such as Northeast, South, and Midwest. The market remains in unstable condition with supply greater than demand; and the increased offering courses and places by the HEIs.

The undergraduate e-learning courses (*Fig. 8*) are mainly concentrated in the Southeast, followed by the Northeast, South, and Midwest regions, respectively. A rise is observed over the period for all areas, except the North, where there has been a fall in the offering. This scenario reinforces the unstable market condition beforehand mentioned.

From the demand perspective, the expansion of higher education occurred in the country, predominantly, with the number of vacancies followed by a substantial increase in the number of educational institutions (Corbucci, 2014). Despite the growing demand for higher education in Brazil related to the expansion of the completion of basic education rate, this requirement was only partially met, given the predominantly private character of the offered places (Corbucci, 2014), which requires financial means to match fees

charged. Part of the supply of places in private higher education institutions has been accompanied by an increase in the proportion of empty places.

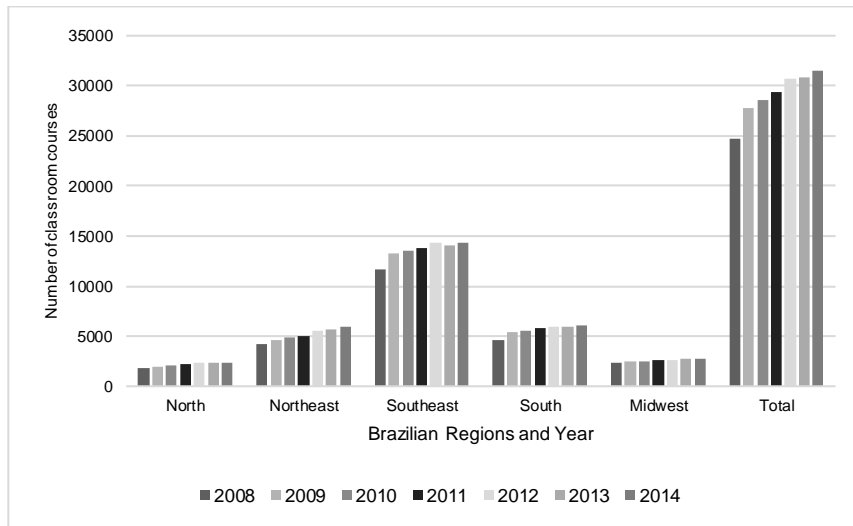


Fig. 7 Number of Undergraduate Classroom Courses in Brazil, 2008-2014. Source: MEC/ INEP

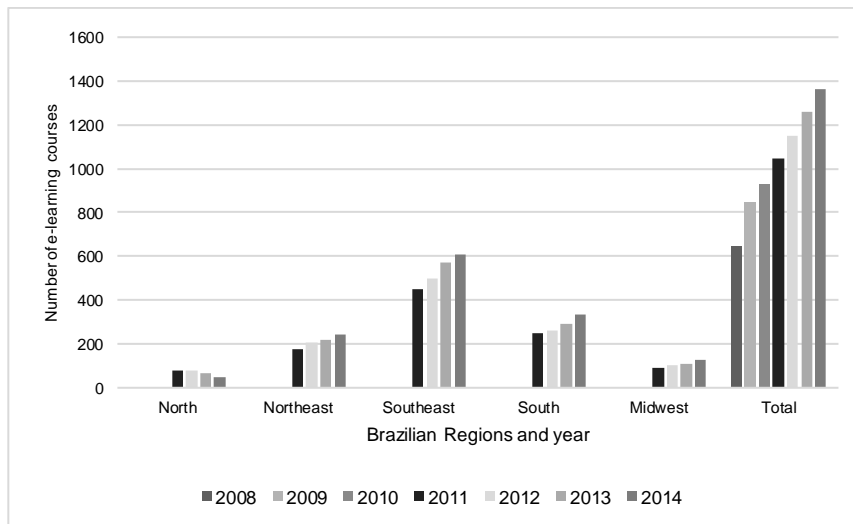


Fig. 8 The number of Undergraduate E-learning Courses in Brazil, 2008-2014. Source: MEC/ INEP¹⁶

Another reason that contributes to the considerable number of vacant, empty or unfilled places on the higher education institutions is due to the priority and the rapid expansion of the network of universities, not followed by corresponding growth in the lower levels of education, mainly high school, blocking the advance to higher education (C. Castro, 2006). Only a few entered the beginning of school and many stranded midway, due to high failure rates and evasion in this level of education, reflecting on the potential demand

¹⁶ The microdata source is available only for the period of 2012 to 2014.

for higher education (Barioni, Razente, Marcelino, Traina, & Traina, 2014; Corbucci, 2014).

Other factors influence demand, for example, the great portion of the population that do not have access to higher education in the age group considered "ideal," as well as livelihood opportunities and the needs of the labor market (Neri, 2011). Therefore, there is a contingent of people over 24 years to be addressed, namely the "late entry" population (Corbucci, 2014). Another aspect, which can be considered, is the limited number of public HEIs comparatively to the Private ones.

All these factors contribute to a lack of efficiency in Higher Education purposes (Teichler, 2008).

4.1.3. The Undergraduate Students

Based on the Higher Education Census (INEP, 2014), *Table 12* indicates the number of enrolled undergraduate students in 2013 and 2014.

Table 12 Number of enrolled undergraduate students, Brazil, 2013-2014

		Undergraduate Classroom Courses	Undergraduate E-learning Courses	TOTAL
Enrolled students	2013	6,486,171	1,341,842	7,828,013
	2014	6,152,405	1,153,572	7,305,977

Source; MEC, INEP

Based on the data from the most recent years¹⁷, it is observed that the highest and the lowest mean ages of students enrolled in undergraduate courses - classroom and e-learning - varies among 18 to 60 years old, depending on its fields of interest. *Figure 9* and *Figure 10* present boxplots for the age variable, allowing to compare the age of the enrolled undergraduate students per field of interest in HEIs in 2013 and 2014.

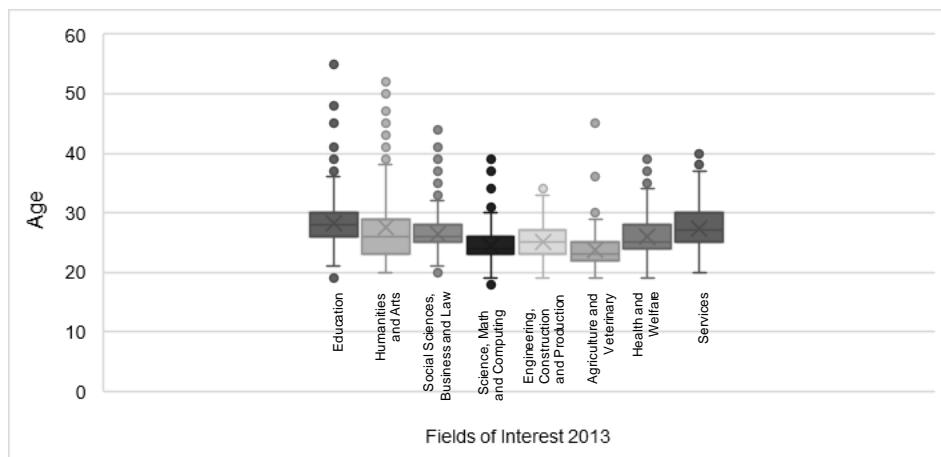


Fig. 9 Boxplot diagram with the ages of enrolled undergraduate students per field of interest, Brazil, 2013. Source: MEC/INEP

¹⁷ Higher Education Census of 2013 and 2014.

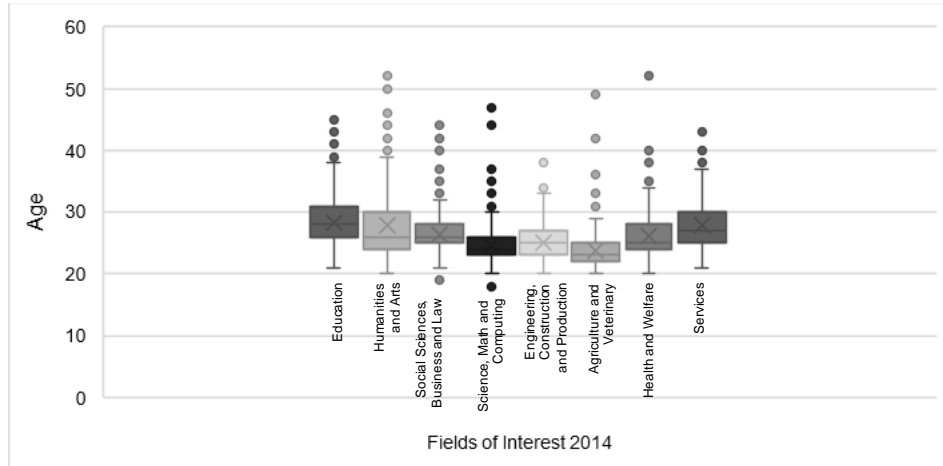


Fig. 10 Boxplot diagram with the ages of enrolled undergraduate students per field of interest, Brazil, 2014. Source: MEC/INEP

The age considered “ideal” for undergraduate courses of 18 to 24 years old has changed when observing the age of students enrolled in undergraduate courses in 2013 and 2014. There is a significant contingent of students older than 24 years old, coherent to what was mentioned before as “late entry population” (Corbucci, 2014).

Most of the areas have a predominance of students older than 24 (Fig. 11 to Fig. 26). The youngest – aged between 18 and 19 – are present in Engineering, Production, and Construction; and Agriculture and Veterinary areas, only in 2013. The oldest is in the areas of Humanities and Arts. These findings also indicate the aging of the students’ population. The illustrations represent the students’ ages (x-axis) and the HEIs (y-axis), in each area of OECD. From the illustrations, the areas where there is a significant concentration of enrolled students can be depicted, and their preferences or the preferences for potential demand can be mapped.

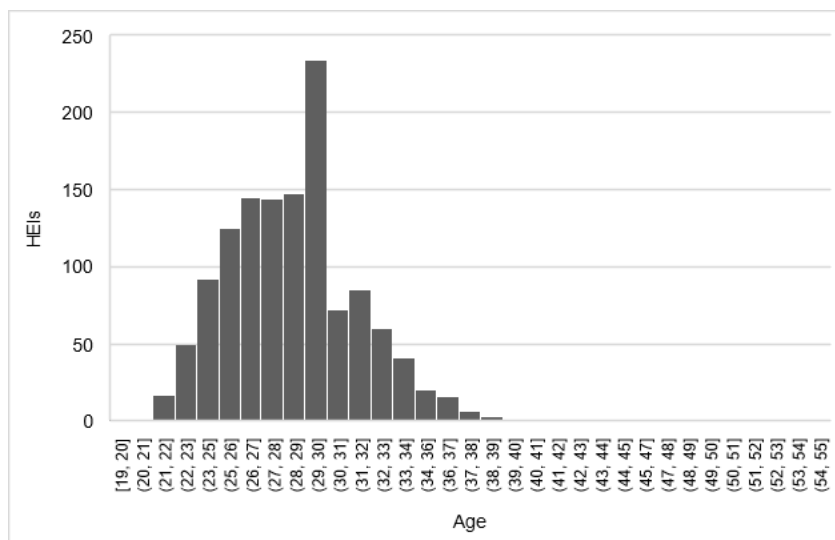


Fig. 11 Age of Undergraduate Students in Education, 2013. Source: MEC/INEP

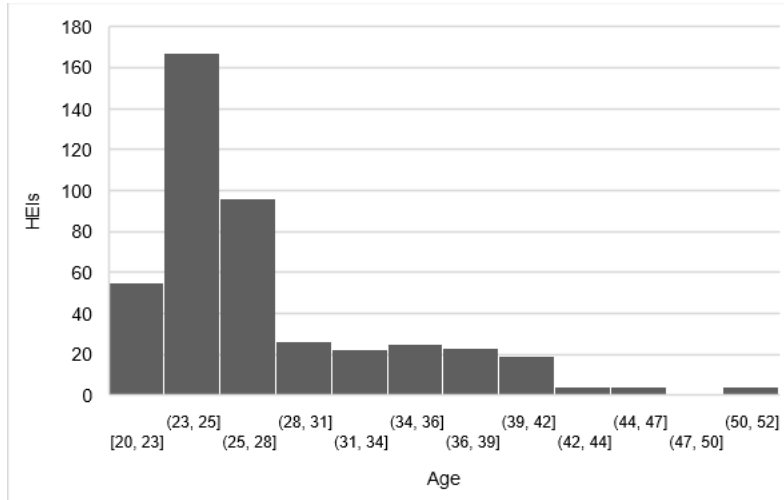


Fig. 12 Age of Undergraduate Students in Humanities and Arts, 2013. Source: MEC/INEP

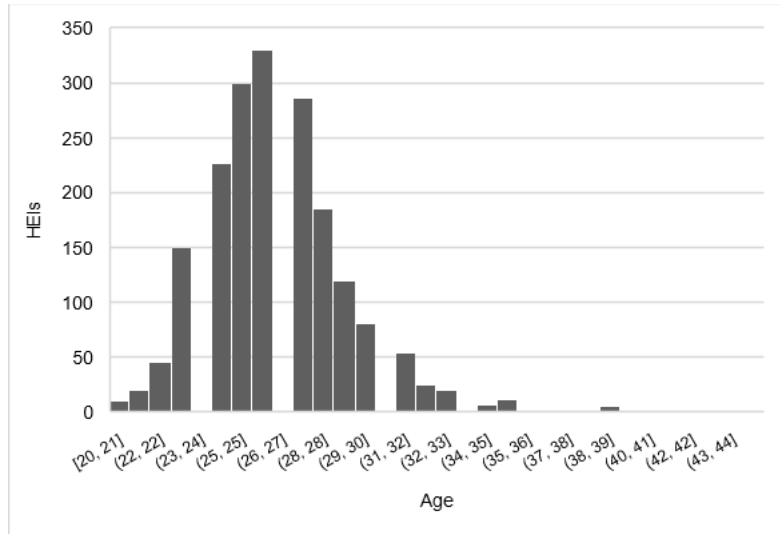


Fig. 13 Age of Undergraduate Students in the Social Sciences, Business, and Law Areas, 2013. Source: MEC/INEP

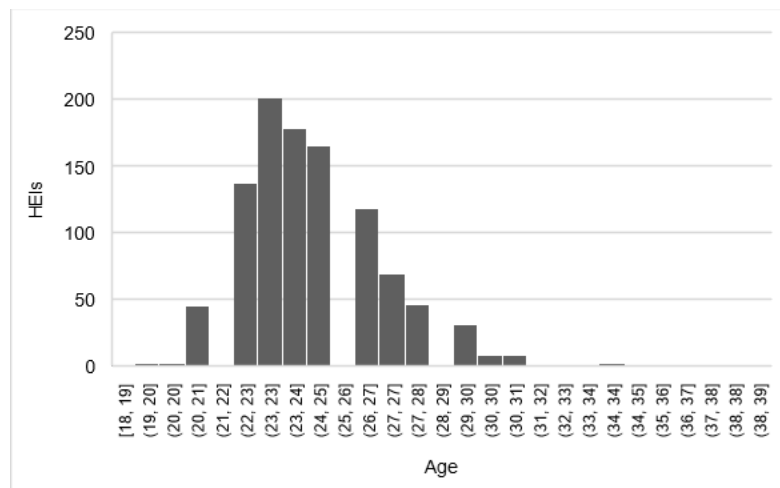


Fig. 14 Age of Undergraduate Students in Science, Mathematics, and Computing Areas, 2013. Source: MEC/INEP

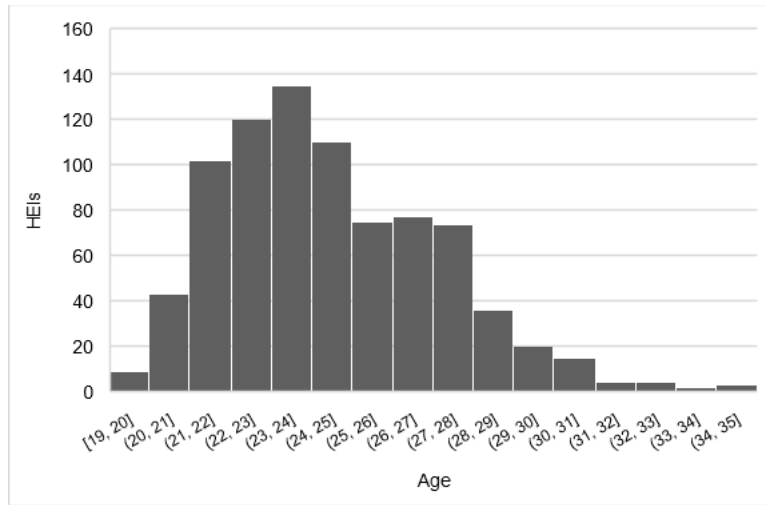


Fig. 15 Age of the Undergraduate students in Engineering, Production, and Construction Areas, 2013. MEC/INEP

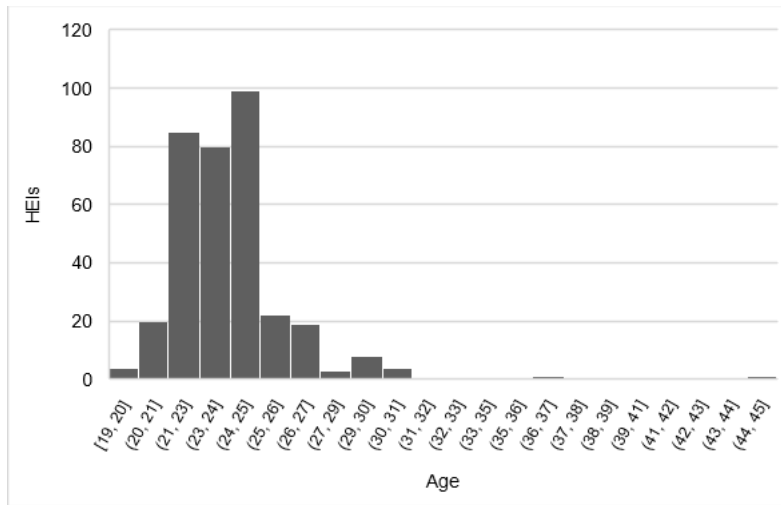


Fig. 16 Age of Undergraduate Students in Agriculture and Veterinary Areas, 2013. MEC/INEP

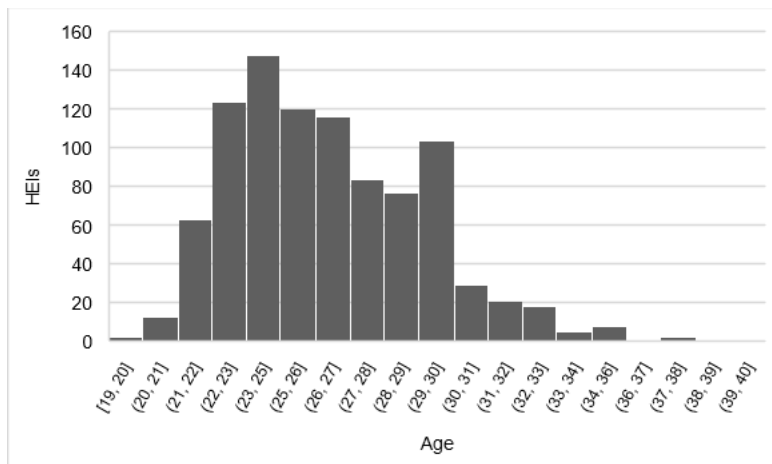


Fig. 17 Age of Undergraduate Students in Health and Welfare Areas, 2013. MEC/INEP

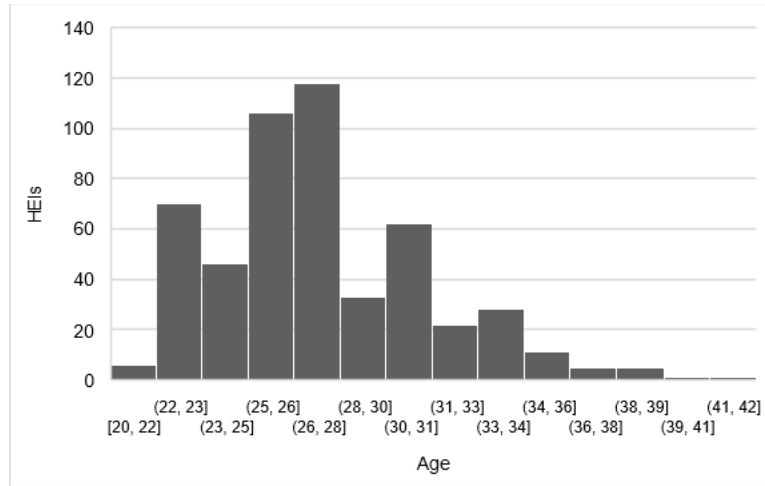


Fig. 18 Age of Undergraduate Students in Services, 2013. MEC/INEP

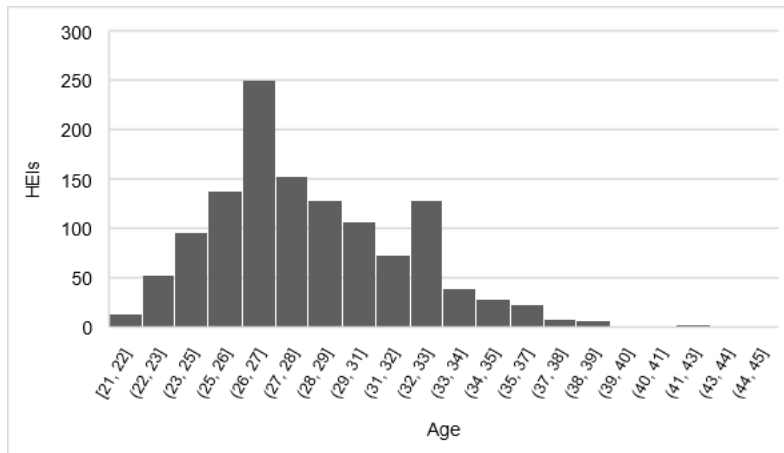


Fig. 19 Age of Undergraduate Students in Education, 2014. Source: MEC/INEP

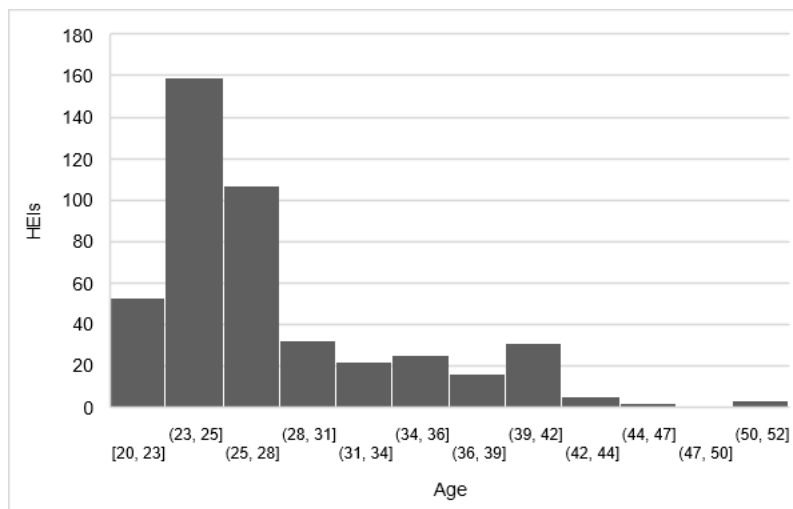


Fig. 20 Age of Undergraduate Students in Humanities and Arts, 2014. Source: MEC/INEP

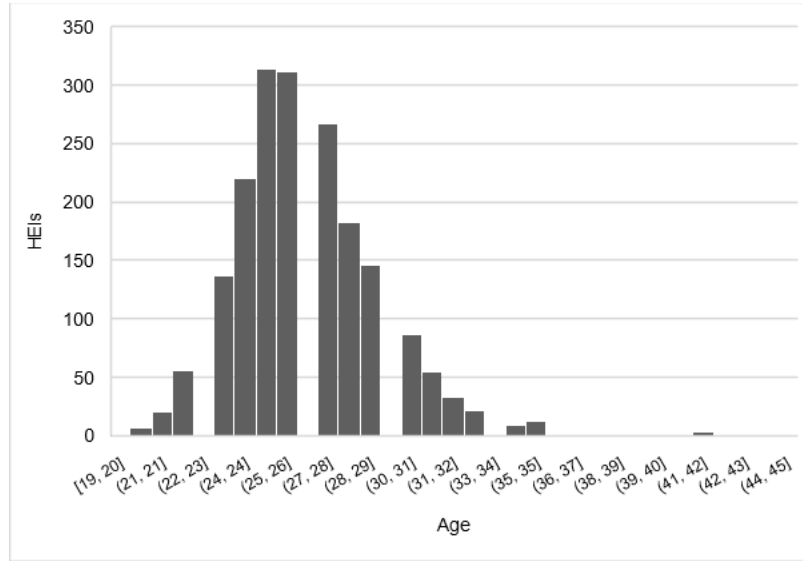


Fig. 21 Age of Undergraduate Students in the Social Sciences, Business, and Law Areas, 2014. Source: MEC/INEP

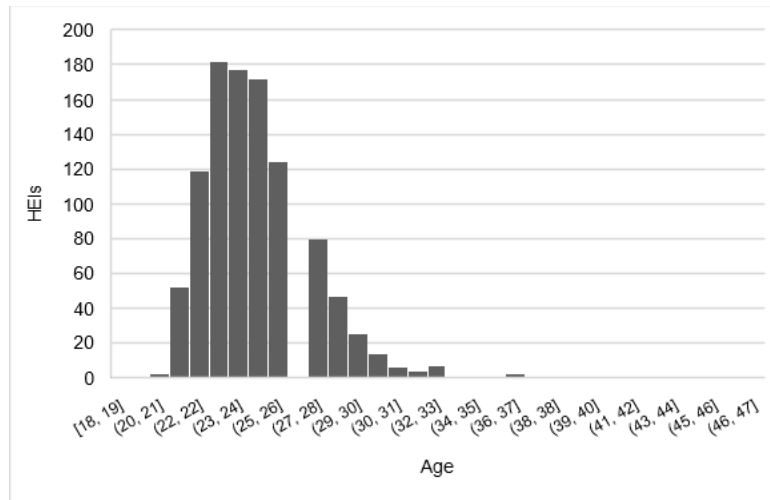


Fig. 22 Age of Undergraduate Students in Science, Mathematics, and Computing Areas, 2014. Source: MEC/INEP

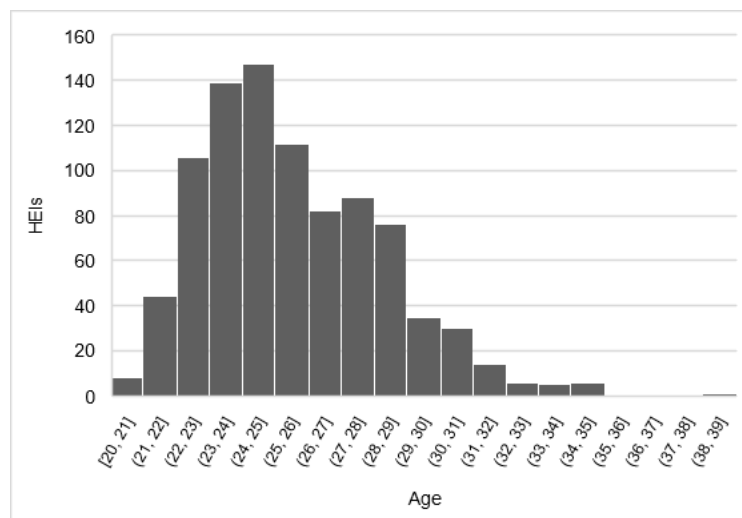


Fig. 23 Age of the Undergraduate students in Engineering, Production, and Construction Areas, 2014. MEC/INEP

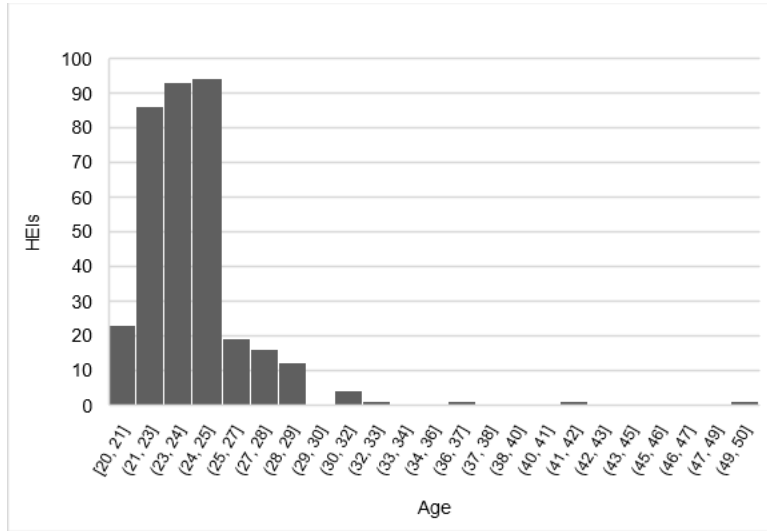


Fig. 24 Age of Undergraduate Students in Agriculture and Veterinary Areas, 2014. MEC/INEP

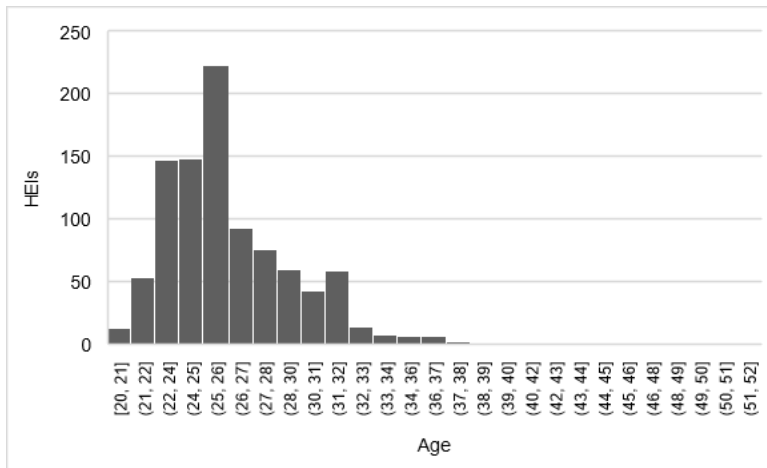


Fig. 25 Age of Undergraduate Students in Health and Welfare Areas, 2014. MEC/INEP

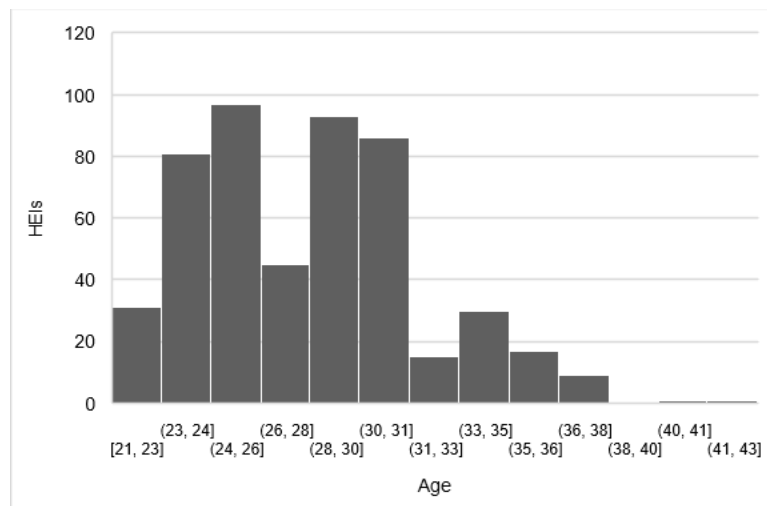


Fig. 26 Age of Undergraduate Students in Services, 2014. EC/INEP

Considering the Higher Education Census of 2013 and 2014, it is observed that the age of enrolled students has already increased for Education (from 19 to 21 years old), Engineering, Production and Construction (from 19 to 20), Agriculture and Veterinary (from 19 to 20), Health and Wellness (from 19 to 20), and Services (from 20 to 21 years old). Also, the maximum age of enrolled students has risen in certain areas as Science, Math and Computing (up to 47 years old), Engineering, Production and Construction (up to 28), Agriculture and Veterinary (up to 49 years old), Health and Wellness (up to 52) and Services (up to 43 years old).

These findings are coherent to the OECD's report (OECD, 2015) which concluded that "Between 2009 and 2013, the share of the population aged between 25 and 64 years old having completed tertiary education increased by three percentage points, reaching 14% in 2013".

Another point to be considered is the financial situation of enrolled students, in particular, the undergraduate students who benefit from government economic and funding programs. From the Higher Education Census data (INEP, 2014), it is observed that 2,494,014 (32%) of the enrolled students benefited themselves from public financial programs in 2014. Most of them were enrolled in Social Sciences, Business and Law, Health and Welfare, and Engineering, Production, and Construction undergraduate courses. This number has increased since 2013 (*Fig. 27*).

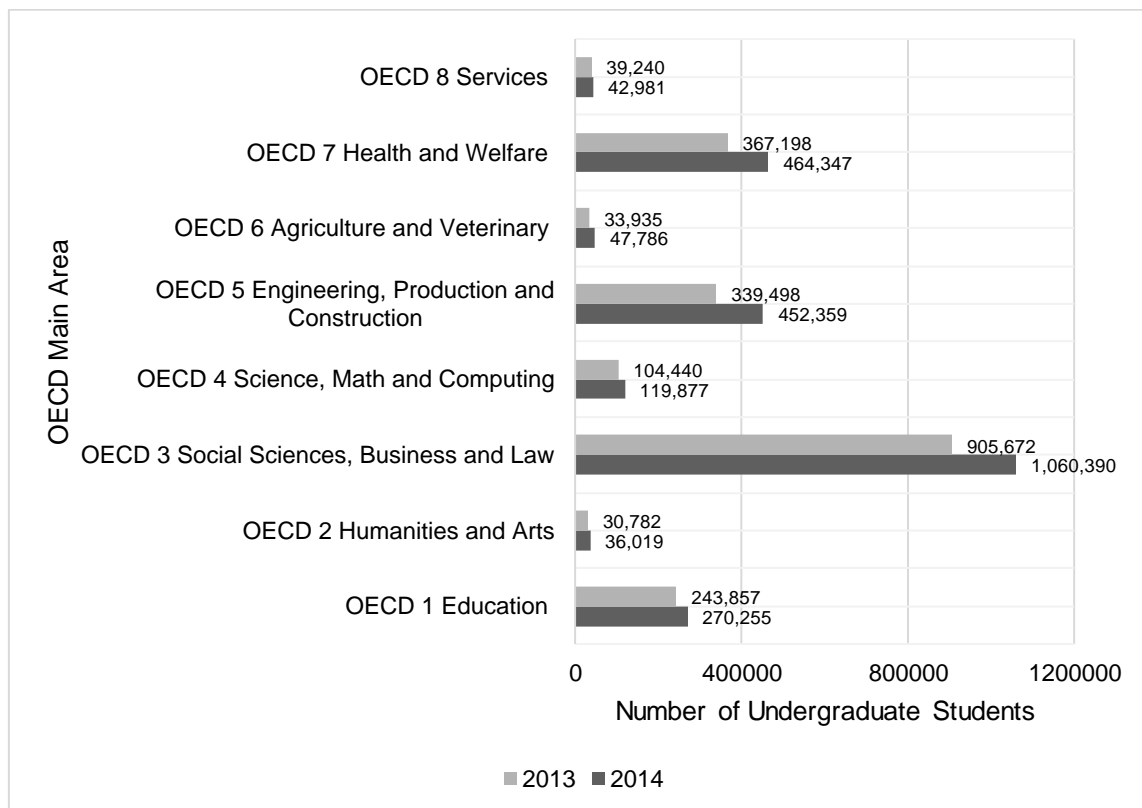


Fig. 27 Number of undergraduate students with scholarships, 2013-2014

Any change in the funding public policy, the country's economic situation, and the students or their family income rates can affect, directly or indirectly, the HEIs enrollment rates.

Research presented by the Brazilian Association of Maintainers of Higher Education - ABMES, showed that 50.5% of young people who wish to join higher education could not afford to pay the tuition fees and need the help of government financial and funding programs. Of them, 37.3% said they could afford the monthly payments, and 12.2% stated that they might afford it. The study surveyed a thousand Brazilians aged between 18 and 30 years with high school degrees (Cruz, 2016). This statement points a tendency for the governments' financial and funding programs' rise policy on the contrary to what has been announced. Moreover, it also indicates the potential demand trend, related to the candidates or entrants to higher education.

In Brazil, it was also observed that the students that enter (entrants) Higher Education have a preference for certain knowledge areas (*Fig. 28*) such as Social Sciences, Business, and Law (40%), Education (18%) and Engineering, Production and Construction (15%), making up for 73% of all preferences.

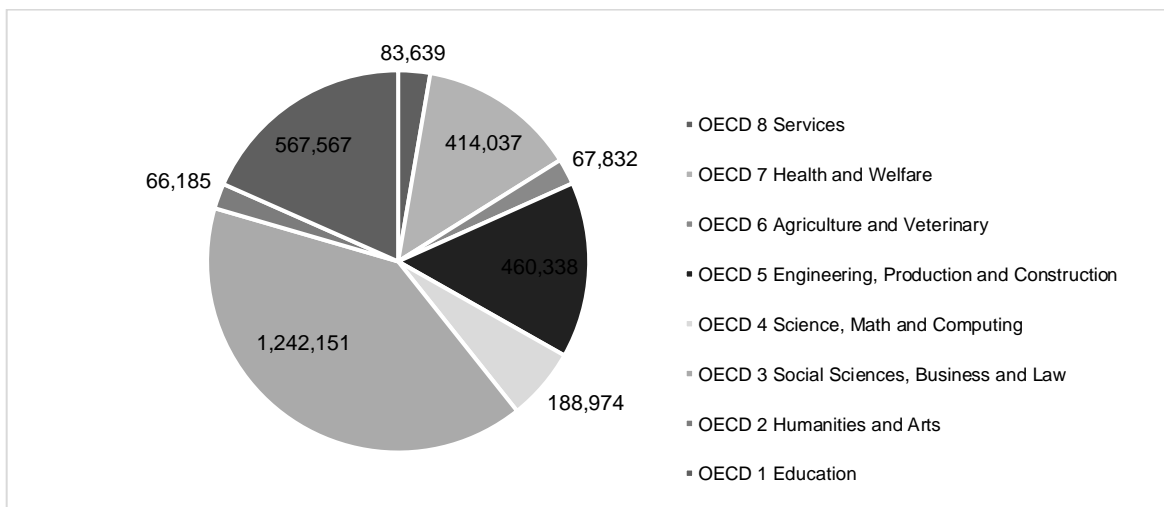


Fig. 28 Preferred OECD Main Areas of entrant undergraduate students, Brazil, 2014. Source: MEC, INEP

In relation to gender, the female presence is higher (57%) than the male (43%) in the undergraduate courses in 2014. This condition was similar in 2013 for enrolled students' data (*Table 13*).

Table 13 Distribution of enrolled student, Brazil, 2013-2014

Gender	2013	%	2014	%
Female	4,179,621	57.23%	4,486,412	57.40%
Male	3,124,169	42.77%	3,329,062	42.60%

Source: MEC, INEP

The differences between genders are also present in the number of enrolled students per OECD main area. The female preferences are Social Sciences, Business, and Law, Education, Health and Welfare. The male preferences are Social Sciences, Business, and Law; Engineering, Production and Construction (Fig. 29). This condition is similar for both 2013 and 2014.

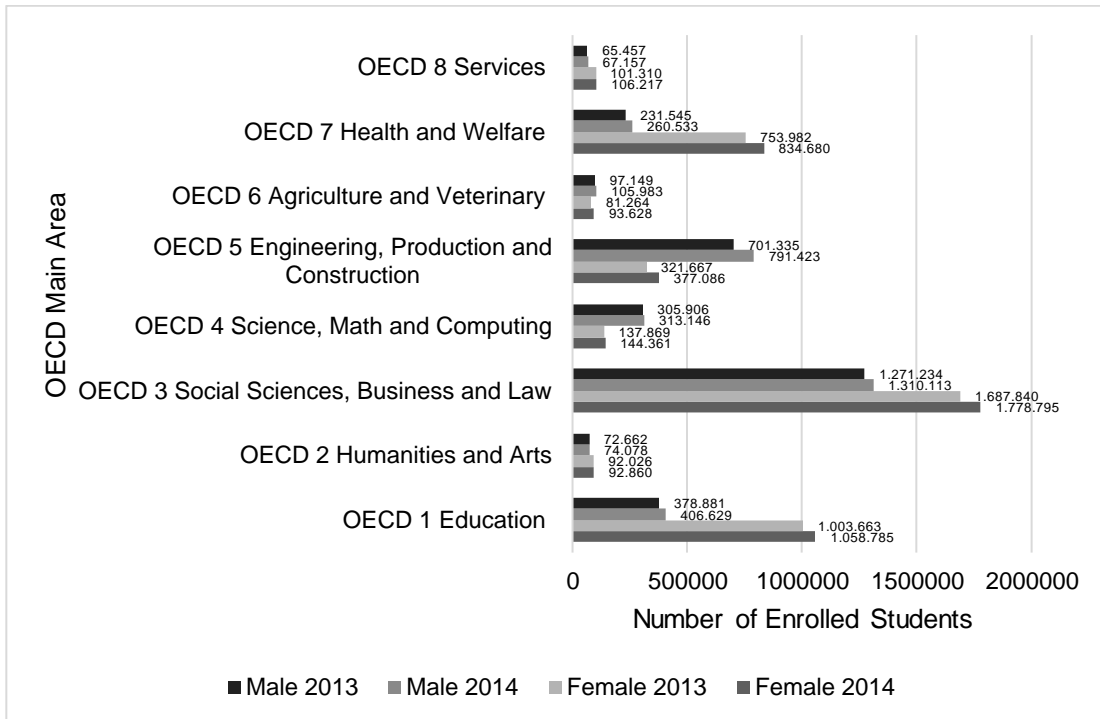


Fig. 29 Enrolled students by gender in OECD Main Areas, Brazil, 2013-2014. Source: MEC, INEP

4.2. The Demographic Standpoint: Undergraduate Students of the Future

From the demographic point of view, it is assumed that there is a market instability, which is getting worse, since the evolution of the size of Brazilian youth, over these last decades, especially in the range of 18 and 24, representing the incoming quota for higher education, is not presented in ascending order.

According to the outlook, this young cohort grew until 2008, when it reached its peak and, from there, according to the Department of Strategic Affairs (SAE) (Brasil, 2013) of the Presidency of Brazil (2013), it declined.

According to the estimates (Brasil, 2013), the youth expanded sharply in a period of 20 years (1983 to 2002) and will remain stagnant for another 20 years (2003-2022), and then, in the twenty years following, twitching in the same rhythm with which it expanded (the size of the youth is expected to contract by 12.5 million between 2023 and 2042).

Associated with this condition is the fact that Brazil undergoes a period of transition in which there is an increase in life expectancy and lower birth rates, reflected in a

reduction in the average number of children per woman. Thus, also, to the decrease in the number of children, there is a slowing of population growth, with a significant impact on the youth contingent (IBGE, 2010; INEP, 2013, 2014; Queiroz et al., 2013).

Brazil had, in 2010, a resident population of 190,755,799 people (Census 2010). Of these, 3,367,172 aged 18 were hypothetically entitled to enter higher education. However, this entire contingent did not arrive at higher education, since the data provided by the Higher Education Census showed that the number of entrants was 1,590,212 and 5,449,120 were registered, less actually than the number of places offered 3,120,192 in 2010 (*Table 14*).

Theoretically, the number of young people old enough to enter higher education (18 years) is 3,367,172 for 3,120,192 (2010) places offered, considering the hypothesis that all this contingent would meet the pre-requisites to enroll themselves in Higher Education.

Table 14 Total percentage of young people aged 18 to 24 in the total population

Total number of places offered	The total proportion of young people aged 18 to 24 in the total population		
	Age Group	Percentage	Number
3,120,192	18 years' old	1.77%	3,367,172
	19 years' old	1.71%	3,265,826
	20 years' old	1.78%	3,389,729
	21 years' old	1.79%	3,421,736
	22 years' old	1.84%	3,510,497
	23 years' old	1.79%	3,420,254
	24 years' old	1.84%	3,502,976
	Total resident population		190,755,799

Sources: IBGE (Demographic Census, 2010) & MEC/INEP

However, as evidenced by the data from the Higher Education Census, in practice, the number of entrants was 1,590,212 (2010), which represents only 47% of all young people in the age range considered ideal for pursuing it. Even smaller is the number of undergraduate students. It is forecast that the number of youths will suffer a drastic reduction from 2022, confirming that this "potential demand" will be reduced even further and that there is a contingent of youth people that, for diverse reasons, have not completed higher education.

Given the need for subsistence or joining the large contingent of the population entering the labor market, the continuation of studies is further prevented, for a large number of young adults (Neri, 2011). A smaller number of young people apt to enter the HE will result in a fiercer competition.

Based on the above it can be argued that the expansion of higher education policy has shown signs of exhaustion, with idleness on the number of vacancies offered, student

debts and the inability to commit to a significant part of the income from the monthly payment (C. Castro, 2006; Neri, 2011; Queiroz et al., 2013).

This instability of supply and demand conditions directly affects the sustainability and governance of HEIs. That is the main reason why they need consistent demand estimation models as well studies involving educational distribution, especially in a country like Brazil, of large territorial dimensions (Dickson & Harmon, 2011), associated with the review and proposal of public policies conducive to its actual scenario.

4.3. The Brazilian Higher Education Assessment System: the IGC Index and the Main Areas of Prevalence

The General Index of Evaluated Courses (IGC) is an indicator of quality that evaluates institutions of higher education in Brazil. It is calculated annually considering: 1) the average of the last available CPC¹⁸s of the establishment's assessed courses in the year of calculation and in the previous two, weighted by the number of enrolments in each of the courses computed; 2) the average of the evaluation concepts of the *stricto sensu* postgraduate programs awarded by CAPES¹⁹ in the last available triennial evaluation, converted to a compatible scale and weighted by the number of enrolments in each of the corresponding postgraduate programs; 3) the distribution of students between different levels of education, graduation or post-graduation *stricto sensu*, excluding the information of item 2 for institutions that do not offer *stricto sensu* graduate degree. As the IGC considers the CPC of the courses evaluated in the year of calculation and the two previous years, its disclosure always refers to a triennium, thus comprising all areas evaluated or even the whole evaluation cycle. Therefore, even though IGC evaluates the courses, in the end, it is a performance metrics index, which is attributed to the Higher Education Institution. So, to have a better idea of the undergraduate courses in quality evaluation, offered by the HEIs in Brazil, the studied variables were compared to the HEIs' IGC index.

For this analysis, it was considered the 1 to 5, and the s/c' (without grade) categories and the results are presented as follows.

Table 15 Distribution of HEIs per IGC, 2014

IGC	Number of HEIs	%
5	25	1.1
4	323	13.6
3	1,363	57.6
2	325	13.7
1	5	0.2
s/c	121	5.1
other	206	8.7
TOTAL	2,368	100

¹⁸ The CPC is an indicator of quality that evaluates higher education. It is calculated in the year following the completion of the ENADE of each area, based on the performance evaluation of students, faculty, infrastructure, didactic-pedagogical resources and other inputs, according to technical guidance approved by MEC/INEP. ENADE – The National Student Performance Exam - is a mandatory exam that evaluates the performance of undergraduate students in relation to the syllabus contents, skills and competences acquired during their undergraduate course.

¹⁹ CAPES is a foundation linked to the Ministry of Education (MEC) of Brazil that works in the expansion and consolidation of *stricto sensu* (master's and doctorate)(Collins, 2001 /3616) post-graduation courses in all the states of the country.

Source: MEC/INEP

According to the Brazilian National System of Evaluation of Higher Education Institutions Indicator, denominated General Index of Evaluated Courses (IGC) of Higher Education Institutions, whose score varies from 5 to 1, with five being the highest and one being the lowest, there is a distribution of HEIs as displayed in *Table 15*. Most parts of the HEIs in Brazil received a 3-score IGC (*Table 15*).

Most of the classroom and e-learning undergraduate courses offered in 2014 received a 3-score IGC, as indicated in *Figure 30*. It is important to state that undergraduate courses that score below three are considered to be of poor quality.

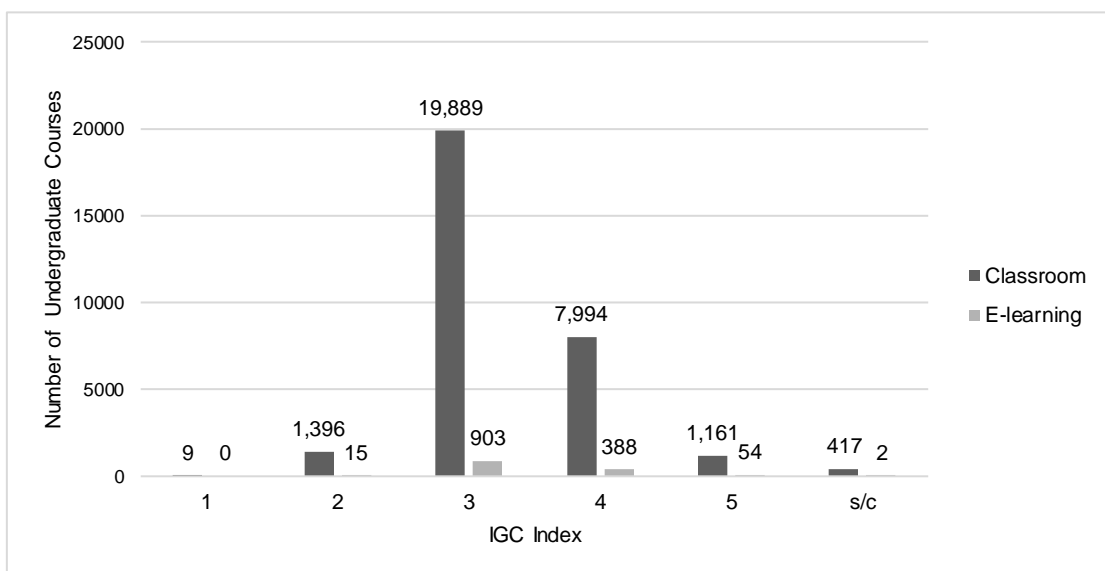


Fig. 30 The number of Undergraduate Courses classified per IGC. Source: MEC, INEP, 2014.

More than 50% of the total of the offered undergraduate courses are concentrated in the Main Areas 1 and 3 of OECD, as indicated in *Table 16*. Just 26.01% of the courses obtained scores 4 and 3.77% obtained score 5 in the IGC's evaluation, attributed to their HEIs (*Table 16*).

Table 16 Undergraduate courses distributed by OECD Main Areas²⁰ and by IGC Index, 2014

IGC	OECD 1	OECD2	OECD3	OECD4	OECD5	OECD6	OECD7	OECD8
1	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
2	1.02%	0.12%	1.82%	0.33%	0.32%	0.08%	0.53%	0.15%
3	15.57%	2.11%	20.67%	5.78%	8.63%	1.57%	7.71%	2.48%
4	6.13%	1.55%	6.47%	3.10%	3.99%	0.95%	3.04%	0.78%

²⁰ OECD 1 – Education
 OECD 2 – Humanities and Arts
 OECD 3 – Social Sciences, Business and Law
 OECD 4 – Science, Math and Computing
 OECD 5 – Engineering, Production and Construction
 OECD 6 – Agriculture and Veterinary
 OECD 7 – Health and Welfare
 OECD 8 – Services

5	0.99%	0.47%	0.55%	0.54%	0.66%	0.16%	0.36%	0.04%
SC	0.33%	0.03%	0.49%	0.05%	0.15%	0.03%	0.19%	0.03%

Source: MEC, INEP.

Considering the variables related to the places offered, entrants, enrolled and graduate students, *Figure 31* illustrates that the vast majority of places offered, entrants, enrolled and undergraduate students are in the Social Sciences, Business and Law (3), Education (1), Engineering, Production and Construction (5) and Health and Welfare (7) OECD Main Areas, respectively, provided by HEIs whose IGC's evaluation score is 3 or 4.

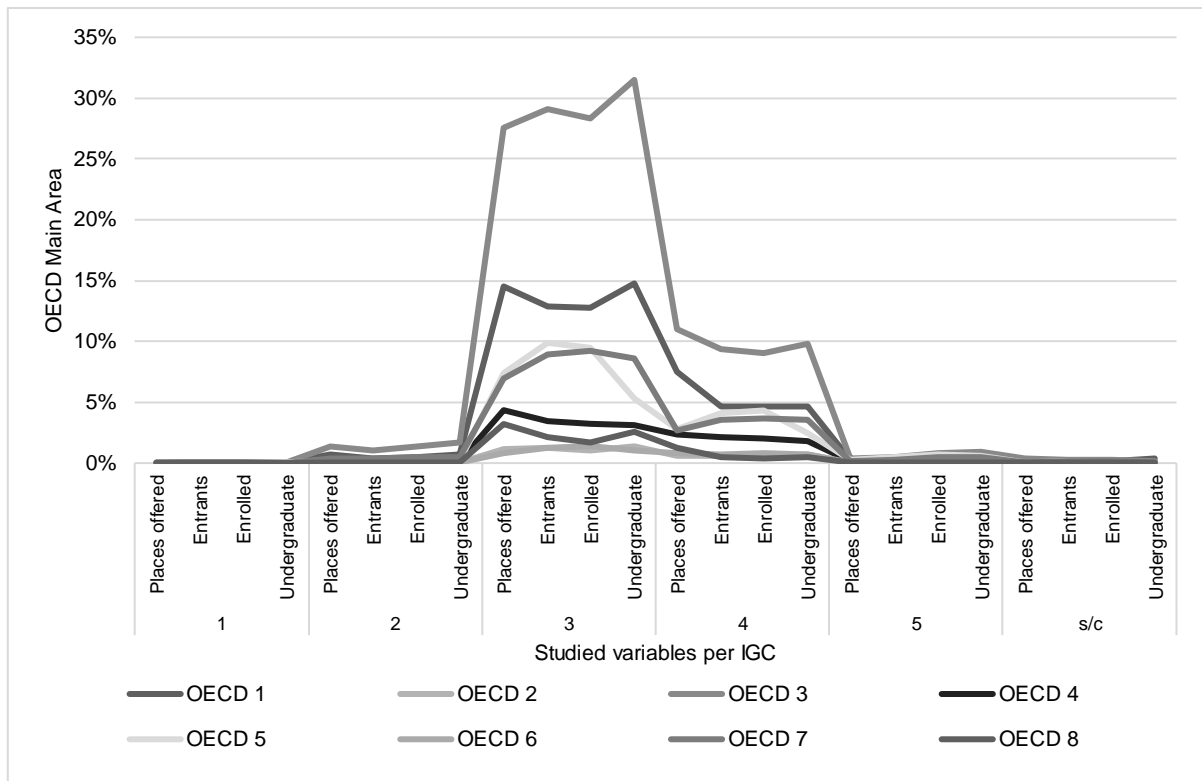


Fig. 31 Main variables' distribution per IGC. Source: MEC, INEP.

Concerning the professors' Educational Level, when it comes to analyze the undergraduate courses comparing to the IGC index attributed to the HEIs, it is observed that the 3-score HEIs have courses with a predominance of master's professors (26.13%); 4-score HEIs have courses with a slight predominance of Ph.D. (15.20%) over masters (11.19%) professors; and 5-score HEIs have courses with a predominance of Ph.D. (6.28%) professors (*Fig. 32*).

Most of the undergraduate students with scholarships are concentrated in the OECD Main Areas²⁰ 1 (42.58%), 7 (18.62%) and 5 (18.09%) as already mentioned (*Fig. 33*). Most of them are enrolled in 3-score (78.12%) HEIs undergraduate courses. The 4-score HEIs have 18.15% of students with scholarships. HEIs with 5-score IGC practically do not have students (0.03%) with scholarships, considering all OECD areas²⁰. One possible reason for that is that from the 25 (*Table 15*) HEIs which obtained the 5 grades in 2014, 15 were public and 10 were private institutions; in the public institutions, the

undergraduate course is free of charge which does not justify the application for a scholarship.

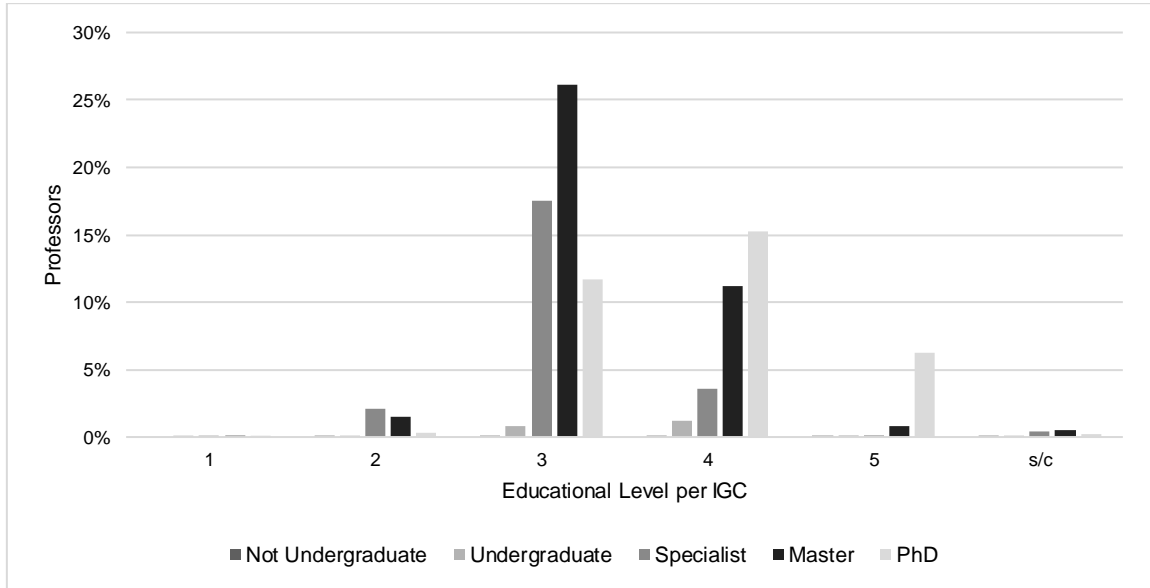


Fig. 32 Professors Educational Level per IGC. Source: MEC/INEP

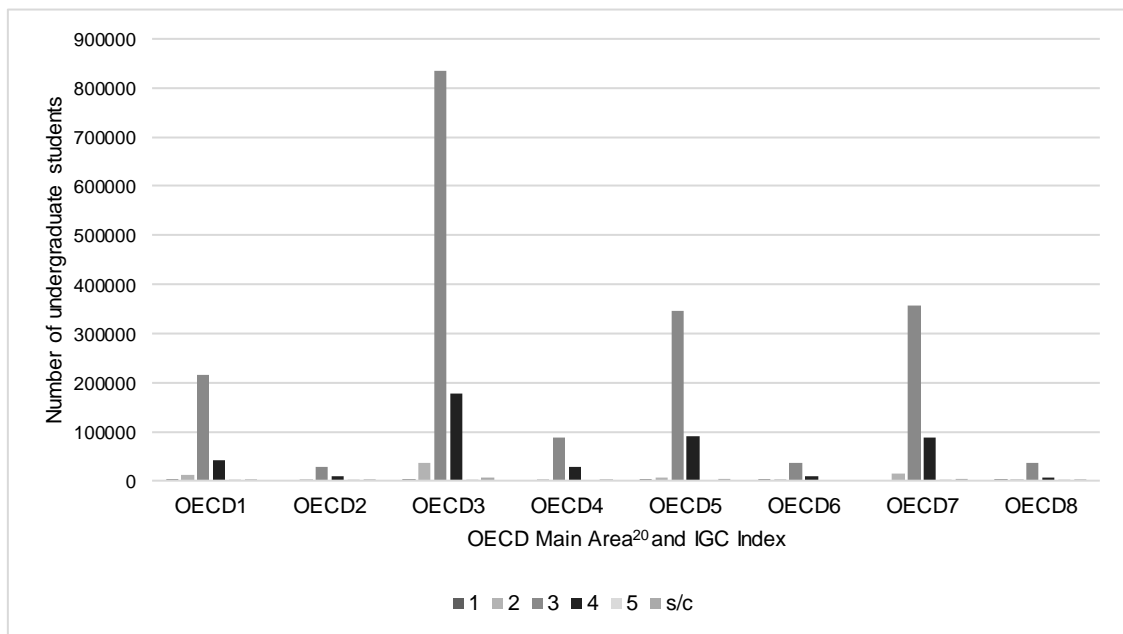


Fig. 33 Undergraduate students with scholarships per IGC. Source: MEC/INEP

4.4. The OECD perspective: a comparative overview

Comparative studies have been addressed as relevant to improve the robustness of the research, broaden the observation base and to achieve a more broad and reliable comprehension of the phenomena observed (Reale, 2014a; Teichler, 2014).

The education systems can be diverse both across countries and for different individuals within the same country. As people have different abilities, needs, and preferences, most education systems try to offer various types of education programs and modes of participation, particularly in the most advanced levels of education and for adults (OECD, 2016b).

In order to have a reference for a comparison to the Brazilian data, we tried to explore similar information based on the OECD report indicators, which comprise data from 35 countries, two partner countries that participate in the OECD Indicators of Education Systems Programme (INES), Brazil and the Russian Federation, and other partner countries that do not participate in INES (Argentina, China, Colombia, Costa Rica, India, Indonesia, Lithuania, Saudi Arabia and South Africa) (OECD, 2015, 2016b) as well as the data for Israel. A global overview of information about educational institutions, undergraduate and completion rates, age, sex, genre, and preferred areas for undergraduate courses was depicted.

Although there is a substantial level of private funding at the tertiary level, on average across OECD countries, 84% of all funds for primary to tertiary educational institutions comes directly from public sources. Comparing expenditure on primary to tertiary levels of education combined, the proportion of private funds exceeds 30% in Chile, Colombia, Korea, and the United States. By contrast, in Austria, Belgium, Denmark, Finland, Iceland, Norway, and Sweden, 5% or less of expenditure on education comes from private sources. In Brazil, in 2013, the public educational expenditure represented 16,1% of total government spending (OECD, 2016b). The specific expenditure at the tertiary level increased modestly, from 0.7% of GDP in 2005 to 0.9% in 2013 (OECD, 2016a).

An average of 36% of young people across OECD countries today is expected to graduate from tertiary education at least once before the age of 30. Women are over-represented among tertiary graduates (57% across OECD countries) though remain under-represented in some areas such as science and engineering while, in the field of education, four women graduated for every man in 2014.

In 2014, most first-time tertiary graduates (72%) earned a bachelor's degree and 16% earned a short-cycle tertiary diploma. Graduates in science and engineering areas combined represented around 22% of graduates at all tertiary levels. 49% of young people (including international students) today can be expected to graduate from higher education at least once during their lifetime, on average across the 26 OECD countries with comparable data for 2014.

The proportion ranges from 22% in Luxembourg, where many citizens choose to study abroad, to 70% or more in Australia, Japan, and New Zealand. More young people are expected to graduate from a bachelor's degree program over their lifetime than from any other level of tertiary education.

On average across OECD countries, over their lives, 38% of young people in each country are expected to graduate with a bachelor's degree, and 11% are meant to graduate from a short-cycle tertiary program. Although bachelor's degrees remain the most common tertiary diploma to be held by graduates in OECD countries, countries are also promoting other levels of higher education. To improve employability and the transition into the labor market, some countries are supporting short-cycle tertiary programs, as in the case of Brazil, for example. The probability of a person in Austria, China, New Zealand, and the Russian Federation to graduate from a short-cycle tertiary program over his or her lifetime is 25% or higher. In some countries, a significant proportion of graduates from higher education englobes international students.

The term "international students" refers to students who have crossed borders with the intent to study. For various reasons, international students have a marked impact on estimated graduation rates. Due to the lack of information, they are often considered first-time graduates, regardless of their previous education in other countries (i.e., an international student who graduates from a second-degree program will be regarded as a first-time graduate in the country of destination). In some countries with a high proportion of international students, such as Australia and New Zealand, graduation rates are thus inflated. When international students are excluded, first-time tertiary graduation rates drop by 30 percentage points for Australia and 17 percentage points for New Zealand (OECD, 2016b).

Comparatively, there are very few international Brazilian students in tertiary education, accounting for a mere 0.2% of all students enrolled in bachelor's programs. At the master's level, international students represent about 1% of all graduates, and most of them are from the STEM areas (OECD, 2016a).

The first-time graduation rate from higher education among people under the age of 30 is an indicator of how many young people are expected to enter the labor force for the first time with a tertiary qualification. On average, across the 20 countries with available data, 36% of young people (excluding international students) are expected to obtain a tertiary diploma for the first time before the age of 30. This rate ranges from 47% in Denmark to 12% in Luxembourg. In addition, some education systems accommodate a wider range of ages among their students than others do. In Chile, Iceland, New Zealand, and Switzerland, first-time graduation rates at the tertiary level drop by more than ten percentage points when restricted to young people under 30 (excluding international students). This may suggest that these education systems are more flexible regarding access to and duration of programs and are more suitable for students outside of the typical age of study. Finland, Israel, and Switzerland also have a mandatory military or civilian service that increases the length of tertiary studies (OECD, 2016b).

Across OECD countries in 2014, the average age of first-time graduates was 26. The variation among countries can be substantial, ranging from 23 years in Lithuania and the United Kingdom to 28 years in Iceland, Sweden, and Switzerland. The average age of graduation tends to increase in higher degrees. It is the same in short-cycle programs and bachelors or equivalent level: the average age of graduation is 26. In 2014, an average of 57% of first-time graduates from tertiary education in OECD countries were women, ranging from 49% in Switzerland to 64% in Latvia and the Slovak Republic. In addition, more than one in two first-time graduates from all levels of tertiary education – except the doctoral level – were women. On average, 58% of first-time graduates from bachelor's programs or the equivalent were female. The largest differences between the share of women who graduated with a bachelor's degree or the equivalent and those who graduated with a doctorate (20 percentage points or more) were observed in the Czech Republic, Saudi Arabia, and Sweden (OECD, 2016b).

The distribution of graduates by field of study is related to the relative popularity of these areas among students, the corresponding number of positions offered at universities and similar institutions, and the degree structure of the various disciplines in each country. Many countries are pushing for a better balance in the distribution of graduates across all fields of education. For instance, the United States recently took measures to increase the number of graduates with tertiary science and engineering qualifications by 1 million by 2022 (U. S. D. o. Education, 2011). Similarly, the European Union recently launched the Science with and for Society program which aims to make science more attractive, particularly to young people, and to open further research and innovation activities across Europe (Union, 2012).

The small share of graduates in science and engineering at the tertiary level hides large differences by level of higher education. While 5% of graduates from short-cycle tertiary programs, 9% of graduates from bachelor's or equivalent programs, and 8% of graduates from master's or equivalent programs earned a degree in science in 2014, 27% of graduates from doctoral programs were in sciences, on average across OECD countries. In Canada, France, Israel, and Saudi Arabia, 55% or more of doctoral students graduated from the fields of science or engineering in 2014 (OECD, 2016b).

A low share of tertiary Brazilian students graduates from science, technology, engineering, and mathematics (STEM) fields of study. Only 14% of bachelor's students and 20% of master's students graduate from the fields of sciences or engineering, manufacturing, and construction (OECD, 2016a).

As already mentioned, women are over-represented among tertiary graduates (57% of graduates), although they remain under-represented in some areas of study, such as science and engineering. There are, on average, three times more male graduates in engineering than female graduates. Among all OECD and partner countries, Poland has the lowest gender imbalance in engineering (1.6 men per woman) and Japan the highest (6.9 men per woman). In science, only Italy and Portugal have a larger share of female graduates. These results are partially explained by gender differences in young people's

attitudes and aspirations. The OECD Programme for International Student Assessment (PISA) has consistently found that 15-year-old girls have higher expectations for their careers than boys though, on average, across OECD countries, fewer than 5% of girls of that age contemplate a career in engineering or computing. The fields of education and health and welfare reveal the other extreme. On average, in 2014, four women graduated in teaching for every man. The ratio is highest in Estonia, where more than 12 women graduated for every man.

Similarly, women graduating in health and welfare represented, on average across OECD countries, 3.7 times the number of men. Canada, Estonia, Finland, Iceland, and Latvia have more than five female graduates per male in the field of health and welfare.

Regarding the field of humanities and arts, none of the countries with available data has more male graduates than female. The same pattern is observed in the areas of social sciences, business, and law, except Indonesia, Japan, Switzerland, and Turkey. The areas of agriculture and services have a more even gender balance (OECD, 2016b).

In Brazil, access to tertiary education is lower than in other Latin American countries, with only 14% of adults reaching that level. Women are more likely, also, to graduate from upper secondary and tertiary education than men. At the upper secondary level, 57% of graduates from general programs and 60% from vocational programs are women. On the other hand, Brazil seems to have a more balanced gender distribution across some fields of study than most OECD countries. For example, 29% of graduates from upper secondary vocational programs in the areas of engineering, manufacturing, and construction are women, compared to the OECD average of 12% (OECD, 2016a).

On average across countries with true-cohort data (data on individual students), 41% of students who enter a bachelor's or equivalent program graduate within the theoretical duration of the program, although sometimes from a different educational level. Within three years after the ideal length of the program, the average completion rate increases to 69%. In almost every country, women have higher completion rates than men at the short-cycle tertiary, bachelors, and first-degree levels. Of the students who enter bachelor's or equivalent programs (Data, 2016; OECD, 2016a), an average of 1% transfer and graduate instead of a short-cycle tertiary program within the theoretical duration of the original program. Within three years after the planned duration, over 1% transfer and graduate from a first degree.

Of students who enter a bachelor's or an equivalent program, on average, by the end of the planned duration of the program, 41% have graduated, 18% have left the education system, and 40% continue. Within the predetermined duration plus three years, the share of students who have graduated increases to 69%, the proportion of students who have left the education system increases to 23%, and the percentage of students still in education decrease to 8% (Data, 2016; OECD, 2012, 2016a). In bachelor's or equivalent programs, the gender gap for completion within the planned duration favors women, as women's completion rates at this level are also higher than men's in nearly all countries, with only

one exception in Turkey. The average completion rate in short-cycle tertiary education (68%) is considerably lower than the average for bachelors or equivalent level (75%) and first degrees (72%) (Data, 2016; OECD, 2016a, 2016b).

4.5. The MOOCs and the Digital Humanities

This subchapter presents the results from the exploratory and descriptive study, of quantitative nature, based on an inductive research strategy that mapped the MOOCs offered by Coursera and Veduca portals, and the ones delivered by the higher education institutions (HEIs), comparing their evolution (see 3.2.1.2).

The first phase developed a research in the two most well-known MOOCs portals in Brazil (Coursera, 2015; Veduca, 2015). From both platforms, the courses offered by higher education institutions were selected, where only two Brazilian HEIs were identified: State University of Campinas - Unicamp and the University of São Paulo - USP (Table 17), which represented 2.15% of all related partners (N=139) from 28 countries (Coursera, 2015).

Table 17 MOOCs offered by Coursera through HEIs

	MOOC
UNICAMP	How to create 2D games for iPhone and iPad
	How to enhance and monetize the app for iOS
	The Entrepreneurship and Entrepreneur Skills
	Creating and publishing an application for iPhone and iPad in the App Store
	How to create an iPhone app
	Creating applications with multiple screens for iPhone and iPad
	Digital Signal Processing - Sampling
	Pluralities in Brazilian Portuguese
USP	Big Data in Health in Brazil
	Accounting History
	Origins of Life in the Cosmic Background
	Fundamentals and Business Language: Accounting

Source: Coursera, 2015.

The classes are free and in a reduced number (Table 17). From a total of 1,484 (N = 100%), MOOCs provided by the platform, only 12 (0.8%) are offered by Brazilian HEIs. Moreover, from this total, nine (0.6%) were being offered at the time of this research, which was based on documentary research in the virtual environment, from November to December 2015. The portal Veduca (Veduca, 2015), in turn, includes different categories of courses: for free, MBAs, ²¹ and community services courses (also denominated extension courses); and comprise various areas of knowledge. Seven Brazilian HEIs provide online courses, but MOOCs are offered by three of them (Table 18).

²¹ Master's in business administration

Table 18 MOOCs offered by Veduca Platform

HEI	MOOC
USP	Basic Physics
UNB	Bioenergetics
Unisinos	Brazilian Sign Language - Libras

Source Veduca, 2015.

In sequence, the research mapped the current offer of the two public HEIs, recognized as the MOOC precursors in Brazil: UNESP and USP. According to UNESP (UNESP, 2015a), and in particular, to the Open University, the courses are organized by areas of knowledge (*Table 19*) and are free of charge. Even though the courses intended to be MOOCs, there is no reference to MOOC terminology neither in the name of the courses nor in the web portal of the institution.

Table 19 MOOCs offered by the Open University, UNESP

Knowledge Area	MOOCs
Biological	Content and Teaching of Physical Education
	Numerical Calculus roots functions - method of Bisection
Exact	Machinery Diagnostic Tools
	The Education Basis and Guidelines Law
	Public communication, citizenship and digital democracy
	Literacy Content and Curriculum
	Content and Teaching Arts
	Content and Teaching of Science and Health
	Content and Teaching of Geography
	Content and Teaching of History
	Content and didactics of Portuguese Language and Literature
	Course Assistive Technology, Projects, and accessibility. Promoting School Inclusion
	General Didactics
	Administrative law
	Education and Language: Early Childhood Education
	Education and Society
	Inclusive and Special Education
	Children's education: curriculum approaches
	Early Childhood Education: Different forms of Expressive and Communicative Languages
Human	Ethics and Citizenship
	Philosophy of Education
	Children's Education Foundations and Principles
	History of Education
	Introduction to Scientific Research
	Educational politics
	Educational Psychology
	Relations and procedures in the Workplace
	Sociology of Education

Source: Portal UNESP, 2015.

According to the USP web portal (USP, 2015), the identified courses are listed in *Table 20* and include different categories, other than MOOCs. As already seen above, in the USP web portal, there are no explicit references to MOOC terminology to the courses offered. Both are free of charge.

Table 20 Courses offered by USP

Undergraduate	Blended undergraduate course in Sciences
Specialization	Specialization in Ethics, Values, and Health in School Motor Learning
Update	Food and Agribusiness Marketing
Diffusion	Introduction to Education Design

Source: Portal USP, 2015.

The second phase of the study mapped the supply of online undergraduate courses in Brazil, 2008-2013, based on the Higher Education Census (INEP, 2013). It adopted the year 2013 as a reference for being the last to official data available and the 2008 year for comparative 5-year analysis. This part of the study had the intention to check if the Godwin-Jones' assumption²² could be confirmed or rejected, by evaluating the online courses offered by the HEIs in the country and compare them to the MOOCs category. The results are presented below.

In Brazil, for decades, there has been an increase in the number of HEIs, with a corresponding rise in the number of courses and places offered. From 2008 to 2013, this represents an increase of around 6%. In the same period, regarding the accredited online undergraduate courses, it can be observed an increase in the number of classes offered, and students enrolled, but a decrease in the number of places offered, as shown in *Figure 34*.

In this period, the number of undergraduate courses almost doubled. The number of students enrolled in 2013 also had a significant increase compared to 2008, indicating a potential interest in e-learning. However, only 18,75% of all the country's student body is enrolled in online undergraduate courses. The number of places offered is already greater than the number of pupils enrolled, pointing to a vast number of vacant (available) places.

²² "MOOCs are neither open nor massive, but often regular online simply courses that have been re-branded" (Godwin-Jones, 2014).

Doctoral Programme in Information Management

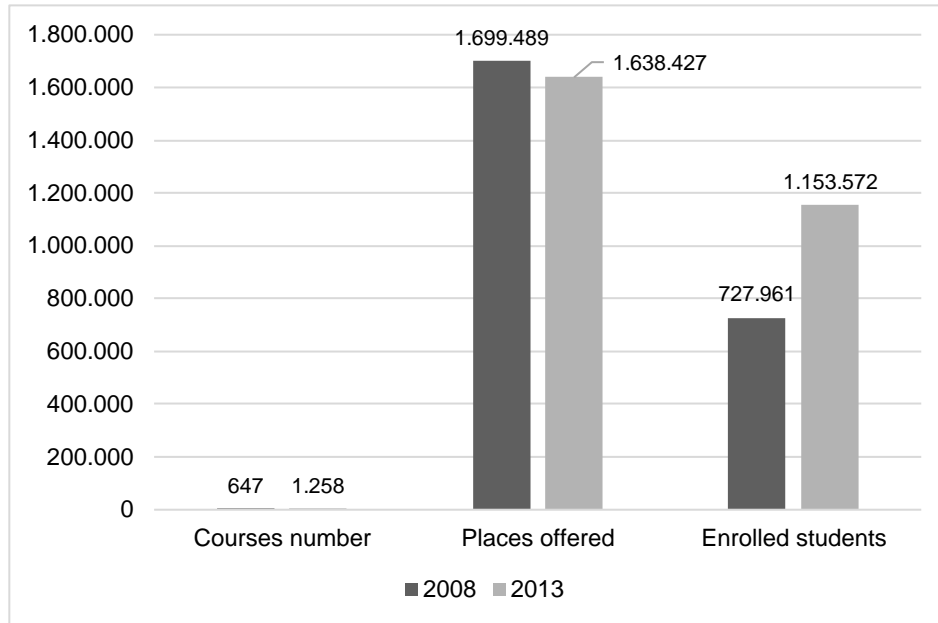


Fig. 34 The number of course places offered and enrolled students. Source: MEC, INEP, 2013.

The vast majority of online courses offered, according to the Higher Education Census (INEP, 2013), are in the areas of education; Social Sciences, Business, and Law; followed later by others, as demonstrated in *Figure 35*.

Taking into account the OCDE main areas, there is more receptivity to the courses offered in the Humanities and Social Sciences, although such courses are still small in gross numbers if compared to the total traditional undergraduate courses (N=30.791) provided in the country.

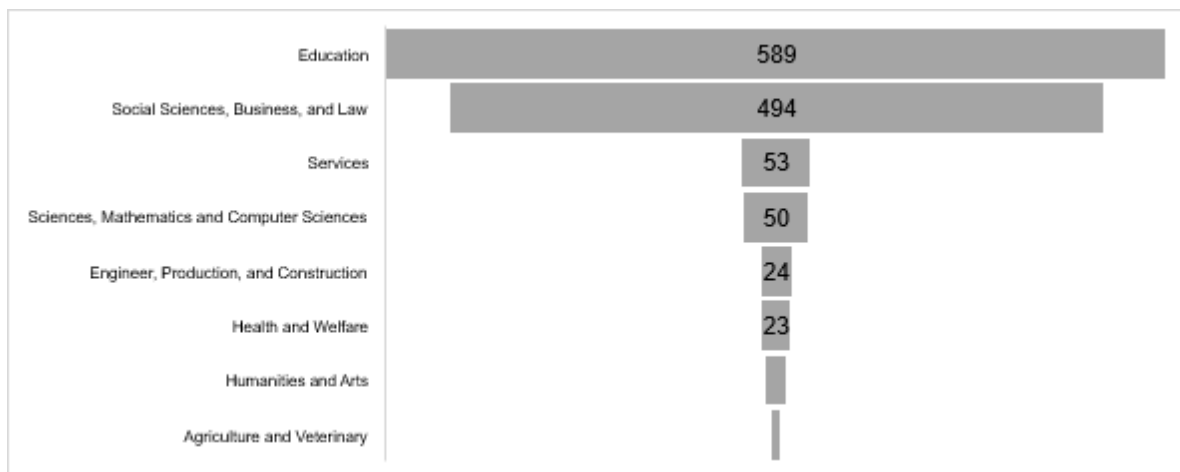


Fig. 35 Online courses offered by OCDE main areas, 2013. Source: MEC, INEP, 2013.

4.6. The Digital Humanities in the Brazilian Context

The results present the main areas of knowledge that prevail against the present offer conditions in the country, in both modalities of courses, and their relationship with the subject of Digital Humanities (see 3.2.1.3).

The first phase, developed through virtual documentary research, in the two main portals of MOOCS in Brazil: Coursera (Coursera, 2015) and Veduca (Veduca, 2015), with the aim of mapping the supply of MOOCs in Brazil by the Coursera platform, identified a total of 1,484 courses registered in the areas of Arts and Humanities, Business, Computer Science, Data Science, Biological Sciences, Mathematics and Logic, Personal Development, Science and Physical Engineering; and Social Sciences, based on 139 partners in 28 countries, according to their own classification and terminology (Coursera, 2015). In this platform, in Brazil, only the University of São Paulo - USP, the State University of Campinas - Unicamp and the Lemann Foundation appear as proposer of courses, that is, 2.15% of all related partners. In the HEIs category, only USP and Unicamp are suppliers of MOOCs. It can be observed that the courses offered by Unicamp are free and in small numbers (n = 8), and a course was not available for consultation at the time of data collection. A similar condition exists for the courses offered by USP, which offered four courses, where two were not being offered at the time of data collection.

Listed below are the courses offered by the Higher Education Institutions - State University of Campinas - UNICAMP, and University of São Paulo - USP (*Table 21*) from the Coursera portal

Table 21 MOOCS offered by UNICAMP and USP

MOOC	
Unicamp	How to create 2D games for iPhone and iPad *
	Improving and monetizing your iOS application *
	Entrepreneurship and Entrepreneur Skills
	Creating and publishing an app for iPhone and iPad in the App Store *
	How to create an iPhone application *
	How to create multi-screen apps for iPhone and iPad *
	Digital Signal Processing - Sampling
	Plurality in Brazilian Portuguese
Usp	Big Data in Health in Brazil
	Accounting History
	Origins of Life in the Cosmic Context
	Fundamentals and Business Language: Accounting

Source: Coursera, 2015.

The courses are free of charge and in small numbers (*Table 21*). When accessing the Unicamp platform, it is observed that five of the courses, indicated with the asterisk (*), make up another category of course, distinct from the undergraduate course, called *lato sensu* specialization in Development and Design iPhone applications. A similar condition applies to courses offered by USP (*Table 21*), where two courses are offered free of

charge, without the issuance of a certificate, as the message that the "certificate registration period is closed" appears. Two others do not have the offer period, which allows concluding that they are not offered at the moment.

Thus, out of a total of 1,484 (N = 100%) MOOCs offered by the platform, only 12 (0.8%) are from Brazilian HEIs. Of these, nine (0.6%) are being offered.

In the Veduca portal (*Table 22*), the category of courses includes the free, MBAs²¹, and extension courses. The offering institutions in Brazil are BM & FBOVESPA²³, FIA²⁴, Fundação Lemann, UFSC²⁵, UNB²⁶, Unesp²⁷, Unicamp²⁸, Unisinos²⁹, and USP³⁰. The areas of knowledge include administration and business; arts & architecture; astronomy; biology; computer science; communication & journalism; right; economy; education; engineering; philosophy & religion; physics; geography & cultural studies; story; literature, languages and linguistics; mathematics & statistics; medicine & health sciences; environment & earth sciences; politics; psychology; and chemistry, according to their own classification and terminology.

In the category of MOOCs, the target of this phase of the research, the following HEIs, courses, and modalities (*Table 22*) were identified:

Table 22 MOOCS offered in the Veduca Platform

IES	MOOC
USP	Basic Physics
UNB	Bioenergetics
Unisinos	Brazilian sign language

Source: Veduca, 2015.

In addition, about other 39 options of free classes and community services (extension) courses are offered on the platform by Brazilian institutions.

Subsequently, research was carried out similar to the previous one, that is, virtual consultation of the portals of two Public Higher Education Institutions, recognized as the precursors in the MOOCs offer in the country, namely the University of São Paulo (USP) and Paulista State University "Júlio de Mesquita Filho" (UNESP).

In consultation with the UNESP website, in particular, the Open University, it is observed that the courses are organized by the areas of knowledge - biological, exact and human. They are free courses, without pedagogical advice (mentoring), evaluation and certification

²³ FBOVESPA – Fundação Bolsa de Valores de São Paulo

²⁴ FIA – Fundação Instituto de Administração

²⁵ UFSC- Universidade Federal de São Carlos

²⁶ UNB – Universidade de Brasília

²⁷ UNESP – Universidade Estadual Júlio de Mesquita Filho

²⁸ UNICAMP – Universidade Estadual de Campinas

²⁹ UNISINOS – Universidade do Vale do Rio dos Sinos

³⁰ USP – Universidade de São Paulo

(Table 23), not referring to MOOC terminology. Moreover, they are, for the most part, the human area.

Table 23 Courses offered by the Open University, UNESP

Area	E-learning Course
Biological	Contents and Didactics of Physical Education
Exact	Calculation of Numerical roots of functions - Bisection
	Machine Diagnostic Tools
	The law of directives and bases
	Public communication, citizenship and digital democracy
	Contents and Literacy Didactics
	Contents and Didactics of Arts
	Content and Didactics of Science and Health
	Contents and Didactics of Geography
	Contents and Didactics of History
	Contents and Did. Language Port. and Literature
Human	Course Tec. Assistiva, Proj. and Acess. School inclusion
	General Didactics
	Administrative law
	Education and Language: Early Childhood Education
	Education and Society
	Inclusive and Special Education
	Infantile Education: curricular approaches
	Ed Inf. : Dif. Ling forms. Express. Communicative
	Ethics and Citizenship
	Philosophy of Education
	Fundamentals and Principles of Early Childhood Education
	History of Education
	Introduction to Scientific Research
	Educational politics
	Educational psychology
Relationships and Procedures in the Workplace	
Sociology of Education	

Source: Portal UNESP, 2015.

In a similar query to the USP Portal, the following categories of courses were identified (Table 24).

Table 24 On-line courses offered by USP

Undergraduate	Master's Degree in Lic. Sciences
Specialization	Course of Esp. Ethics, Values, and Health at School

	Motor Learning
Update	Marketing in Food and Agribusiness
Diffusion	Introduction to Educational Design

Source: Portal USP, 2015.

USP offers at least, two (2) refresher courses, six (6) courses, five (5) specializations, eleven (11) MBAs³¹ and one (1) MBE³² in the past year. In addition, worthy of note is the e-lessons portal, where more than 1208 hours of video lessons can be found, organized by human, exact, and biological areas.

4.7. The Traditional Classroom Undergraduate Courses versus the MOOCs

The second phase of the study mapped the offer of undergraduate courses in Brazil, from 2008 to 2014, based on data from the Higher Education Census, in order to evaluate this scenario against the offer of MOOCs. The year 2014 was adopted as a reference because it was the last one with official microdata available, thus allowing the parallel identification of supply in the country. The year 2008 was adopted as a reference point for comparative analysis.

In Brazil, from 2008 to 2014, there has been a relative increase in the number of higher education institutions until the year 2012, as shown in Figure 36, with a slight decrease in this number in 2013 and 2014; (public and private) and academic organizations (university, university center, faculty, institutes, etc.) related to Higher Education Institutions.

The expansion of higher education in the country had been occurring, especially in the last decades, in order to increase the population's access to education, which was called the democratization and / or universalization of education (Gomes & Moraes, 2012; Lima, 2014; Martins, 2009; Sampaio, 2014b).

³¹ MBA – Master of Business Administration

³² MBE – Master of Business Economics

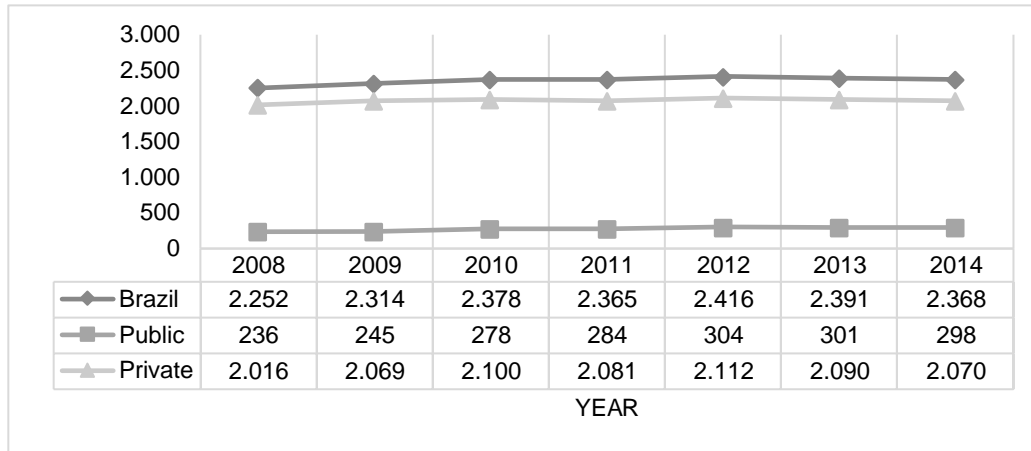


Fig. 36 Evolution of the number of HEIs from 2008 to 2014 in Brazil. Source: MEC, INEP, 2008-2014

Regarding undergraduate education in the classroom or face-to-face modality, it can be observed that, from 2008 to 2014, there was a significant increase in the number of courses, vacancies and enrolled students, as shown in *Figure 37*.

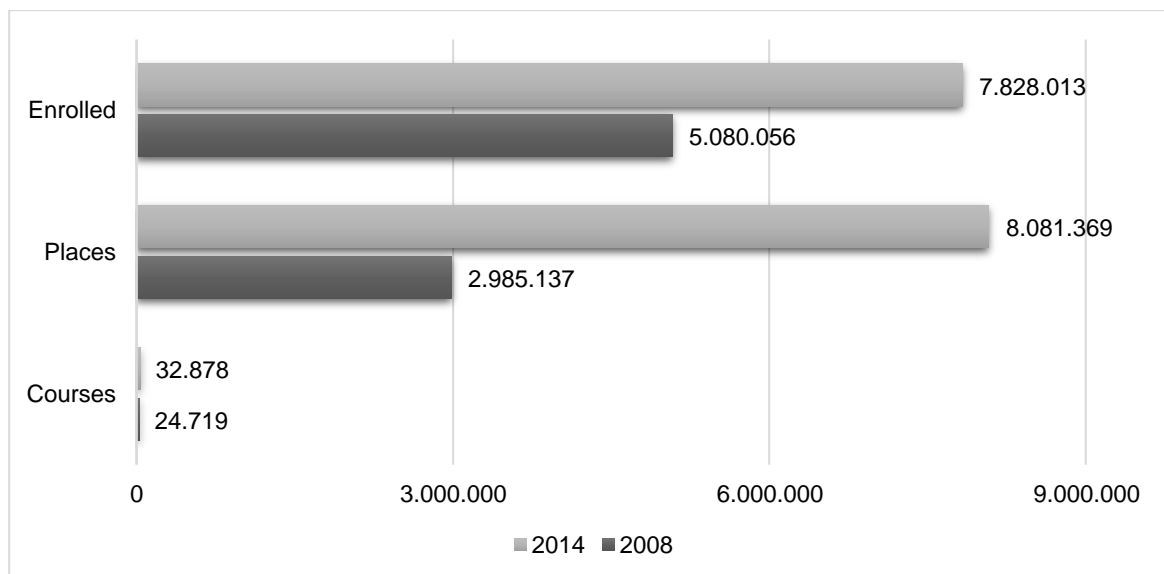


Fig. 37 Evolution of the number of courses, places, and students enrolled in face-to-face modality. Source: MEC, INEP, 2008-2014.

According to data from the Higher Education Census 2014 (INEP, 2014), the vast majority (20,293 courses) of the 32,878 courses offered, including both modalities, is in the area of Humanities since they include Social Sciences, Business, and Law ; Education; Services; and Humanities and Arts. Of these, 31,513 are face-to-face, and 1,365 are in distance mode (INEP, 2014).

Below, we present the distribution of courses offered in the face-to-face modality according to the main areas of the OECD, where 60.50% of the offer is concentrated in the humanities area (*Table 25*).

Table 25 Main areas of the OECD and the total number of courses offered in face-to-face

Undergraduate courses, face-to-face, according to the main areas of the OECD, 2014	
Education	7.241
Social Science, Business and Law	9.279
Services	1.089
Science, Mathematics, and Computing	3.183
Engineering, Production, and Construction	4.501
Health and Welfare	3.853
Humanities and Arts	1.459
Agriculture and Veterinary	908
TOTAL	31.513 (100%)

Fonte: MEC, INEP, 2014.

These courses are offered by 2,363 IES and correspond to 18,319 baccalaureate courses: 7,261 undergraduate courses and 5,933 technologist-training courses.

4.8. The Online Undergraduate Courses and the MOOCs

Regarding undergraduate distance (on-line) education, from 2008 to 2014, there is an increase in the number of courses offered, the number of places offered, and the number of students enrolled, as shown in Figure 38.

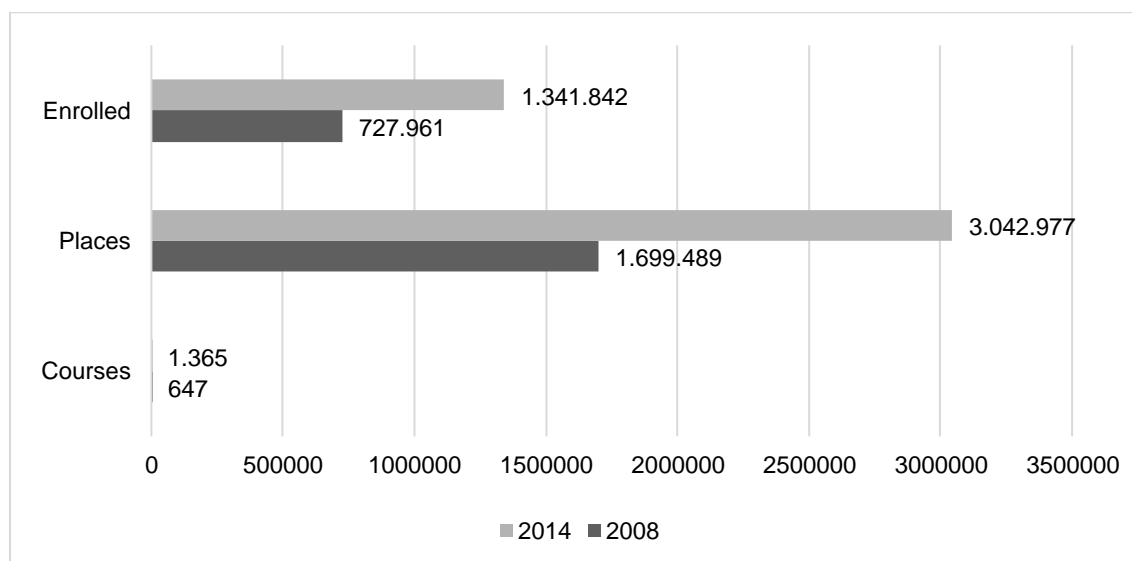


Fig. 38 Evolution of the number of courses, places, and students enrolled in the distance modality. Source: MEC, INEP, 2008-2014.

From 2008 to 2014, the number of courses and vacancies offered in this modality has grown significantly. The number of students enrolled in 2014 also increased compared to 2008, which indicates a potential interest in distance learning (*Figure 38*).

Although it cannot be said that all those enrolled in distance learning courses will successfully complete the course. In contrast, recent studies (Bittencourt.; & Luis Paulo Leopoldo Mercado, 2014; Filho;, Motejunas;, Hipólito;, & Lobo, 2007; Lobo, 2011) point out that evasion rates are higher in the distance modality (28, 8% in the distance modality, compared to 24.9% in the classroom, in 2013) (ABED) and that its number of graduates is lower than that of face-to-face courses, which are also reduced. It should also be noted that in Brazil, 17.14% of all students are enrolled in distance learning courses.

In addition, the vast majority of courses offered in this modality, according to data from the Higher Education Census (INEP, 2014) are in the areas of Education; Social Sciences, Business, and Law; followed, later, by all the others, according to *Table 26*.

Table 26 Main areas of the OECD and the total number of courses offered in distance learning

Undergraduate courses, distance learning, according to the main areas of the OECD, 2014	
Education	592
Social Sciences, Business, and Law	549
Services	61
Science, Mathematics, and Computing	57
Engineering, Production, and Construction	42
Health and Welfare	30
Humanities and Arts	23
Agriculture and Veterinary	11
TOTAL	1.365

Source: MEC, INEP, 2014.

These courses are offered by a total of 177 HEIs, of which 290 are baccalaureate, 595 undergraduate and 480 technologist-training courses.

4.9. The Globalization, Internationalization, and Mobility in Brazil

The results visualize the scenery of the internationalization among the HEIs, their students and professors, and its evolution through the 2014-2015 period (see 3.2.1.4).

As already stated, the internationalization of higher education has become a priority in many worldwide countries (Izabel Cristina de Araujo, 2012). The national educational policies have given place to numerous initiatives, ranging from the funding for undergraduate and graduate students and professors to stay abroad and to cooperation among universities in different countries. The information and communication technology made knowledge all over the world more accessible, and people are embedded inevitably into these new global trends. Even so, the regulatory and funding systems of Higher Education are national as a rule (Teichler, 2014). Despite the

tendencies, there is a conflict between the internationalization of learning and the nationalization of its purposes, cause each country is a single case (Teichler, 2014).

Based on the subject, this subchapter presents the data related to the status of Brazilian internationalization and academic mobility, considering the 2014-2015 period, based on the 22 selected variables (*Table 27*) of the Brazilian Higher Education Census:

Table 27 Brazilian Higher Education Census, 2014-2015

Selected Variables		
Professors	X ₁ = CO_IES	Higher Education Institution code.
	X ₂ = DS_CATEGORIA_ADMINISTRATIVA	Administrative category code.
	X ₃ = DS_ESCOLARIDADE_DOCENTE	Teacher level of education.
	X ₄ = IN_SEXO_DOCENTE	Professors Genre.
	X ₅ = NU_IDADE_DOCENTE	Professors Age.
	X ₆ = CO_PAIS_DOCENTE	Teacher country of birth or naturalization.
	X ₇ = CO_NACIONALIDADE_DOCENTE	Teacher's nationality code.
	X ₈ = DS_NACIONALIDADE_DOCENTE	Teacher's nationality country.
	X ₉ = IN_VISITANTE	Teacher work as a visiting professor.
	X ₁₀ = IN_VISITANTE_IFES_VINCULO	Visiting faculty link in the HEIs.
Students	X ₁₁ = CO_IES	Higher Education Institution.
	X ₁₂ = DS_CATEGORIA_ADMINISTRATIVA	Administrative category code.
	X ₁₃ = CO_NACIONALIDADE_ALUNO	The nationality of the student code.
	X ₁₄ = DS_NACIONALIDADE_ALUNO	The nationality of the student.
	X ₁₅ = DS_SEXO_ALUNO	Students Genre.
	X ₁₆ = NU_IDADE_ALUNO	Students Age.
	X ₁₇ = CO_PAIS_ORIGEM_ALUNO	Country of birth or naturalization of the international student.
	X ₁₈ = IN_ING_CONVENIO_PECG	If the student joined the Foreign Agreement Program - PEC-G.
	X ₁₉ = IN_MOBILIDADE_ACADEMICA	If the student is enrolled in an undergraduate course that is temporarily linked to another institution.
	X ₂₀ = CO_MOBILIDADE_ACADEMICA	Type of academic mobility to which the student participates.
	X ₂₁ = CO_MOBILIDADE_ACADEMICA_INTERN	If the student is regularly enrolled in an undergraduate course, in a national HEI, with a temporary link in an international institution: 1. Exchange, or 2. Sciences without Frontiers (SwB) Program.
	X ₂₂ = CO_PAIS_DESTINO	Country of the receiving institution of the student in academic mobility, in which his / her bond is temporary.

Source: MEC/INEP, 2014-2015.

For this analysis, it was considered the registers of the in-service professors and students, as described in *Table 28*.

Table 28 Total number of HEIs` professors, 2014-2015

		2014	2015
Professors	All	396,595	401,299
	In-service	383,386 (96.66%)	388,004 (96.68%)
Students		10,808,686	10,260,627

Source: MEC/INEP, 2014-2015.

4.9.1. Data concerning Brazilian professors

In 2014, the HEIs received 1,440 visiting teachers, and this number dropped to 994 in 2015. In 2014, 701 were female, and in 2015, only 490 were from the feminine genre. Most of all visiting professors were working in public HEIs (*Table 29*).

Table 29 Visiting professors by HEIs administrative category, 2014-2015

	2014		2015	
Public	1,189	82.57%	626	62.97%
Private	238	16.52%	357	35.91%
Special (others)	13	0.9%	11	1.10%
TOTAL	1440	100%	994	100%

Source: MEC/INEP, 2014-2015.

Concerning their qualifications, in the last two years, the visiting professors are mostly Ph.D. (*Fig. 40*). Only in 2014, it was observed a considerable number of undergraduate (36%) teachers under this condition. In the same year, 1,373 were Brazilian, and 67 were foreigners acting as visiting professors. The professors came from 23 different countries. From this contingency, 82.57% were concentrated in Public HEIs, while only 16.52% were in the Private HEIs (*Table 29*). Besides that, 72.36% were in the great Universities, 11.60% in the faculties and 17.78% in all other categories of institutions.

In 2015, 929 professors were Brazilian's and 65 were foreigners acting as visiting professors. They came from 24 different countries. From this contingency, 62.97% were concentrated in Public HEIs, while 35,91% were in the Private HEIs (*Table 29*). Added to this, 53.22% were in the great Universities. Besides that, 30,18% were in the faculties and 16.60% in all other categories of institutions.

The graphics below illustrate the distribution of visiting professors by genre (*Fig. 39*), degree (*Fig. 40*) and age (*Fig. 41*).

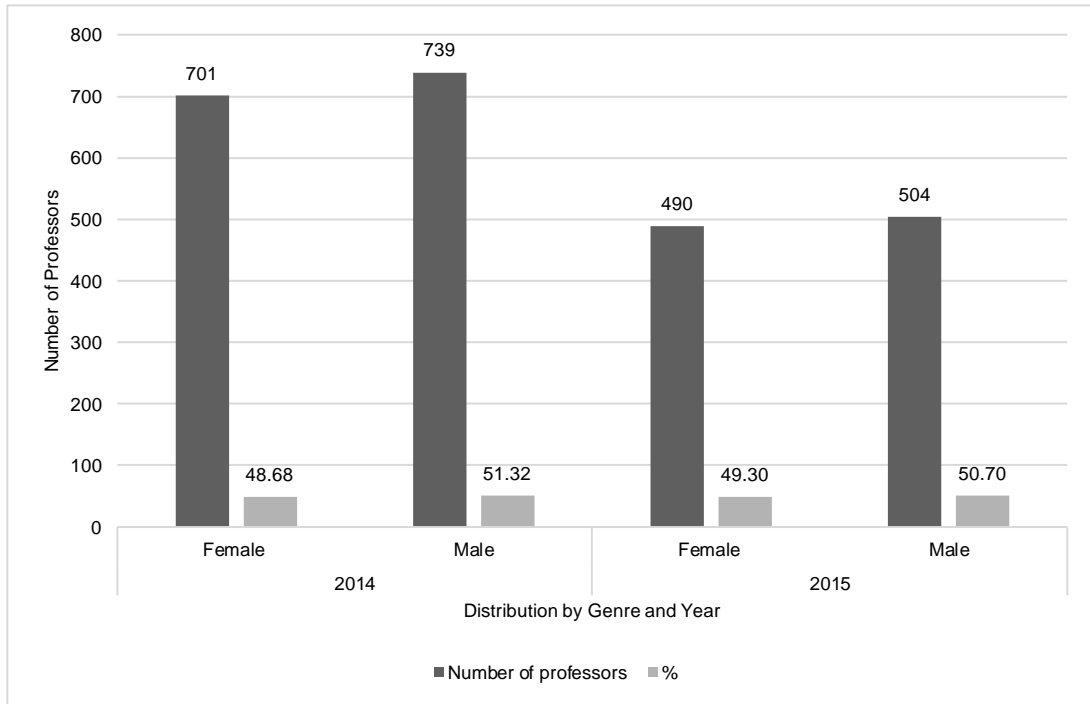


Fig. 39 Genre distribution among visiting professors, 2014-2015. Source: MEC-INEP, 2014-2015.

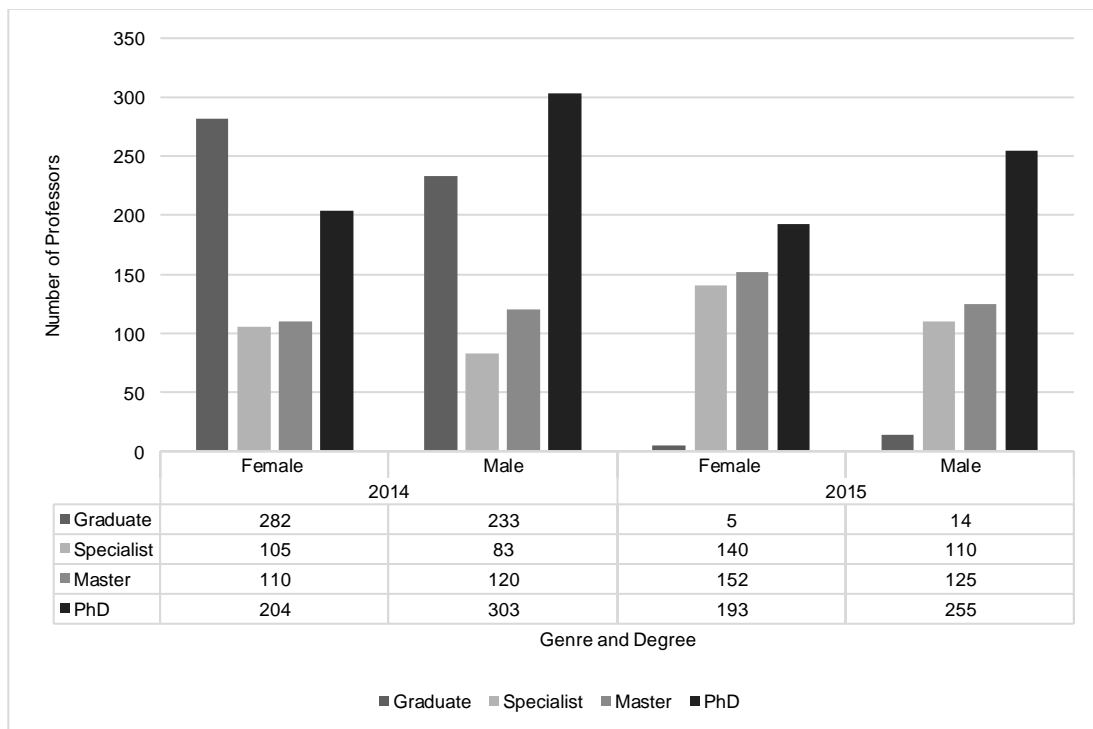


Fig. 40 Degree and genre of visiting professors, 2014-2015. Source. MEC-INEP, 2014-2015

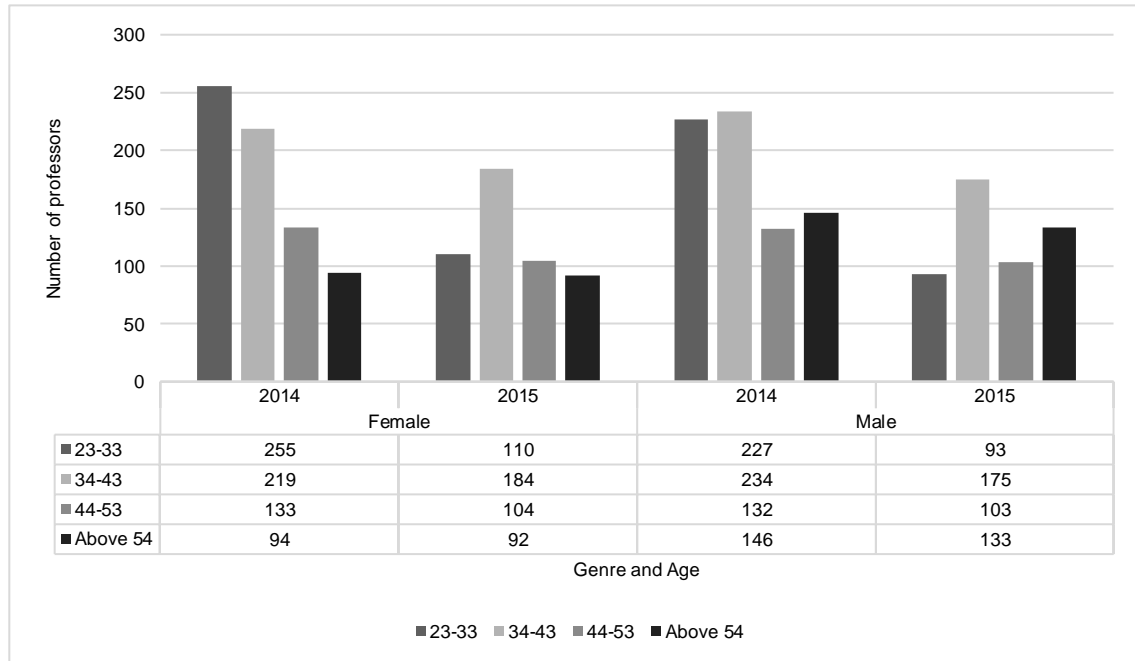


Fig. 41 Age and Genre of visiting professors, 2014-2015. Source: MEC-INEP, 2014-2015.

4.9.2. Data concerning Brazilian undergraduate students

The HEIs students' official figures include international and national mobility, but the information about national mobility is restricted to the public institutions (Federal and State Public HEIs). The students engaged in national mobility in 2014 were from 34 public HEIs (33 public Universities). The students engaged in international mobility were from 305 HEIs (163 private and 142 public institutions). From the private institutions involved in international mobility, there were 51 Universities, 49 Academic Centers, and 63 Faculties.

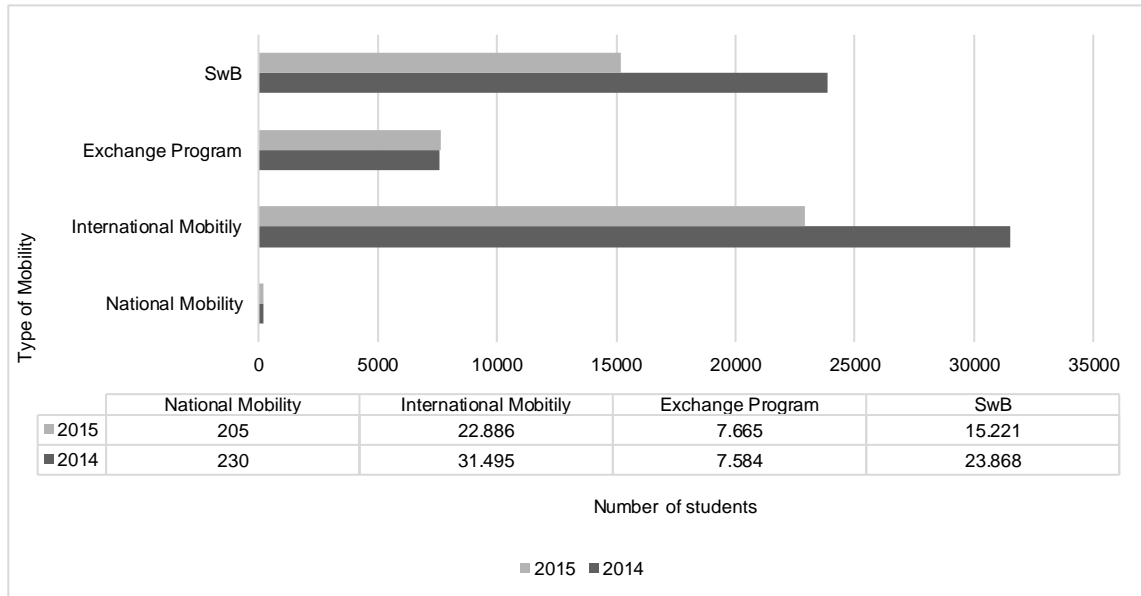


Fig. 42 Students' Mobility, 2014-2015. Source: MEC-INEP, 2014-2015.

In 2015, the students engaged in national mobility were from 34 public HEIs (31 public Universities). The students engaged in international mobility were from 246 HEIs (138 private and 108 public institutions). From the private institutions involved in international mobility, there were 50 Universities, 34 Academic Centers, and 53 Faculties.

In 2014, there were 230 students in national mobility and 31,495 students in international mobility. From the international mobility, 7,584 students were in HEIs' exchange program and 23,868 students in the Science without Borders (SwB) Government Program (Fig. 42).

In 2015, there were 205 students in national mobility and 22,886 students in international mobility. From the international mobility, 7,665 were in HEIs' exchange program and 15,221 students in the Science without Borders (SwB) Program. Most students are engaged in international mobility to 54 different countries in 2014 and 51 different countries in 2015 (Fig. 42).

Considering the student's profile, in the last two years, there is a slight prevalence of male over female students traveling abroad (Table 30), and their ages distribution concentrates in the range from 18 to 24 years old.

Table 30 Distribution of students by genre, 2014-2015

	2014	2015
Male	17,047	12,241
Female	14,676	10,850

Source: MEC/INEP, 2014-2015.

4.10. The Graduate Courses from a temporal perspective

The results present the temporal analysis of data provided by the Coordination for the Improvement of Higher Education Personnel (CAPES), between the years of 2010 and 2015, to map the offering conditions and to give an overview of all Education Graduate Courses offered in the country (See 3.2.1.5).

4.10.1. The Institutions

A total of 475 (N=100%) institutions were organized in a database, through the studied period, and they were divided into two groups. The first group (n¹= 346, 73%) includes the institutions found in the Higher Education Census³³, which were herein denominated academics. The second group (n²= 129, 27%) includes the ones whose categories are not in the Higher Education Census, englobing other kinds of entities like foundations, study and research centers, associations, among others (Table 31).

Table 31 Groups of institutions, 2010-2015

Groups	Number of Institutions	%
1 Academic (from the Higher Education Census)	360	68
2 Others	115	32
Total	475	100

4.10.2. The Graduate Programs offered by Group 1

The offered programs comprehend nine different areas: Agrarian Sciences, Biological Sciences, Health Sciences, Earth Sciences, Human Sciences, Applied Social Sciences, Engineering, Linguistics, Letters and Arts, Multidisciplinary and the *uninformed*. Along the studied period, it was observed an increase in the offering for all areas, as illustrated in *Table 32*.

Disregarding the programs with *uninformed data*, the ones whose increase was most representative are in the multidisciplinary area, in all years, followed by Biological Sciences in 2011; Agrarian Sciences in 2012; Applied Social Sciences in 2013-2014 and Biological Sciences in 2015. Only in 2013, there was a reduction in the number of Programs Offered in the Linguistics, Letters and Arts area (Table 32).

Even though the raw number of programs has increased in some areas, in the period studied, it can be depicted that its total growth rate has decreased from 2010 to 2015, from 10.1% to 4.9% (Table 32).

³³ Universities, University Centers, Faculties, Federal Institute of Education, Teaching and Technology and Federal Center of Technological Education.

Table 32 Offered Programs by Area and their growth rate, 2010-2015

Program Area	2010	%	2011	%	2012	%	2013	%	2014	%	2015
Agrarian Sciences	304	6.3	323	8.7	351	4.0	365	3.0	376	1.3	381
Biological Sciences	231	9.5	253	4.3	264	0.8	266	4.1	277	4.0	288
Health Sciences	419	6.9	448	3.3	463	3.0	477	4.4	498	2.8	512
Earth Sciences	270	3.0	278	3.2	287	2.1	293	1.4	297	1.7	302
Human Sciences	397	8.3	430	6.5	458	0.9	462	4.3	482	3.1	497
Applied Social Sciences	312	5.8	330	5.5	348	5.5	367	6.0	389	3.9	404
Engineering	289	6.2	307	4.2	320	2.5	328	3.7	340	2.6	349
Linguistics, Letters and Arts	160	8.8	174	1.1	176	-0.6	175	3.4	181	2.8	186
Multidisciplinary	266	18.8	316	11.7	353	12.5	397	9.8	436	4.8	457
Uninformed	191	40.3	268	20.1	322	26.4	407	16.0	472	17.6	555
TOTAL	2839	10.1	3127	6.9	3342	5.8	3537	6.0	3748	4.9	3931

Considering that Brazil is a vast territory, and it is divided into five regions, most of the offered programs – in raw numbers -, as described in *Table 34*, are concentrated in the southeast region. Despite that, the growth rate, from 2010 to 2015, was more representative in the west and north regions, proportionally. Disregarding the programs with unavailable data (*uninformed*), most of them were in the multidisciplinary area.

From the total of programs offered by the academic institutions, the public institutions deliver around 80%. From 2010 to 2015, they demonstrated a slight increase in their number, thus maintaining the same proportion, while the private institutions suffered a slight reduction in their participation from 18.9 to 18.2%, in the same period, as demonstrated in *Table 33*.

Table 33 Offered Programs by administrative category, 2010-2015

Program Area / Year	Private				Public			
	2010	%	2015	%	2010	%	2015	%
Agrarian	15	0.5	21	0.5	289	10.2	360	9.2
Biological	15	0.5	16	0.4	216	7.6	272	6.9
Health	61	2.1	69	1.8	358	12.6	443	11.3
Earth	20	0.7	21	0.5	250	8.8	281	7.1
Human	98	3.5	103	2.6	299	10.5	394	10.0
Applied Social	118	4.2	144	3.7	194	6.8	260	6.6
Engineering	38	1.3	45	1.1	251	8.8	304	7.7
Linguistics, Letters and Arts	25	0.9	24	0.6	135	4.8	162	4.1
Multidisciplinary	56	2.0	82	2.1	210	7.4	375	9.5
Uninformed	90	3.2	192	4.9	101	3.6	363	9.2
TOTAL	536	18.9	717	18.2	2303	81.1	3214	81.8

Table 34 Offered Programs by Regions, 2010-2015

Program Area / Year	West			Northeast			North			Southeast			South		
	2010	2015	%	2010	2015	%	2010	2015	%	2010	2015	%	2010	2015	%
Agrarian	22	37	68.2	69	87	26.1	20	22	10.0	132	151	14.4	61	84	37.7
Biological	13	23	76.9	42	55	31.0	19	23	21.1	113	134	18.6	44	53	20.5
Health	20	30	50.0	68	89	30.9	7	16	228.6	248	287	15.7	76	90	18.4
Earth	19	20	5.3	63	76	20.6	16	16	0.0	123	137	11.4	49	53	8.2
Human	40	54	35.0	71	98	38.0	18	28	55.6	182	209	14.8	86	108	25.6
Applied Social	21	28	33.3	53	75	41.5	13	16	23.1	146	178	21.9	79	107	35.4
Engineering	18	19	5.6	57	70	22.8	7	8	14.3	147	168	14.3	60	84	40.0
Linguistics, Letters and Arts	15	19	26.7	29	35	20.7	8	9	12.5	77	85	10.4	31	38	22.6
Multidisciplinary	29	55	89.7	54	96	77.8	19	34	78.9	109	171	56.9	55	101	83.6
Uninformed	10	35	350.0	28	101	360.7	6	33	550.0	104	270	259.6	43	116	269.8
TOTAL	207	320	54.6	534	782	46.4	133	205	54.1	1381	1790	29.6	584	834	42.8

According to the academic categories, the universities have a prevalence in the graduate programs offer, in all areas, as illustrated in *Table 35*. A high number of data are kept in a group entitled *uninformed*.

Table 35 Offered programs by academic category, 2010-2015

Program Area / Year	University		Center		Faculty		Federal Institute		Uninformed		Null	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Agrarian	251	304	0	0	0	0	1	4	24	34	28	39
Biological	180	222	1	1	0	0	0	0	29	36	21	29
Health	291	359	1	1	4	7	0	0	92	97	31	48
Earth	210	227	0	0	1	2	0	1	34	40	25	32
Human	314	383	4	5	4	3	0	0	42	62	33	44
Applied Social	233	287	5	12	10	14	0	0	43	58	21	33
Engineering	219	263	3	3	4	5	1	2	34	42	28	34
Linguistics, Letters, and Arts	123	141	2	3	0	0	0	0	21	28	14	14
Multidisciplinary	190	323	5	12	2	4	0	3	44	76	25	39
Uninformed	95	304	6	19	8	22	1	14	38	97	43	99
TOTAL	2106	2813	27	56	33	57	3	24	401	570	269	411

4.10.3. The Graduate Programs offered by Group 2

The programs offered by *Group 2* comprehend the same nine (09) areas above mentioned. Along the period, it was observed an increase in the offering of the raw number of graduate programs for Agrarian Sciences, Biological Sciences, Health Sciences, and Multidisciplinary areas. On the contrary, the Applied Social Sciences and Engineering areas suffered a reduction in their programs' number, as demonstrated in *Table 36*.

Table 36 Offered Programs by Area and their growth rate, 2010-2015

Program Area	2010	%	2011	%	2012	%	2013	%	2014	%	2015
Agrarian Sciences	5	0.0	5	0.0	5	20.0	6	16.7	7	14.3	8
Biological Sciences	10	0.0	10	10.0	11	0.0	11	9.1	12	8.3	13
Health Sciences	9	11.1	10	0.0	10	10.0	11	9.1	12	0.0	12
Earth Sciences	9	0.0	9	0.0	9	11.1	10	0.0	10	0.0	10
Human Sciences	1	-100.0	0	100.0	1	-100.0	0	10.0	1	0.0	1
Applied Social Sciences	3	0.0	3	0.0	3	-33.3	2	0.0	2	0.0	2
Engineering	6	0.0	6	0.0	6	0.0	6	0.0	6	-16.7	5
Linguistics, Letters, and Arts	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Multidisciplinary	6	33.3	8	-12.5	7	57.1	11	9.1	10	0.0	10
Uninformed	0	0.0	0	0	0	0.0	0	0.0	0	0.0	0
TOTAL	49	-56	51	97.5	52	-35.1	57	12.5.8	60	5.9	61

Table 37 Offered Programs by Regions, 2010-2015

Program Area / Year	West			Northeast			North			Southeast			South		
	2010	2015	%	2010	2015	%	2010	2015	%	2010	2015	%	2010	2015	%
Agrarian	0	0	0.0	0	0	0.0	2	2	0.0	3	4	33.3	0	2	100.0
Biological	0	0	0.0	0	0	0.0	5	7	40.0	5	6	20.0	0	0	0.0
Health	0	0	0.0	2	2	0.0	0	0	0.0	7	10	42.9	0	0	0.0
Earth	0	0	0.0	1	1	0.0	0	0	0.0	8	9	12.5	0	0	0.0
Human	0	0	0.0	0	0	0.0	0	0	0.0	1	1	0.0	0	0	0.0
Applied Social	1	1	0.0	0	0	0.0	0	0	0.0	2	1	-50.0	0	0	0.0
Engineering	0	0	0.0	0	0	0.0	0	0	0.0	6	5	-16.7	0	0	0.0
Linguistics, Letters and Arts	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Multidisciplinary	0	0	0.0	0	0	0.0	0	0	0.0	6	10	66.7	0	0	0.0
Uninformed	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
TOTAL	1	1	0.0	3	3	0.0	7	9	40.0	38	46	108.7	0	2	100.0

There is a vast difference among the graduate programs distributed around the country regions. Most of them – in raw numbers - are concentrated in the southeast region. Despite that, some programs were also delivered in south and north regions, as illustrated in *Table 37*.

From the total of programs offered by these institutions, the public ones deliver around 75% of them, similarly, to the academic institutions, considering the programs in their category. From 2010 to 2015, they demonstrated a slight increase in their number, thus maintaining the same proportion, while the private institutions increased their participation from 0.6 to 21.3%, as demonstrated in *Table 38*.

Table 38 Offered Programs by administrative category, 2010-2015

Program Area / Year	Private				Public			
	2010	%	2015	%	2010	%	2015	%
Agrarian	0	0.0	0	0.0	5	10.2	8	13.1
Biological	2	0.1	3	4.9	8	16.3	10	16.4
Health	5	0.2	7	11.5	4	8.2	5	8.2
Earth	1	0.0	1	1.6	8	16.3	9	14.8
Human	1	0.0	0	0.0	0	0.0	1	1.6
Applied Social	3	0.1	2	3.3	0	0.0	0	0.0
Engineering	0	0.0	0	0.0	6	12.2	5	8.2
Linguistics, Letters and Arts	0	0.0	0	0.0	0	0.0	0	0.0
Multidisciplinary	0	0.0	0	0.0	6	12.2	10	16.4
Uninformed	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL	12	0.6	13	21.3	37	75.5	48	78.7

4.10.4. The Scholarships offered by Groups 1 and 2

Most of the institutions (77.9%) which offer scholarships are, also, academic, as they are included in the Higher Education Census, thus being from *Group 1*, as demonstrated in *Table 39*.

Table 39 Number of Institutions that offer scholarships, 2010-2015

Groups	Number of Institutions	%
1 Academic (from the Higher Education Census)	330	77.9
2 Others	73	22.1
Total	403	100

It was observed a high discrepancy among the number of scholarships offered by both groups, as illustrated in *Figure 43*. Even though there was a reduction in its offering, from 2014 to 2015 by *Group 1* while *Group 2* has increased its number since 2012.

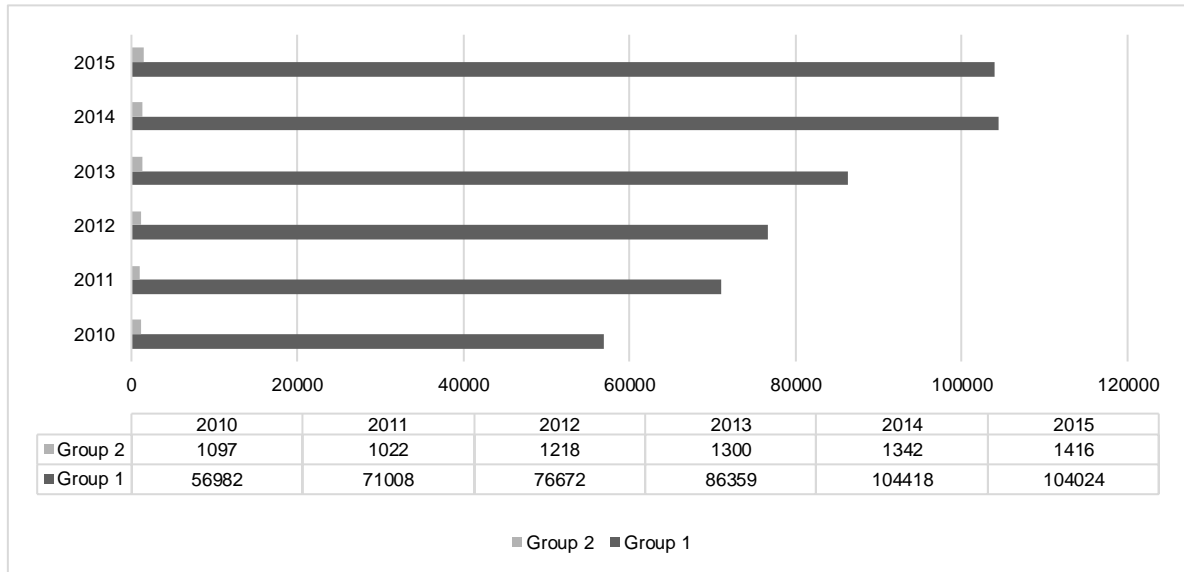


Fig. 43 Number of Scholarships, 2010-2015

Table 40 represents the number of scholarships according to the Programs Areas and Evaluation's Areas, along the studied period. Their number has increased in all areas, from 2010 to 2015, except for Engineering and Multidisciplinary.

Table 40 Scholarships according to the Program and Evaluation Areas, 2010-2015

Program and Evaluation Areas	2010	2011	2012	2013	2014	2015
Agrarian Sciences						
Food Science	131	134	130	124	122	132
Agricultural Sciences I	574	663	650	688	628	676
Veterinary Medicine	139	158	174	195	204	217
Zootechnic / Fishery Resources	179	217	220	216	202	225
	1023	1172	1174	1223	1156	1250
Biological Sciences						
Biodiversity	294	362	401	431	373	394
Biological Sciences I	182	228	230	223	217	234
Biological Sciences II	241	264	262	211	225	235
Biological Sciences III	78	84	100	107	107	116
	795	938	993	972	922	979
Health Sciences						
Physical Education	89	97	109	141	136	145
Nursing	78	94	97	131	141	137
Pharmacy	122	145	152	174	191	189
Undefined	5					
Medicine I	257	191	184	206	208	216
Medicine II	126	186	195	231	219	221
Medicine III	35	63	59	74	79	83

Nutrition	46	52	47	52	53	56
Dentistry	158	161	163	200	196	199
Collective Healthy	92	95	96	125	128	131
	1008	1084	1102	1334	1351	1377
Earth Sciences						
Astronomy / Physics	207	205	216	185	173	182
Biodiversity	30	33	23	18	18	23
Computer Science	160	152	161	188	183	183
Geosciences	128	127	109	130	140	153
Mathematics, Probability and Statistics	132	186	194	212	149	153
Chemistry	235	240	237	213	220	232
	892	943	940	946	883	926
Human Sciences						
Anthropology / Archeology	62	72	73	75	81	84
Political Sciences and International Relations	51	57	64	84	86	97
Education	305	280	270	373	362	381
Philosophy /Theology: subcommittee Philosophy	84	86	85	101	108	114
Philosophy /Theology: subcommittee Theology	24	25	26	37	36	37
Geography	111	127	117	146	169	178
History	127	121	122	170	170	167
Psychology	136	142	148	189	196	202
Sociology	128	122	125	144	138	141
	1028	1032	1030	1319	1346	1401
Applied Social Sciences						
Administration, Accounting Sciences and Tourism	155	165	165	232	222	220
Architecture and Urbanism	73	85	84	115	111	116
Applied Social Sciences I	108	110	113	148	145	153
Law	83	105	104	177	200	199
Economics	75	84	80	109	110	115
Urban and Regional Planning / Demography	48	49	52	73	77	81
Social Service	43	52	56	79	73	74
	585	650	654	933	938	958
Engineering						
Engineering I	243	234	222	227	213	221
Engineering II	236	247	254	227	221	244
Engineering III	260	255	235	256	246	259
Engineering IV	232	232	201	218	209	208
	971	968	912	928	889	932
Not Informed						
Undefined	163	161	205	353	810	955
	163	161	205	353	810	955
Linguistics, Letters, and Arts						
Arts / Music	99	101	91	121	125	125

Letters / Linguistics	266	284	265	366	367	368
	365	385	356	487	492	493
Multidisciplinary						
Biotechnology	85	105	117	155	185	218
Environmental Sciences	83	102	132	204	216	242
Teaching	397	431	85	118	132	165
Interdisciplinary	57	66	356	494	510	544
Materials	622	704	72	75	78	83
Total	7452	8037	762	1046	1121	1252

4.10.5. The Graduate Courses in Education

For this analysis, it was considered the graduate courses offered by the academic institutions, which englobes the HEIs with programs in the Human Sciences Area and in Education.

During the studied period, the number of graduate courses in Education (*Table 41*) increased from 98 in 2010 to 163 in 2015.

Table 41 Offered Programs in Education by the HEIs, 2010-2015

	2010	2011	2012	2013	2014	2015
Education	98	112	121	142	155	163

The education programs represented from 24.7% to 32.8% of all programs offered in the Human Sciences Area and around 3.5% to 4.1% of all programs offered in the country (*Table 42*).

Table 42 Offered Programs in Education, 2010-2015

	Programs in Education	% of Human Sciences	% of the total of Programs offered	Total Programs in the Human Sciences	Total Programs in all areas
2010	98	24.7%	3.5%	397	2839
2011	112	26.0%	3.6%	430	3127
2012	121	26.4%	3.6%	458	3342
2013	142	30.7%	4.0%	462	3537
2014	155	32.2%	4.1%	482	3748
2015	163	32.8%	4.1%	497	3931

The graduate programs in Education consider the masters, the professional masters, and the complete programs, which englobes the doctorate. Based on the data analyzed, while the masters itself increased slightly during the studied period, the professional master and the complete programs were the ones who increased the most, as shown in *Table 43*.

Table 43 Offered Programs in Education by its categories, 2010-2015

Education	Master	%	Professional Master	%	Program (Master and Doctorate)	%	Total	%
2010	46	47%	1	1%	51	52%	98	100%
2011	52	46%	6	5%	54	48%	112	100%
2012	51	42%	9	7%	61	50%	121	100%
2013	47	33%	22	15%	73	51%	142	100%
2014	52	34%	30	19%	73	47%	155	100%
2015	52	32%	37	23%	74	45%	163	100%

Despite the increase of the Professional Masters, the master's and the Complete Programs represent most of the offered courses as illustrated in *Fig. 44*.

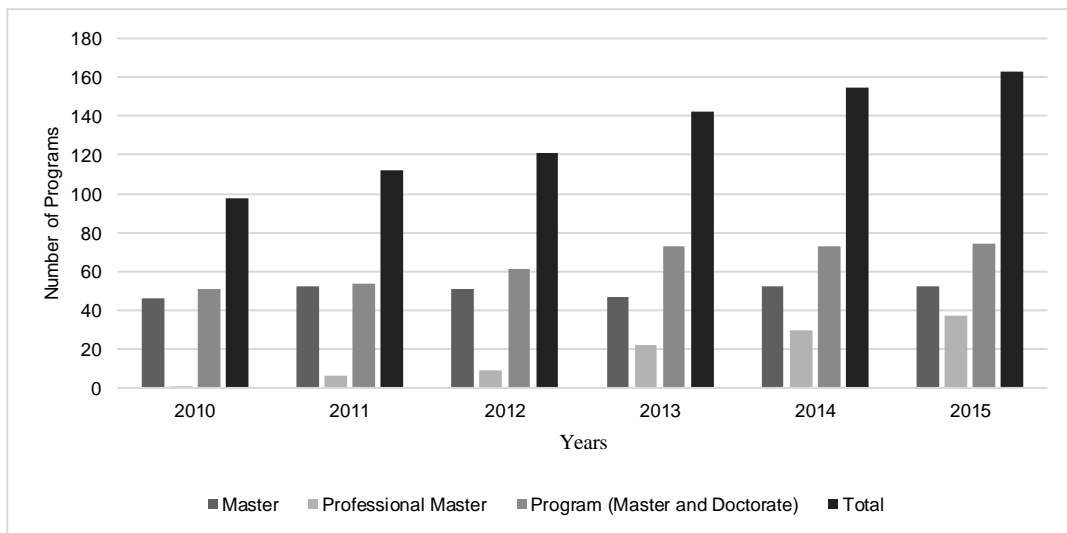


Fig. 44 Programs offered in Education, 2010-2015.

Considering that Brazil is divided into five regions, most of the programs – in raw numbers -, are also concentrated in the southeast region, as described in *Table 44*.

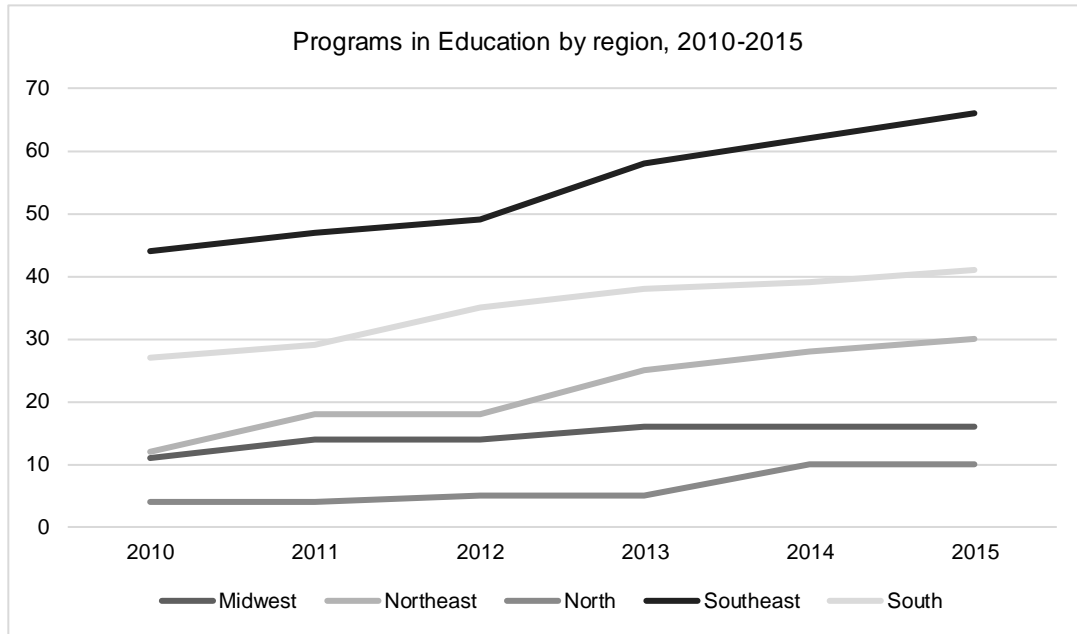


Fig. 45 Programs in Education by region, 2010-2015.

Proportionally, from 2010 to 2015, the Education Area growth was more representative in the north and northeast regions (*Table 44*), contrary to other programs offered in Brazil whose increase was predominantly in the Midwest and North regions (*Table 37*).

Table 44 Offered Programs in Education by region, 2010-2015

Education	Midwest	%	Northeast	%	North	%	Southeast	%	South	%	Total	%
2010	11	11%	12	12%	4	4%	44	45%	27	28%	98	100%
2011	14	13%	18	16%	4	4%	47	42%	29	26%	112	100%
2012	14	12%	18	15%	5	4%	49	40%	35	29%	121	100%
2013	16	11%	25	18%	5	4%	58	41%	38	27%	142	100%
2014	16	10%	28	18%	10	6%	62	40%	39	25%	155	100%
2015	16	10%	30	18%	10	6%	66	40%	41	25%	163	100%

Considering the Education area, from 2010 to 2015, it was observed an increase in the programs offered, in all regions (*Table 45*).

Table 45 Offered Programs in Education according to the total programs, 2010-2015

Program Area / Year	Midwest		Northeast		North		Southeast		South	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Human	19%	17%	13%	13%	14%	14%	13%	12%	15%	13%
Education	28%	30%	17%	31%	22%	36%	24%	32%	31%	38%

Public institutions, as illustrated in *Table 46* offer most of the programs in Education. It is also depicted that the participation of the private institutions was proportionally reduced along the period (*Table 46*).

Table 46 Offered Programs in Education according to the administrative category, 2010-2015

	2010	%	2011	%	2012	%	2013	%	2014	%	2015	%
Private	38	39%	40	36%	42	35%	45	32%	47	30%	48	29%
Public	60	61%	72	64%	79	65%	97	68%	108	70%	115	71%
TOTAL	98	100%	112	100%	121	100%	142	100%	155	100%	163	100%

According to the academic category, most of the Education Programs are offered by the universities. Another kind of academic institutions like centers, faculties, federal institutes, and federal centers also offered graduate programs in Education, but they are in a remarkably smaller proportion (*Table 47*).

Table 47 Offered Programs in Education according to the academic category, 2010-2015

	University	Center	Faculty	Federal Institute	Federal Center	Null
2010	82	2	-	1	-	1
2011	91	2	-	1	-	1
2012	95	2	-	1	1	1
2013	103	2	-	2	1	1
2014	108	3	1	3	1	1
2015	109	3	2	3	1	1

Additionally, most of the Education Programs, which were evaluated, achieved a 3-score grade, which is the minimum for its implementation and operation. The courses with 5-score grade, which are considered of excellence, have slightly diminished in number, and the ones with 6 or 7-scores, in smaller quantities, have proportionally remained the same since 2012, as shown in *Table 48*.

Table 48 Offered Education Programs Evaluation, 2010-2015

	2010	%	2011	%	2012	%	2013	%	2014	%	2015	%
3	35	36%	49	44%	58	48%	65	46%	77	50%	85	52%
4	42	43%	42	38%	42	35%	51	36%	51	33%	51	31%
5	13	13%	13	12%	13	11%	17	12%	18	12%	18	11%
6	5	5%	5	4%	5	4%	6	4%	6	4%	6	4%
7	3	3%	3	3%	3	2%	3	2%	3	2%	3	2%
Total	98	100%	112	100%	121	100%	142	100%	155	100%	163	100%

Taking for granted only the excellent and internationalized Education Programs, the vast majority was offered by the public institutions, with a slight increase in the number of programs ranked 5-score grade and the maintenance of the number of programs with a 6 or 7-scores (*Table 49*).

Table 49 Excellent and Internationalized Education Programs, 2010-2015

Grade Year	5				6				7			
	Public	%	Private	%	Public	%	Private	%	Public	%	Private	%
2010	11	11%	2	2%	3	2%	2	1%	2	1%	1	1%
2011	11	11%	2	2%	3	2%	2	1%	2	1%	1	1%
2012	11	11%	2	2%	3	2%	2	1%	2	1%	1	1%
2013	13	13%	4	4%	3	2%	3	2%	2	1%	1	1%
2014	13	13%	4	4%	3	2%	3	2%	2	1%	1	1%
2015	13	13%	4	4%	3	2%	3	2%	2	1%	1	1%

As the doctorates are concerned with knowledge creation, they were analyzed separately. It was observed that the PhD courses demonstrate a growing trend in their offering (Fig. 46).

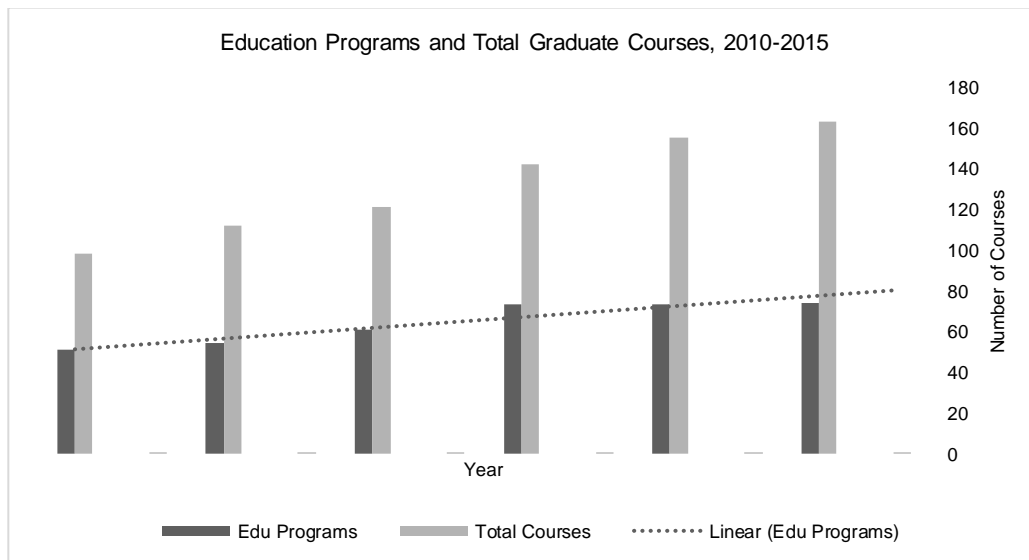


Fig. 46 Education Programs with a doctorate and Graduation Programs, 2010-2015

Considering the Education Programs with doctorates, since 2013, there was a slight increase in the courses with a 3-score grade; and maintenance in the raw number of courses that achieved the 4, 5, 6 and 7-score grades (Table 50).

Table 50 Doctorate Education Programs Evaluation, 2010-2015

Grade	Programs 2010	%	Programs 2011	%	Programs 2012	%	Programs 2013	%	Programs 2014	%	Programs 2015	%
3	0	0%	0	0%	0	0%	1	1%	1	1%	2	3%
4	30	59%	33	61%	40	66%	46	63%	46	63%	46	62%
5	13	25%	13	24%	13	21%	17	23%	17	23%	17	23%
6	5	10%	5	9%	5	8%	6	8%	6	8%	6	8%
7	3	6%	3	6%	3	5%	3	4%	3	4%	3	4%

Thus, it can be depicted that the Education Programs with doctorates not only grew in quantity but also maintained their scores, since 2012, as shown in *Fig. 47*.

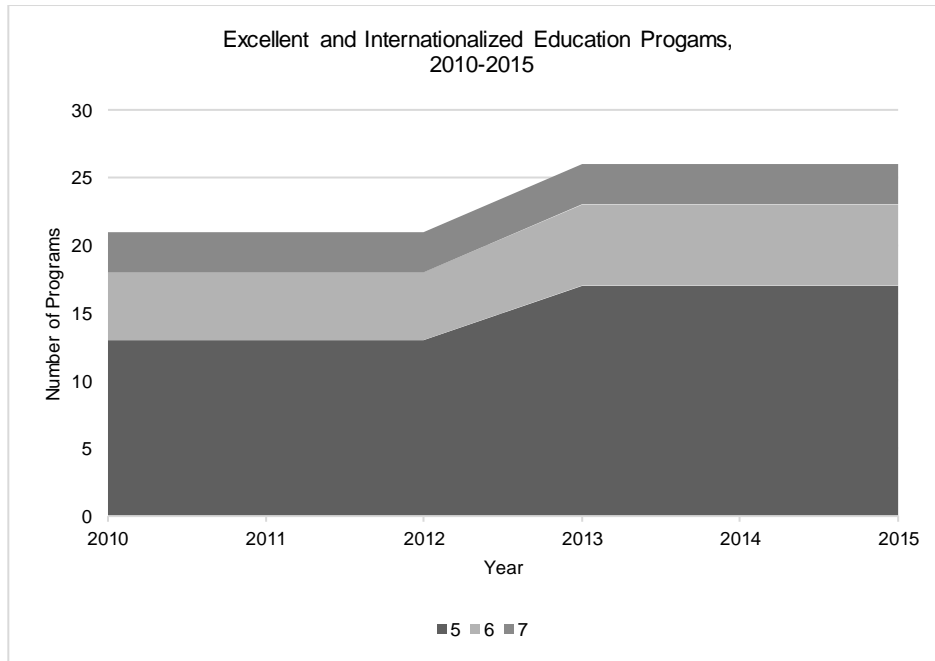


Fig. 47 The Excellence and Internationalized Education Programs, 2010-2015

Based on the analysis of the Education Programs names, which, we suppose, express their study orientation and focus, it was observed that the words that most frequently appear are education, followed by management, training, and teaching (*Fig. 48*).



Fig. 48 The occurrence of the Education Programs' names

5. MAIN DISCUSSIONS AND IMPLICATIONS FROM THE EXPLORATORY PHASE

5.1. The Supply and Demand Conditions in Brazil

From 2008 to 2014, the number of Higher Education Institutions varied slightly. Considering the year 2008 as a reference, the total number has increased from 2252 to 2367 (Fig. 4 and 5).

The number of undergraduate classroom courses increased during 2008-2014 (Table 9). However, this was not reflected in the number of enrolled students when compared to the demographic, young population data. If, in the 1960s many students were concurring to a place in the HEIs (Braghini, 2014), nowadays, the situation inverted. There is a high number of vacant or unfilled places for each potential student. As an example, from 2008 to 2014, the number of places offered for undergraduate courses almost doubled from 1,715,994 to 3,545,294. In addition, the number of candidates improved from 5,534,689 to 13,245,796, though, as already said, was not converted in enrolled students as the same candidate can enroll for more than one process in different HEIs. For the same period, the number of entrants has grown from 1,505,819 to 2,110,766 (Table 10).

A similar condition occurred with the undergraduate e-learning courses whose number also increased during 2008-2014 (Table 11), although not reflected in the number of enrolled students. There is also a high number of vacant or unfilled places for each potential student. As an example, from 2008 to 2014, the number of places offered for undergraduate e-learning courses almost doubled from 1,699,489 to 2,800,358. In addition, the number of candidates increased from 708,784 to 2,112,930, though, as already said, was not converted into enrolled students. For the same period, the number of entrants has grown from 430,259 to 691,731 (Table 11).

The number of undergraduate students for classroom and e-learning courses is lowest if compared to the enrolled students, calling the attention to the fact that, despite all the efforts of the expansion and internalization of HEIs in Brazil, it has little effect in practice: the undergraduates do not actually increase, which reinforces the lack of improvement in the higher education purposes. The same occurs across the 20 OECD countries with available data, as only 36% of young people (excluding international students) are expected to obtain a tertiary diploma for the first time before the age of 30.

Besides that, the information generated from the analysis of microdata of the Higher Education Census, associated with the Demographic Census data (2010), in Brazil, points to a drastic reduction in the population of young people aged 18-24 years, which is going to be scarce in a short period. Today, Brazil has the largest number of young people in its history (Brasil, 2013). However, as studies indicate (Corbucci, 2014), from 2022, this figure will be reduced drastically.

Both conditions – reduced number of enrolled and undergraduate students added to the reduction of the young population considered ideal for undergraduate courses – will affect the higher education institutions' sustainability conditions. Nowadays, HEIs already have more places offered than the number of enrolled students.

It is important to state that Public Education for undergraduate courses is free of charge, while Private Education is paid. In any case, the number of empty places continues, for most undergraduate courses, in both kinds of institutions. Moreover, considering the private HEIs, price concurrence varies widely in the country, depending on the knowledge area, country regions, HEI's price, and discount policies and government subsidies.

Comparing to the OECD countries, it is also observed that over the past two decades, tertiary education has changed significantly. The student body became more international, more women undergraduate from this level of education and, in some countries, more students have access to the tertiary level of study, mainly in science and engineering fields.

These changes might also reflect concerns about competitiveness in the global economy and the labor market, like what occurred in Brazil, as globalization and internationalization have a global impact. It is also relevant to note the importance of reducing differences in educational opportunities and outcomes for men and women, as women have increasingly improved their participation at all levels of education around the globe, despite the differences in earnings persist.

Worldwide, some fields are more popular among students. The areas of science and engineering have a preference, and an unbalance gender distribution with a prevalence of male gender. The opposite occurs in the areas of Education, Welfare, and Health where there is a female prevalence.

Independently of the country, there are some challenges to be faced in Higher Education: to confront the evasion and drop-out rates, as undergraduate average rates, are around 40% and, after that, to ease the transition into the labor market for the undergraduate students.

5.2. The Online Courses Offered in Brazil: the latest years context

Unlike MOOCs that early in its offer were free, undue courses and did not provide certification; in Brazil, the undergraduate online or blended courses are from a different provision category, offered only by an accredited public or private higher educational institution. They can be free or paid, depending on the HEI category – if public or private. These courses depend on prior accreditation by the Ministry of Education, which regulates, supervises and evaluates the institutions of higher education and its undergraduate courses (M. d. Educação, 2007; Selingo, 2014). Many of the online undergraduate courses, according to Brazilian legislation (M. d. Educação, 2007; Selingo, 2014), though not obtain the title of MOOC or use its terminology, may have a high number of places offered, which means they can be massive; also can be free; but are not “open” in the MOOCs context, cause the students obligatory need to have concluded previous education.

Besides the fact that some countries already discuss the possibility of credit-earning MOOCs courses, in Brazil, they comprised, exclusively, the courses without accreditation and delivered through third platforms. Including the courses offered by HEIs, which are open about their content which is available to any person; are modest in quantity but can rely on payment for the issuance of a certificate and are delivered through Coursera and Veduca platforms. Their "denominations" are entirely different from those accredited courses offered in online or blended mode by HEIs (Tables 17, 18, 19, 20). Concerning the assumption stated by Godwin-Jones (2014), in Brazil, the MOOCs are open and massive courses but are not regular online courses that have been re-branded, because the "regular online courses" are the accredited ones. It is important to state that, besides the limited number of MOOCs offered in the country, even by HEIs, it is highly recommended to evaluate the number of students enrolled, to map its massive extent. Besides that, the courses have different publics as a target.

Another interesting conclusion depicted from this research is related to knowledge areas of the courses offered (Figure 35) which are Education; and Social Sciences, Business and Law despite the 'apparent' resistance of Social Sciences area to the use of technological resources, as shown by the literature (T. C. o. H. Education, 2013; Reichard 2015). There is not much overlapping concerning the topics dealt, despite the differences between the MOOCs and the online undergraduate courses. Apparently, this situation can be justified by the government policy of training of the teaching workforce, especially in basic education.

It becomes necessary to think about new ways of offering courses in a connected society in which new paradigms guide the communication practices, looking out at present as a promise of renewal of knowledge, motivated by new ways of knowledge creation, enabled by digital networking environment (Burdick, 2012). At the same time, it is necessary to discuss that, as an essential part of the societal role of universities is to facilitate lifelong learning, regardless of age, place of residence, and life situation. Flexible education is a core term in this context as its deliveries education that can be carried out regardless of time and place; that requires less presence on campus.

5.3. The MOOCs and Digital Humanities in the Brazilian Context

It is concluded that the MOOCs in Brazil, especially those offered in the year under study, are smaller in number and are not offered by Higher Education Institutions. Still, the courses meet the conditions of gratuity and are free but diverse in knowledge. It is important to highlight that it was not possible to evaluate the number of students which were enrolled, and which concluded the courses in this modality, thus making it impossible to analyze their "massive" condition.

With regard to the undergraduate courses offered by HEIs, the number of courses, vacancies (vacant places), and students enrolled (Figure 37) is growing from 2008 to 2014, a fact that also occurs in relation to distance courses (Figure 38). Even with more diversity in the offer of courses, the areas of Human Sciences and Applied Social Sciences (Tables 51 and 52) predominate and prevail, in both modalities.

Although this growth is representative, it is worth noting the low proportional number of graduates in relation to the number of enrolled students, being 837,284 for the courses in the classroom mode (*Table 51*) and 189,788 in the distance mode (*Table 52*).

Table 51 Courses, places, entrants, enrolled, graduated, classroom mode, according to OECD Main Areas

Undergraduate Courses, classroom modality, according to OECD Main Areas, 2014					
OCDE Main Areas	Courses	Places	Entrants	Enrolled	Graduated
Education	7241	744775	296395	924596	142184
Social Sciences, Business, and Law	9279	1937325	909930	2510517	362352
Services	1089	145475	52858	116755	23348
Science, Mathematics and Computing	3183	431091	165029	424664	53127
Engineering, Production and Construction	4501	807645	442721	1140886	86346
Health and Welfare	3853	695996	368108	988752	122423
Humanities and Arts	1459	148967	62313	161599	27788
Agriculture and Veterinary	908	100215	65631	196116	19716
TOTAL	31.513	5.011.489	2.362.985	6.463.885	837.284

Source: MEC, INEP, 2014.

Table 52 Courses, places, entrants, enrolled, graduated, e-learning, according to OECD Main Areas

Online undergraduate Courses, according to OCDE main areas, 2014					
OCDE Main Area	Courses	Places	Entrants	Enrolled	Graduated
Education	592	1109654	271172	538952	74403
Social Sciences, Business, and Law	549	1325177	332221	575483	86260
Services	61	230291	30781	56619	9160
Science, Mathematics and Computing	57	134763	23945	31610	3239
Engineering, Production and Construction	42	60176	17617	26454	2338
Health and Welfare	30	127429	45929	104939	13361
Humanities and Arts	23	14708	3872	5339	623
Agriculture and Veterinary	11	40779	2201	2446	404
TOTAL	1.365	3.042.977	727.738	1.341.842	189.788

Source: MEC, INEP, 2014.

Despite the great number of courses in Human Sciences and Applied Social Sciences, it is necessary to expand the discussion about Digital Humanities, approaching these areas of technological resources, given that, based on the observed data, the knowledge and the construction of meaning is still specific and particular to the traditional segmentation by area of knowledge. The use of technological resources is a deterministic rhetorical question, imposed by those who are skeptical of the Digital Humanities. One lives in a connected, networked society, and there can be no human sciences without the digital, because, in practice, they already exist (Chun, 2014).

It can be observed, as a result, that in Brazil there is no highlight for MOOCs, which presupposes a certain prejudice about terminology, although it is observed that even in traditional, accredited courses, in the distance (online) mode, there may be authorization for a great number of places, which would indicate a certain massive supply.

In addition, it is concluded that the gross number of MOOCs is not enough to evaluate their massiveness since even a small number of courses in this modality could have a high number of enrolled students. The possibility of the participation of Brazilian students in other platforms, internationally known may be a factor to be investigated, since it would justify the low number in the country, raising the hypothesis that the offer may be taking place through other platforms and other languages.

It should be noted that what characterizes the MOOCs in Brazil is that it does not require prior training or qualification from participants. Contrary to what happens with regular and accredited courses, in the classroom and distance (online) modes, where the students must have completed high school.

As a result of the reflection on the theme of Digital Humanities, it is necessary to think of new ways of offering courses, not only undergraduate, in a connected society, where new paradigms guide the communication practices; and emphasize what the Digital Humanities claim to be, in the present time, a promise of renewal of knowledge, motivated by new modes of training activated by digitally networked environments (Burdick, 2012).

It is also suggested the evaluation of factors that involve the qualification and evaluation of distance (online) education; the appropriate technological resources for each modality and its limits; business models and resulting quality assessment; as well as the organization, use and ownership of the data coming from teaching / learning platforms since these issues directly or indirectly impact on the offer conditions of Higher Education Institutions.

5.4. The Globalization, the Internationalization, and Mobility in Brazil

The concept of internationalization varies from an increasing involvement of enterprises in international markets to a more complicated relationship, which involves a process to improve goals, functions, and delivery of higher education concerning teaching, research, and quality. Scholars agree that there are different kinds of internationalization, depending on the sector, occurrence, organizational level, and modalities.

Despite the differences in concept, most of them agree that internationalization is an important subject for Higher Education Institutions and that the most common modalities are mobility; international cooperation in teaching and research through international consortia; cooperative programs; and joint universities.

From the data analyzed, through the Brazilian Higher Education Census, it can be inferred that the Brazilian internationalization or academic mobility have specific characteristics. Through the analyzed dataset and its variables (Table 53), the process of internationalization is focused on the nationality and the visiting status of professors, and

the national or international mobility of students which was also marked by a reduction in the number of HEIs (*Table 53*), in the number of visiting professors and students in the Science without Borders (SwB) international mobility program. There is no information about teaching or research activities among HEIs and other stakeholders, which are also good drivers for the internationalization process.

Table 53 HEIs involved in Academic Mobility, 2014-2015

HEIs	Public		Private	
	National	International	National ³⁴	International
2014	34	142	-o-	163
2015	34	108	-o-	138

As the Brazilian Higher Education Institutions have different administrative (public versus private) and academic (universities, faculties, academic centers, national institutes, e.g.) categories, it was observed that, in 2014, 163 private HEIs had students in academic mobility and this number dropped to 138 private HEIs in 2015. The number of private institutions was significant when compared to the actual number of public establishments in the country, despite its reduction from one year to the other and the fact that their information was restricted to international mobility.

Most of the visiting professors were concentrated in the public universities. On the other hand, most of the students enrolled in academic mobility came from private institutions. It is important to state that, in Brazil, the undergraduate courses are mostly offered by the private HEIs, and most of them are classified as “faculties” (which are smaller institutions) which also engage a vast majority of enrolled students.

Concerning the professors, the information was restricted to their nationality and status as ‘visiting professor’. Thus apart, the reduction in the number of visiting professors of 68.6% from 2014 to 2015 was significant and was eminently among visiting Brazilian professors, as the number of foreign visiting professors remained almost the same (from 67 to 65 respectively).

These findings also pointed out the number of students engaged in international mobility in public and private institutions and national mobility, restricted to the public institutions. A reduction in the number of students around 64% in the SwB³⁵ Program was also observed in the period studied, even though the number of students enrolled in exchange programs increased slightly (from 7,584 to 7,665) in the same period. These results do not consider their socio-economic level evaluation, which would contribute to a better assessment of their profile.

It was also observed that the vast majority of students involved in academic mobility came from the Science without Borders (SwB) Program. Thus, the Brazilian Government was

³⁴ No data available.

³⁵ Science without Borders Program - SwB

responsible for funding a significant number of students studying abroad in recent years. This reduction in the number of participants was due to its restrictive budgetary policy adopted recently because of its economic-political crisis.

As a result, and according to the Brazilian Higher Education Public Policy, it concludes that, considering that only universities are required to develop research, which is a driver of internationalization processes among educational institutions and other stakeholders; and for the other categories of institutions, the research is optional, the internationalization process could be classified as a kind of individual internationalization, as proposed by Palma (Knight, 2007), and is limited to students and professors personal and particular interests other than institutional guidelines.

5.5. The Graduate Courses in Education

The graduate programs have expanded themselves in raw numbers in the studied period. From 2014 to 2015, their growing rate achieved 4.9%. Despite the fact that the southeast regions have the most significant number of courses, the increase was more representative in the Midwest and North regions of the country.

In 2015, the Public Institutions offered 10% of all programs in the Human Sciences Area, and the private ones offered only 2.6%, the majority by the universities, which are the most prominent institutions in the country.

The Education Programs, in 2015, represented around 32.8% of all programs in the Human Sciences Area and 4.1% of all programs offered in Brazil. Most of them concentrated in the Southeast Region, even though the regions where they increased the most were the Northeast and North ones.

In 2015, 45 % of the Graduate Programs in Education contained a doctorate and were offered by the public institutions (71%), while the private ones, primarily the universities, offered 29%. Their majority (52%) achieved a 3-score grade, while 31% obtained a 4-score, 11% a 5-score, and 6% a 6-7 score, respectively, in the evaluation occurred in the period.

Concerning the internationalized Education Programs which are considered of excellence, it was observed a slight increase in the number of programs ranked 5 or 6-score grades and the maintenance of the number of programs that achieved a 7-score grade. Thus, 17% were considered of excellence, and 6% were considered internationalized.

When it comes to the Doctorate Courses, it was depicted that there was an increase in their raw number whose scores were 3, 4, 5 or 6-grades, from 2010 to 2015. The maintenance of the courses scored a 7-grade during the same period was also observed, which indicates that they not only grew in number but also maintained their standard.

Most of the Education Programs have their names related to education, management, training, and teaching, while de doctorates are mainly concerned with its curriculum, psychology, and personal education.

Considering the analysis of the Education Programs, and taking from granted that evaluation is always of concern, it was observed that there was an increase in its offering in the last years, but most of the offered programs were not considered of excellence, which indicates the necessity of a great effort to improve their score and visibility through the established criteria.

6. HIGHER EDUCATION KNOWLEDGE DISCOVERY PHASE

This chapter presents the Self-Organizing Map (SOM) data analysis for the Brazilian Higher Education Census' data. It used an *inductive* approach through a quantitative research strategy study to focus on knowledge discovery among data from Brazilian Higher Education Census, based on HEIs, their courses, professors, and students to explore patterns hidden in the data and to contribute to advance the RBV Theory.

The data was analyzed under two perspectives: an annual approach, where it was selected the year of 2014 as a reference, and all the components were studied; and an aggregated perspective where the Global SOM was used to study all the dimensions simultaneously (Higher Education Institutions, courses, professors and students) to evaluate their intercorrelations.

In order to achieve the objective of this project, the SOM was also applied to analyze the undergraduate courses quality, considering the IGC Index; to identify the specialized institutions and to identify the profile of the higher education students.

6.1. Knowledge Discovery through the annual SOM

This subsection presents the findings, which were obtained from the analysis of the Higher Education Census' data for 2014 (see item 3.2.2.1).

Despite the fact the Brazilian Higher Education Census habitually distinguishes between private and public institutions, called *administrative* attributes; and among universities, university centers, faculties, colleges, federal and technological institutes, denominated *academic* attributes, this study goes beyond this traditional classification and taxonomy, to look for more relevant information and to discover unknown patterns among the public and official HEIs data to create new knowledge.

Thus, in our data set, each data item was associated with a variable. The variables x_1-x_{32} , disposed of in *Table 6* were used for the analysis and visualization of each proposed dimension of SOM attributes - Higher Education Institutions, Undergraduate Courses, Professors, and Students -, independently, mapping the input vector into a 2-dimensional output space (grid).

Additionally, we used some quantitative auxiliary tools, as the *Davies-Bouldin index* to find the optimal number of clusters for each U-matrix and applied the *k-means* algorithm to SOM units.

The results from these two operations are then mapped for each U-matrix with their respective number of clusters.

As already mentioned in subsection 3.6.1, the two most essential visualization tools of SOM are the component planes and the U-matrix. Then, in the next four subsections, we will interpret the **component planes** to evaluate the data distribution for each SOM dimension,

comparing them to identify correlations among the studied variables. Moreover, identify, through the **U-matrix**, the sets of units that are like each other (darker color regions) or are dissimilar (lighter color regions).

6.1.1. Higher Education Institutions

As a result of the SOM analysis, the Higher Education Institutions in Brazil (HEIs) (N=2,367) are grouped in seven different clusters as illustrated through the U-matrix (Fig.49) and identified by their labels (from 1 to 7).

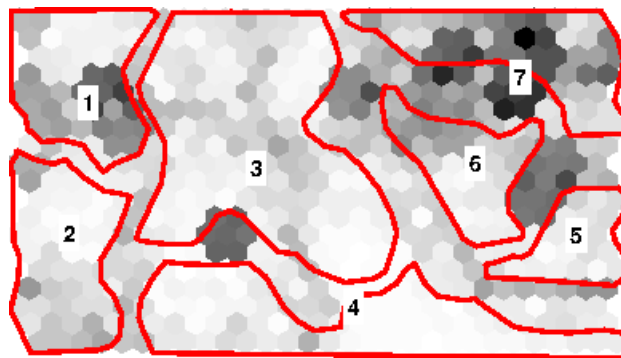


Fig. 49 Visualization of HEIs clusters, 2014

The variables used in the HEIs analysis are indicated in the component planes (Fig. 50). Through their visualization, it is possible to see their distribution and the correlation among them as, when the correlation exists, they will have the same shape. Variables like incomes, remuneration of active teachers, and remuneration of technical-administrative staff have a stronger correlation; investment expenses and other incomes are partially correlated. Variables like administrative staff, financial transferred values, and research and development expenses – have a weaker correlation. It is also possible to interpret them according to the U-matrix (Fig.49).

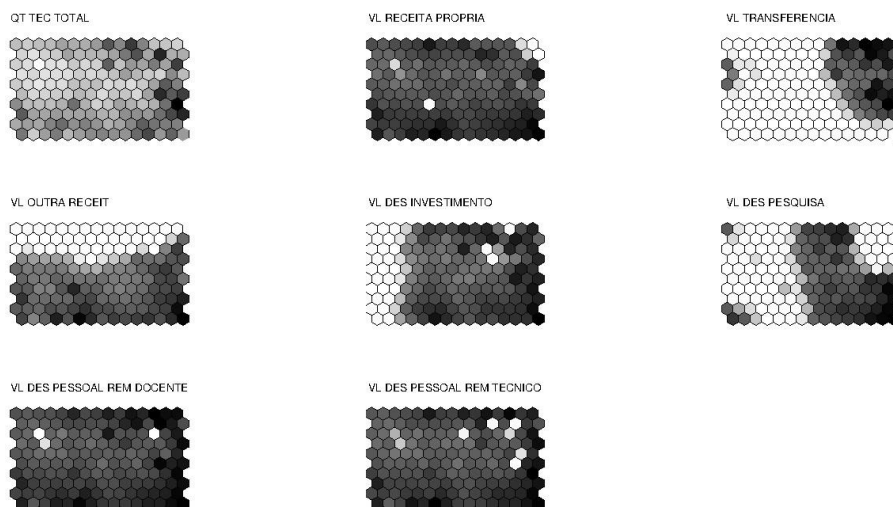


Fig. 50 Visualization of the variables used for the HEIs' component planes, 2014.

From the point-of-view of the HEIs academic and administrative organization, there are two distinctive groups: cluster 3 is the biggest with the most significant number (n=670) of HEIs while cluster 5 is the smallest (n=108). Private HEIs eminently compose clusters 1, 2, 3, 4 and 6. Clusters 5 and 7 have a predominance of public HEIs (*Table 54*).

Interpreting both the component planes and the U-matrix, the HEIs can be understood under a different perspective, considering that each cluster represents a group of HEIs with similar characteristics and that each group distinguishes itself from the others by dissimilar characteristic(s), generally hidden through the data.

Table 54 Discovered patterns and complimentary information for HEIs, 2014

Cluster	HEIs discovered pattern(s)	
1 - Higher Expenses	Financial resources	The HEIs with the highest academic expenses, the highest expenses with professors.
	Complementarily information	It has the smallest number of professors and Ph.D. teachers. It has the smallest institutions considering the number of employees.
2 - No investment	Financial resources	The HEIs with no investment.
	Complementarily information	It has the most significant number of students with funding.
3 – The lowest remuneration	Financial resources	The HEIs with the lowest amount of administrative staff remuneration. The HEIs which have the highest values of the professor's remuneration.
	Complementarily information	It has the fewest number of specialist teachers.
4 – The highest investments	Financial resources	The HEIs with the highest values of incomes and investments.
	Complementarily information	It has the most significant number of students, undergraduate courses, specialist, and master professors.
5 – Expenses in Research	Financial resources	The HEIs with higher expenses in research.
	Complementarily information	It has the largest number of establishments with undergraduate professors.
6 – The lowest revenues	Financial resources	The HEIs with the lowest revenues.
	Complementarily information	It has the lowest number of students, courses and master's degree's teachers.
7 – All attributes	Financial resources	The HEIs with all attributes: a significative revenue, values from transference and spend money on an investment, research, and human resources.
	Complementarily information	It has the biggest number of Ph.D. professors.

Therefore, the HEIs, according to these newly discovered patterns, can be grouped as the ones with the highest research expenses; with the highest and the lowest expenses with teachers and technical-administrative staff remuneration; and the ones with the highest and the lowest incomes and investments; the ones with no investment at all, and the ones with

all the attributes. These newly discovered patterns are also represented through their clusters' labels.

In the subsections 6.1.2, 6.1.3 and 6.1. 4, we present the analysis for the other SOM components – the undergraduate courses, the professors, and the students.

6.1.2. Undergraduate Courses

The Brazilian undergraduate courses (N= 32,878) are analyzed and grouped into four different clusters, identified by their labels (from 1 to 4).

Figure 51 illustrates the U-matrix of the data processed for all of them. The variables used in the Undergraduate Courses (UGC) analysis are indicated in the component planes (*Figure 52*).

Through the analysis of the UGC component planes, which are illustrated in *Figure 52*, it is possible to visualize their distribution and the correlation between their variables and the U-matrix.



Fig. 51 Visualization of Undergraduate Courses' clusters, 2014

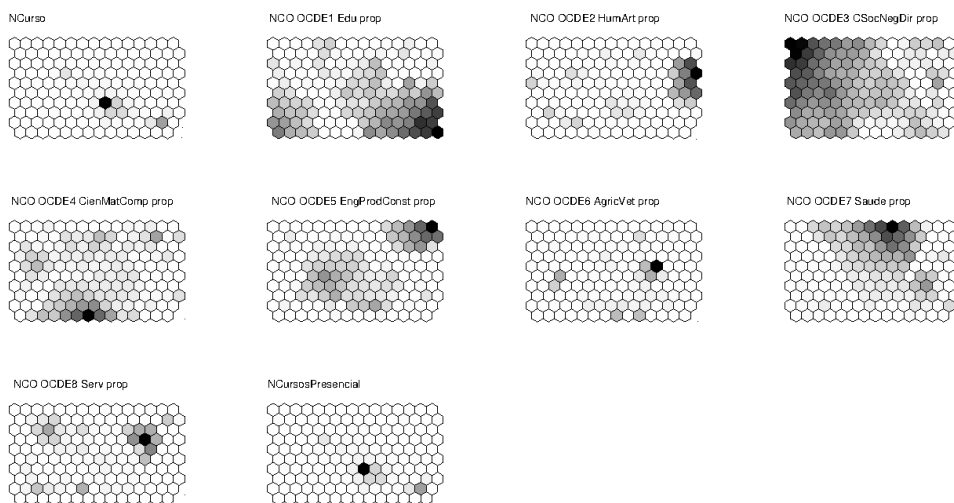


Fig. 52 Visualization of the variables used for the Undergraduate Courses' component planes, 2014.

There is a stronger correlation between the number of undergraduate courses offered by the HEIs and their modality, prevailing the in-classroom mode.

Complementarily, the identified clusters have courses in all OECD main areas, though their distribution is quite different. Most HEIs concentrate their offer in Education and Social Sciences, Business and Law areas.

Interpreting both the U-matrix and the component planes, the discovered patterns related to the undergraduate courses are illustrated in *Table 55* and were grouped according to three categories: a) types of courses and its modalities; b) the number of courses and c) areas of prevalence.

Table 55 Discovered patterns and complimentary information for UGC, 2014

Cluster	Undergraduate Courses discovered pattern(s)	
1 – The lowest number of courses	Type of Courses and modalities	The HEIs with the lowest number of bachelor's degrees, technological and e-learning courses.
	Number of Courses	The HEIs (70,4%) with until an average of 7.5 courses.
	Areas of prevalence	Engineering, Production, and Construction; and Humanities and Arts areas.
2 – The lowest number of enrolled students	Type of Courses and modalities	The HEIs with the most significant number of courses concerning bachelor, teaching, and technical degrees in classroom and e-learning modes.
	Number of Courses	The HEIs (71,7%) which offer the highest number of undergraduate courses (n=32).
	Areas of prevalence	Education, and Sciences, Mathematics, and Computing areas.
	Complementarily information	It has institutions with the lowest number (n=10.277) of enrolled students and students without funding.
3 – The highest number of courses	Type of Courses and modalities	HEIs with the highest number of courses.
	Number of Courses	The HEIs (53,6%) that have 11.6 courses on average.
	Areas of prevalence	Social Sciences, Business, and Law, Education, and Engineering, Production, and Construction areas.
4 –The students depending on public funding	Type of Courses and modalities	HEIs with a teaching degree and classroom mode courses.
	Number of Courses	The HEIs (76,4%) that have seven courses or the lowest number of courses.
	Areas of prevalence	Social Sciences, Business, and Law areas.
	Complementarily information	It has the highest number of HEIs. The ones with the highest number of enrolled students (n=141.475) and the largest number of students depending on public funding.

All clusters have courses in all OECD main areas, though their distribution is quite different. **Cluster 1**, groups the institutions with the lowest number of bachelor's degrees, technological and e-learning courses. It offers the vast majority of undergraduate courses in the Engineering, Production, and Construction, and Humanities and Arts areas. **Cluster 2** includes the HEIs (71,7%) which the highest number of undergraduate courses (n=32) and the most significant number of bachelors, licentiate and technical degrees in classroom and e-learning modes. It focusses on Education, and Sciences, Mathematics, and Computing areas. **Cluster 3** focusses on Social Sciences, Business, and Law, Education, and Engineering, Production and Construction areas. In **Cluster 4**, the HEIs have the lowest number of courses, licentiate, and classroom mode courses. It focusses on Social Sciences, Business and Law areas. On the other side, it has the highest number of HEIs (*Table 55*). Thus, the HEIs' UC discovered patterns could be visualized as: the HEIs with the highest and the lowest number of courses; the HEIs with the lowest number of enrolled students and the HEIs with the highest number of students depending on public funding.

These discoveries are aggregated by different knowledge areas which also distinguished the clusters. Some institutions focused their offer in a specific area. This can be due to their academic and/or administrative category. Mostly private and public universities offer courses in different areas simultaneously, while smaller institutions focused on specific areas.

6.1.3. Professors

Another analyzed dataset refers to the professors (N= 396,569) who work for the Higher Education Institutions (HEIs). *Figure 53* illustrates the U-matrix of the data processed for all professors (N=396,569). They were grouped in five (5) different clusters identified by their labels, from number 1 to 5, which include their degree, sex, and work conditions.

The variables used in the Professors' analysis are indicated in the component planes (*Figure 54*). Through the component planes illustrated in *Figure 54*, it is possible to see their distribution and the correlation between these variables and the U-matrix.

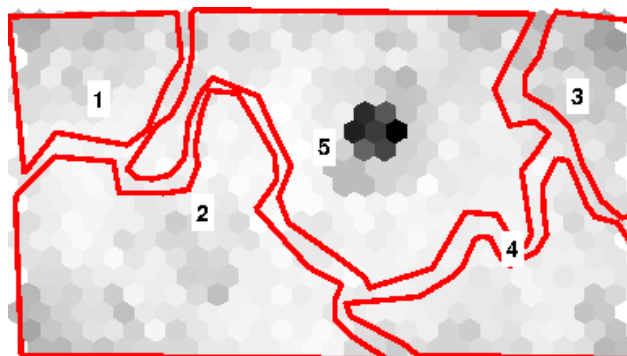


Fig. 53 Visualization of Professors' clusters, 2014

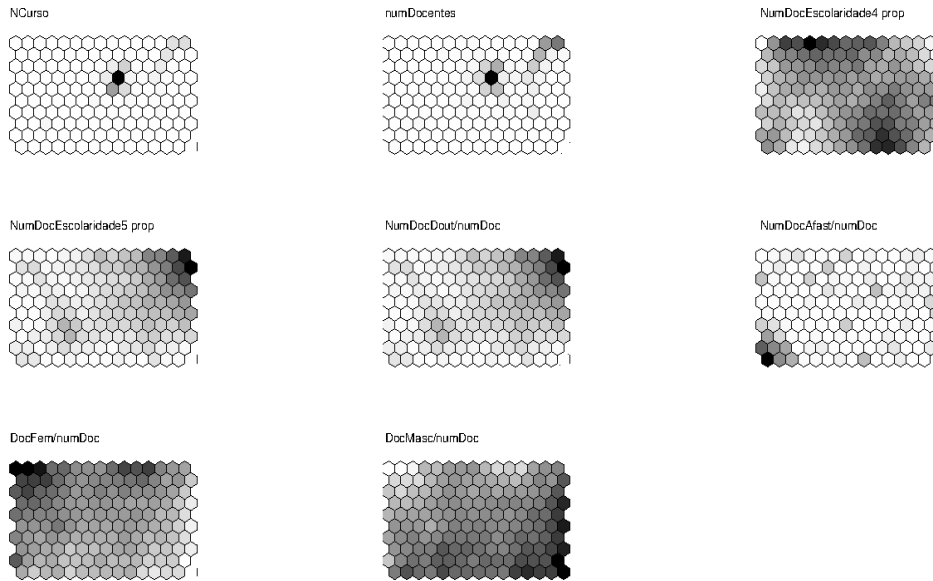


Fig. 54 Visualization of the variables used for the Professors' component planes, 2014.

It is observed that there is a stronger correlation between the number of undergraduate courses offered by the HEIs and the number of professors, and between the number of Ph.D. professors and its proportion among all HEIs, as they have the same shape in the component planes. Complementarily, it is depicted that cluster 1 has more female professors while cluster 4, male professors. In addition, the HEIs with the highest number of professors are grouped in cluster 5.

Table 56 illustrates the discovered patterns (number of courses and professors characteristics) for the main variables of the professors' dataset, and for other dimensions (HEIs, undergraduate courses, and students) variables, which were identified as complementary information, raised from their correlation.

Table 56 Discovered patterns and complementarily information for Professors, 2014

Cluster	Professors data discovered pattern(s)	
1 – The fewest number of Ph.D. professors	Number of courses	The HEIs with the smallest number of courses. It has the fewest number (7%) of Ph.D. professors.
	Professors characteristics	It has the highest proportion of female teachers (70%).
	Complementarily information	The institutions with the smallest number (n=572) of administrative staff and the highest proportion of female students (76%).
2 – Specialist teachers' predominance	Number of courses	The HEIs with the largest number (n=925.9) of courses.
	Professors characteristics	It has the highest proportion (55%) of specialist teachers. It has the highest proportion (58%) of male professors.
3 – Ph.D. teachers'	Number of courses	It has no distinctive information.
	Professors	It has the fewest number of master's degree

	predominance	characteristics	professors. It has the highest proportion of male (63%) professors. It has the highest proportion (65%) of Ph.D. and absent (10%) professors.
		Complementarily information	It has the largest number of employees (n=17.661), and the smallest number of HEIs (n=134).
		Number of courses	It has no distinctive information.
4 – Master teacher’s predominance		Number of courses	It has the HEIs with the most significant number (75%) of male professors.
		Professors characteristics	It has the highest proportion of professors (54%) with a master’s degree and the lowest number (1%) of absent teachers.
		Complementarily information	It has the highest proportion of male students.
5 – Gender balance		Number of courses	It has no distinctive information.
		Professors characteristics	It has the HEIs with an even number of male and female teachers.
		Complementarily information	It has the highest number (n=867) of HEIs.

As a result, it was possible to visualize the HEIs which distinguish themselves for having the highest proportion of Ph.D. or master’s degree or Specialist professors, the HEIs with the fewest proportion of Ph.D. professors and their respective proportion of genre.

It was also observed a predominance of male professors for most of HEIs, except for the ones which belong to **Cluster 1**.

In general, the absent professors vary from 1% to 5% in all HEIs, except in cluster 3, where it achieves a 10% rate. This absence can be due to different causes. Professors can be out of work for qualification; for becoming a member of different bodies or entities; for health treatment and other (personal) reasons.

The SOM technique allows us to identify the clusters with the biggest and the smallest number of HEIs. Also, the ones with the most substantial number of employees and the highest proportion of male students (*Table 56 56*), as some complementary information.

6.1.4. Students

Figure 55 illustrates the U-matrix of the data processed for all Brazilian enrolled students (N=7,805,727) whose registers took part of the Higher Education Census. The number of five (5) clusters was achieved and are identified by their labels, from number 1 to 5.



Fig. 55 Visualization of Students' clusters, 2014.

The variables considered for the student's analysis are indicated in the component planes (Fig. 56).

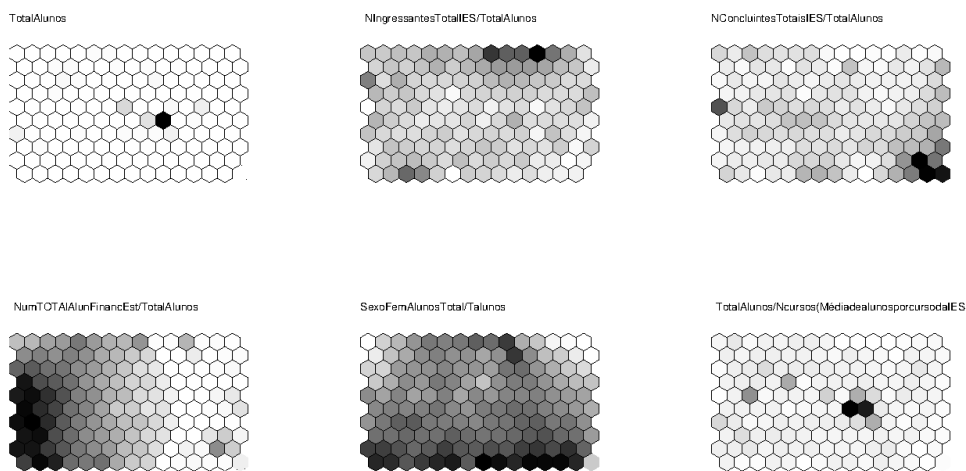


Fig. 56 Visualization of the variables for the Students' component planes in 2014.

Cluster 1 has the HEIs with the lowest number of enrolled students, entrants, and a predominance of students in OECD 5. It has the highest percentage (50%) of students depending on funding and, on average, the lowest rate of female students. **Cluster 2** has the largest number of HEIs, with the biggest number of enrolled students and the largest rate of students per course. On the contrary, it has the lowest rate of undergraduate students. **Cluster 3** distinguishes itself by the greatest number of students depending on funding (65%). **Cluster 4** is identified, on average, by its number of courses and entrants and the lowest proportion of students depending on public funding, sex, Cluster **5** has the highest rate of undergraduate and average female students, though, the smallest number of students, HEIs, courses, and rate of students per HEIs (Table 57).

Through the component planes illustrated in *Figure 56*, it is possible to see the correlation between these variables and the U-matrix (*Fig. 55*). It can be depicted that there is a correlation between the total number of enrolled students and the average number of students per HEIs as their component planes are similar in structure or shape.

Through the component planes and the U-matrix visualization, it is observed that the HEIs with most of the entrants are in **Clusters 2** and **3**. The ones with most of the graduate students are in **Cluster 5**.

Complementarily, the preferred OECD areas of knowledge for undergraduate courses and the dependence on financial funding can be depicted. Besides, it was observed that the OECD main areas 4 (Science, Mathematics, and Computing), 6 (Agriculture and Veterinary) and 8 (Services) are the less explored in the country. Moreover, many students have a high dependence on financial funding.

Contrarily to what was observed in the professor's clusters, here, there is a predominance of the female sex. *Table 57* illustrates the discovered patterns identified for the student's dataset.

Table 57 Discovered patterns and complementarily information for Students, 2014

Cluster	Students discovered pattern(s)	
1 – The lowest number of entrants	Students status	HEIs with the lowest (9%) number of entrants.
	Sex	It has the lowest rate (26%) of female students.
	OECD area of predominance	The predominance of students in OECD area number 5 (Engineering, Production, and Construction).
	Financial information	It has half of the students (50%) depending on funding.
2 – The largest number of enrolled students	Students status	It has the most prominent number of enrolled students, the largest rate of students per course, the lowest rate of undergraduate students, and entrants around 35.40%.
	Sex	HEIs with 56% of female students.
	OECD area of predominance	It has a predominance of students in OECD 2 (Humanities and Arts) and 7 (Health and Welfare).
	Financial information	It has around 48% of the students depending on funding.
	Complementarily information	It has the most substantial number of HEIs.
3 – Students with financial dependence	Students status	It has entrants around 38.9%.
	Sex	HEIs with 72% of female students.
	OECD area of predominance	HEIs with the predominance of students in OECD 1 (Education), 3 (Social Sciences, Business, and Law), and 7 (Health and Welfare).
	Financial information	It has the highest number of students

4 – The highest number of entrants	Students status	depending on funding (65%). HEIs with the highest number (39%) of entrants.
	Sex	HEIs with 50% of female students.
	OECD area of predominance	It has the predominance of students in OECD 3 (Social Sciences, Business, and Law).
	Financial information	It has the lowest proportion (4%) of students depending on funding
5 – Undergraduate students	Students status	It has the highest rate of undergraduate students, and the smallest number of students, HEIs, courses, and the rate of students per course. It has around 15% of entrants.
	Sex	It has the highest rate (75%) of female students.
	OECD area of predominance	HEIs with the predominance of students in OECD 1 (Education).
	Financial information	It has 9% of students depending on funding.

As a result, it was possible to visualize the student`s characteristics, their OECD areas of preference for undergraduate courses, their sex prevalence, and funding dependence.

Based on the student`s analysis, it is possible to visualize the clusters with HEIs which have the greatest and lowest number of entrants, enrolled and graduates. The HEIs whose students most depend on public funding, and their sex prevalence, as already mentioned.

Thus, HEIs can be grouped according to their attributes:

- a) The institutions with the lowest number of entrants and the lowest rate of female students as in cluster 1.
- b) The institutions with the largest number of enrolled and the lowest number of undergraduate students as in cluster 2.
- c) The institutions which have the greatest number of students depending on public financing as in cluster 3.
- d) The institutions, which have the highest number of entrants and the lowest proportion of students based on government funding as in cluster 4.
- e) The institutions which have the highest rate of undergraduate students and the highest rate of female students as in cluster 5.

6.2. Knowledge Discovery through the Global SOM

6.2.1. The HEIs attributes grouped: The Global SOM

To evaluate the intercorrelations among all proposed dimensions for SOM components, we applied the SOM algorithm to all elements simultaneously. As a result, *Figure 57* illustrates the visualization of the clusters for the Global SOM, considering 27 variables from the

dimensions already explored. The number of six (6) clusters was found through the previous adopted techniques and clusters are identified through their labels, from number 1 to 6 (Fig.57).

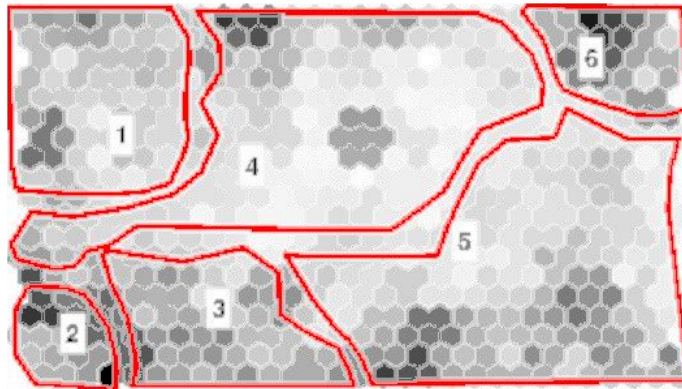


Fig. 57 Visualization of the clusters for the Global SOM

Cluster 1 concentrates its courses' offer (72%) in the Education area (OECD 1 and has the highest number of licentiate courses. It groups the HEIs which have the highest percentual of undergraduate students (24%) and the highest proportion of female students in OECD area 1 (74%). Cluster 1 has the largest number of absent (6%) and female (57%) teachers.

Cluster 2 is the smallest (=84) regarding the number of HEIs. It is the only one that offers courses in the Humanities and Arts Area (OECD 2). It has the lowest number of technological courses. It has the lowest number of students depending on public financing. It has the highest proportion of Ph.D. professors and the lowest proportion of female teachers. It has, on average, the highest number of entrants and the female students in OECD area 2 (76%). It also groups the youngest and the oldest students in OECD areas 6 and 2, respectively.

Cluster 3 has the highest number of courses in Science, Math, and Computing (25%, OECD 4), and Engineering, Production and Construction areas (54%, OECD 5). It has the lowest number of courses in the field of Education and Humanities and Arts and the lowest number of licentiate courses. It also has the lowest proportion of female students. The OECD area 5 is the area that has the highest percentage (47%) of women students. Clusters 2 and 3 have the lowest number of females' professors.

Cluster 4 has the highest number of public institutions and groups most of the universities. It has the largest number of courses in the Health and Wellness area (29%, OECD 7), and Agriculture and Veterinary (3%, OECD 6) areas. It has the highest number (n=384.29) of administrative employees and professors. It has the largest proportion of male students (72%). It distinguishes itself for having the highest number of total courses, bachelor and technological, in classroom and e-learning modes. It has the highest number of total enrolled students, and the smallest number of entrants, on average, and 34% of their female students are in OECD area 7. Cluster 4 is the biggest of all of them: has the highest

number of total professors, the most significant number of undergraduate and specialist professors; teachers with master and Ph.D. degrees.

Cluster 5 has the most significant number of private institutions, both for-profit and non-profit, and groups most of the faculties. It is the biggest concerning the number of HEIs (n= 807). It concentrates its offer in the Social Sciences, Business, and Law areas (72%, OECD 3). It has the greatest proportion of professors with a master's degree and the smallest number of administrative employees (n=47.43) and total courses, bachelor's in classroom and e-learning modes. It has the fewest enrolled students and 78% of their female students enrolled in OECD area 3. Cluster 5 is the smallest with the lowest number of total professors and the lowest number of teachers with master and Ph.D. degrees.

Cluster 6 comprises the HEIs with the highest values of incomes, other revenues, the highest investment expenses, the highest values with professor and staff remuneration and the greatest number of students; they are the ones with no resources from transference. They have the highest number of entrants (first-year students), students with financial funding, and the lowest number of professors with master and Ph.D. degrees. It groups the HEIs which has the lowest proportion of students who achieve an undergraduate degree (13%) and has the highest proportion of students (69%) depending on government funding. Distinguishes itself as it arranges eminently private institutions (99%).

Concerning the age of the enrolled students, the oldest students are concentrated in **Cluster 2**, in the field of Humanities & Arts (OECD 2). It is observed that the age considered ideal for undergraduate students, which was from 18 to 24, has already increased in all OECD Areas. The youngest students are, on average, 23 years old, and are enrolled in Agriculture and Veterinary undergraduate courses (OECD 6).

For the SOM carried out globally, to evaluate the intercorrelations among all previous dimensions for SOM components, we could identify new and distinct relevant information. It detected six clusters about the underlying components. This Global SOM allowed us to compare its variables against each other and to find interesting new relationships as, per example, some areas of OECD which have not been mentioned before and the administrative and academic categories of the HEIs, which were not so relevant for the previous analysis, as below:

Cluster 1 is eminently dedicated to the Education area (OECD 1) and has the highest number of licentiate courses.

Cluster 2 is the only one who dedicates itself to the courses in the Humanities and Arts area (OECD 2).

Cluster 3 concentrates its offer in the Science, Math and Computing and Engineering, Production and Construction areas.

Cluster 4 has the highest number of public institutions and groups most of the universities. It has the highest number of courses in the Health and Wellness area (OECD 7) and Agriculture and Veterinary (OECD 6). It is the biggest cluster.

Cluster 5 has the highest number of private institutions, both for-profit and non-profit, and groups most of the faculties. It concentrates its offer in the Social Sciences, Business, and Law areas (OECD 3).









Cluster 6 comprises the HEIs with the highest values of incomes, other revenues, the highest investment expenses, the highest values with professor and staff remuneration and the greatest number of students; also, they are the ones with no resources from transference. It groups the HEIs which are eminently private institutions (99%).

These results, which consider all the variables of the dimension beforehand analyzed, increment the ones achieved only for the independent HEIs' SOM components and allows a more detailed view of all HEIs, their undergraduate courses, professors and students in the country.

According to *Figure 58* **Erro! Fonte de referência não encontrada.**, it is observed that the distribution of undergraduate courses among the HEI's clusters assume distinct compositions if considered the OECD Main Areas.

For this study purpose, the analysis will focus on the identification of the HEIs, which concentrate their offer exclusively in a specific OECD main area and could, therefore, be considered a niche institution. Additionally, the evaluation of the courses of these 'focused' institutions,' through the IGC Index, will be considered to assess their quality. For better visualization the legend adopted is as follows (*Table 58*):

Table 58 Legend for Courses Distribution according to OECD Main Areas

Legend	Description
	OECD main area 1, Education
	OECD main area 2, Humanities and Arts
	OECD main area 3, Social Sciences, Business and Law
	OECD main area 4, Science, Math and Computing
	OECD main area 5, Engineering, Production, and Construction
	OECD main area 6, Agriculture and Veterinary
	OECD main area 7, Health and Social Welfare
	OECD main area 8, Services

Below, the visualization of the distribution of undergraduate courses offered by the Higher Education Institutions (HEIs), according to OECD Main Areas, per year:

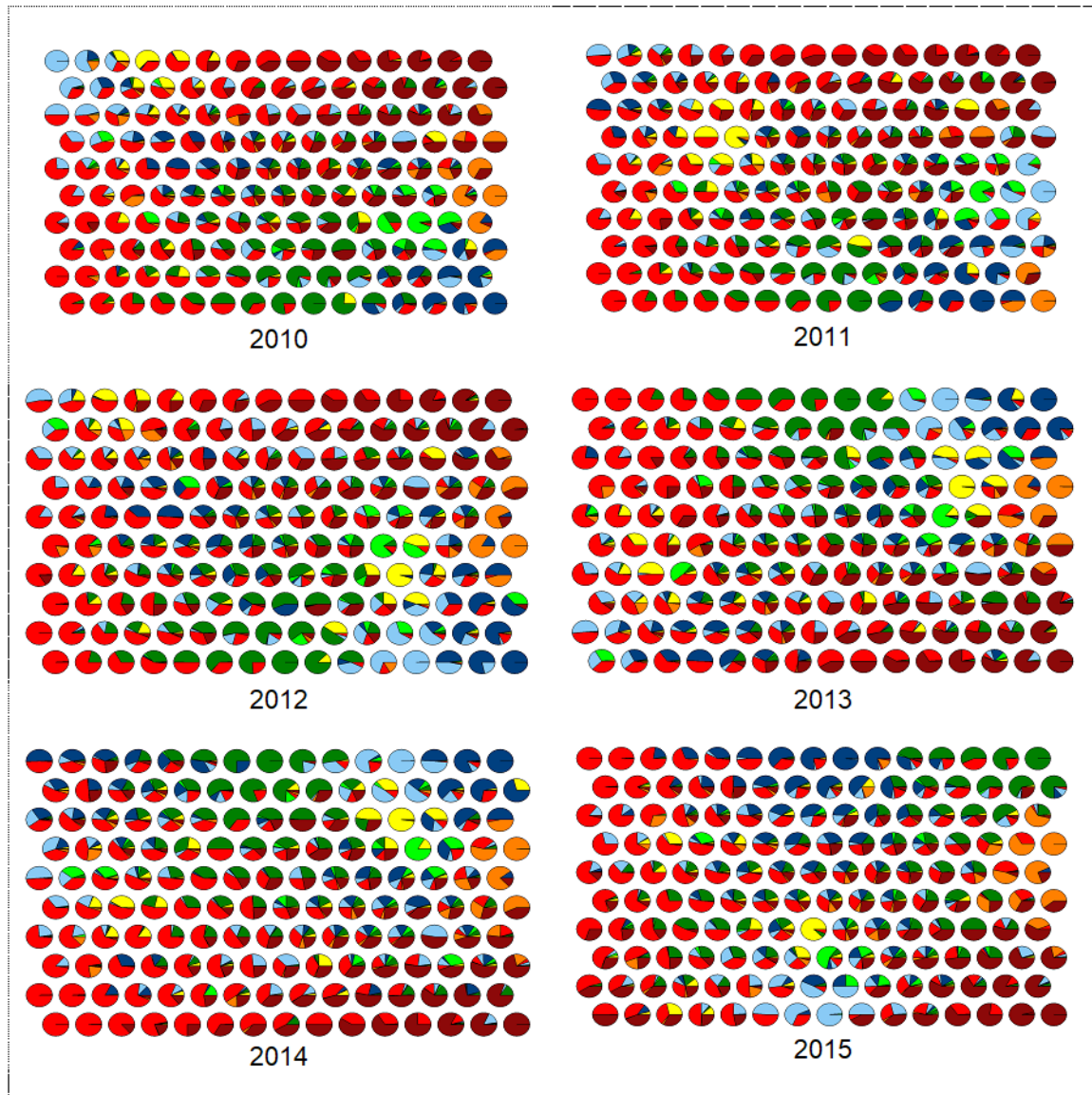


Fig. 58 Distribution of undergraduate courses offered by the HEIs according to OECD Main Areas, 2010-2015

By comparing the images from the years 2010 to 2015 (*Figure 58*), it is possible to visually identify the correlation between the distribution of the HEIs and their courses in different OECD areas. Complementarily, the maps below (*Figure 59*) illustrate the HEIs clusters and their distribution in the Brazilian territory.

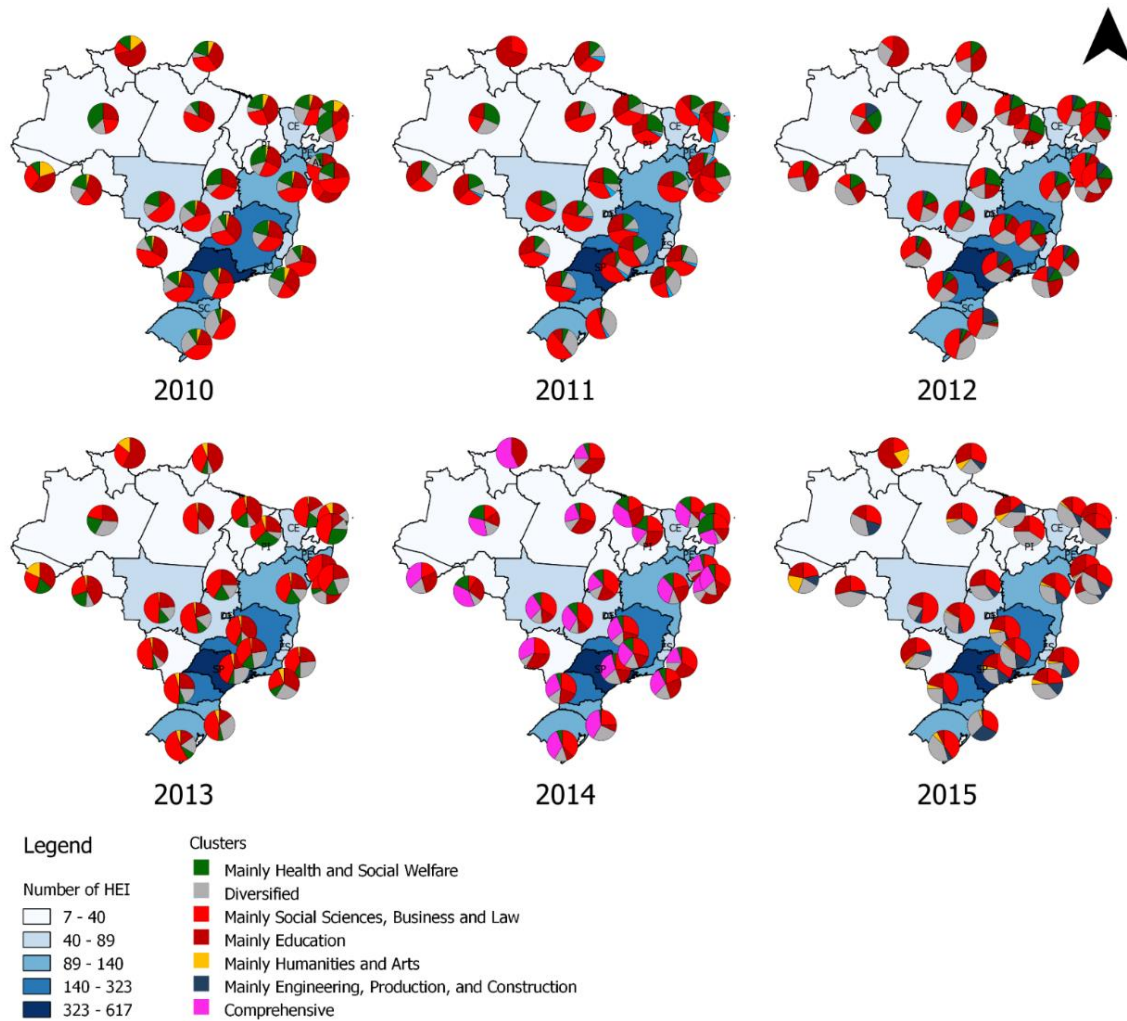


Fig. 59 HEIs and their cluster's distribution, per state, in Brazil, 2010-2015

6.2.2. The temporal perspective

For the temporal analysis, it was considered the registers of 2,465 HEIs, in a consolidated dataset, from academic and administrative categories (Table 5959), as during the period some institutions were extinguished, and new ones emerged.

Table 59 Academic and Administrative categories of the HEIs' consolidated dataset, 2010-2015

2015		Academic Category				
Administrative Category	University	Center	Federal Center	Federal Institute	Faculty	#N/D
Private	92 (3.73%)	175 (7.10%)	0	0	1863 (75.58%)	-
Public	107 (4.34%)	8 (0.32%)	2 (0.08%)	38 (1.54%)	142 (5.76%)	-

#N/D	-	-	-	-	-	38 (1.54%)
TOTAL	199 (8.7%)	183 (7.42%)	2 (0.08%)	38 (1.54%)	2005 (81.34%)	38 (1.54%)

6.2.3. The Higher Education Institutions and their niches

There are two prominent areas of courses offering, from 2010 to 2015: Education; and Social Sciences, Business, and Law. Even though both areas show an oscillation in the proportion of the number of HEIs and courses during the period, in the last years (2014-2015), they demonstrated a drop in the number of HEIs from 23% to 14% and from 34% to 26%, respectively.

The Health and Social Welfare was also a predominant area until 2014, when it suffered a drastic reduction in the number of HEIs, from 332 (14%) in 2010 to 186 (8%). Even though the HEIs devoted exclusively (100%) to Health and Social Welfare increased their participation from 18% (2010) to 33% in 2015.

Considering the proportion of courses offered in the area, there was a reduction from around 37% to 15%. Smaller groups, constituted by other areas, eventually composed an independent cluster, especially when courses offered by HEIs increased, as occurred with Humanities and Arts in 2010, 2013 and 2015; Engineering, Production, and Construction in 2012, and 2015; and Science, Mathematics, and Computing in 2011.

For most of the years, the above areas are grouped in just one cluster of independent HEIs and smaller representativeness, which offer courses in a specific area, called *diversified*. Agriculture and Veterinary; and Services also took part in this cluster and were the most inexpressive along the period.

The *diversified* cluster had a significant increase in the number of HEIs, from 21% to 27% in 2012, and from 15% to 23% in 2015 but on the contrary, a drastic reduction in the niche institutions, from 45% to 9%, in 2015.

Concerning the HEIs which offer courses in the Humanities and Arts area, it was observed that in the period studied, the number of HEIs almost remained the same, but the HEIs which are exclusively devoted to Humanities and Arts suffered a reduction from 68% to 51%.

Engineering, Production, and Construction Areas are the ones where the number of HEIs increased from 170 to 191 from 2012 to 2015, but the *niche* institutions, were subject to a contrary effect, reducing their number from 37% to 12%.

In 2014, differently, from the previous years, it was identified a cluster with 30% of all institutions which offer courses in almost all areas, the so-called *comprehensive*. These HEIs do not concentrate on any specific area but distribute their courses among different

knowledge areas. They act like universities, but they represent smaller institutions called centers and faculties, public and private, and their distribution is indicated in *Table 60*.

Table 60 Distribution of HEIs categories in 2014, the comprehensive cluster

2014 Administrative Category	Academic Category		
	University	Center	Faculty
Private	12%	19%	61%
Public	4%	1%	3%
TOTAL	16%	20%	64%

Table 6161, below, indicates the HEIs, their undergraduate courses distribution, and the IGC *Index* evaluation. *N* indicates the number of HEIs in the cluster and *n* is the number of institutions that are exclusively dedicated to the referred knowledge area.

6.2.4. A global vision of the undergraduate courses' areas

In 2015, the total number of HEIs had dropped in Brazil. On the contrary, the number of undergraduate courses has increased during the period. Despite this increase, according to the data analyzed, this supply has migrated among different areas of knowledge, which may indicate some tendencies regarding potential demand.

Taken the year of 2010 as a point of depart and a reference for the global analysis, *Table 6261* indicates the distribution of the number of courses offered by the HEIs, in each area of predominance, per year, during the period studied. It was observed that, along the period, the offer condition varied significantly.

In general, from 2010 to 2015, there was a reduction in the offer conditions for all areas, except for Engineering, Production, and Construction areas. In addition, there was a highlight for the Science, Mathematics, and Computing Area, which configured itself as an independent cluster in 2011. Also, there were an increase in the proportion of the course among the *diversified* cluster for the Agriculture and Veterinary; and Services areas (*Table 622*).

In 2010 and 2013, the Education area concentrated most of the offered courses. Along the period, Education is also one of the most prominent areas concerning the offer conditions in the country.

In the year of 2014, a group of institutions emerges, in a different cluster, offering courses in several areas, herein titled as *comprehensive*. The year 2014 represented one of the most extreme scenarios considering the distribution of courses, as there was a significant drop in all areas with some of the worst numbers in the last five years.

Table 62 Evolution of undergraduate courses per area during 2010-2015

	Mainly Social Sciences, Business, and Law	Mainly Education	Diversified		Mainly Health and Social Welfare	Mainly Humanities and Arts	Mainly Engineering, Production, and Construction	Mainly Science, Math, and Computing	Comprehensive (non-exclusive)
2010	33.82%	66.03%	Science, Math and Computing	44.64%	36.85%	8.56%			
			Engineering, Production, and Construction	57.37%					
			Agriculture and Veterinary	32.37%					
			Services	44.66%					
2011	44.29%	47.76%	Humanities & Arts	69.83%	22.49%			4.35%	
			Engineering, Production, and Construction	75.39%					
			Agriculture and Veterinary	51.02%					
			Services	53.61%					
2012	36.33%	47.53%	Humanities & Arts	68.98%	20.26%		19.64%		
			Science, Math, and Computing	64.04%					
			Agriculture and Veterinary	59.89%					
			Services	61.78%					
2013	49.19%	68.56%	Science, Math and Computing	33.09%	20.57%	8.53%			
			Engineering, Production, and Construction	54.91%					
			Agriculture and Veterinary	32.55%					
			Services	36.10%					
2014	22.30%	53.33%	Humanities & Arts	10.86%	14.91%				
			Science, Math, and Computing	12.69%					
			Engineering, Production, and Construction	23.42%					
			Agriculture and Veterinary	18.61%					
			Services	12.26%					
2015	29.29%	51.49%	Science, Math and Computing	58.02%		8.44%	29.35%		
			Agriculture and Veterinary	53.28%					
			Health and Social Welfare	76.54%					
			Services	63.66%					

Therefore, the year 2015 demonstrates an attempt to recover from this scenario, with an increase in the *diversified* group, which raises the supposition that the small institutions are getting smaller.

Comparing to other OECD countries, over the past two decades, in some countries, more students have access to the tertiary level of study, mainly in science and engineering fields which is the opposite of what was achieved. Worldwide, some fields are more popular among students. The areas of science and engineering, per example, have a preference. Despite this trend, Brazilian Higher Education (Silvia Regina Machado de Campos et al., 2017) is concentrated mainly in Education and Social Sciences, Business, and Law areas.

Only in 2015, it was observed an increase in the offer of Engineering, Production and Constructions courses from 19.64% to 29.35% and in the areas of Agriculture and Veterinary, Health and Social Welfare, and Services, which were grouped by the *diversified* cluster (Table 622).

The maps below (Figure 60) illustrate the number of HEIs and their IGC Index, from 2010 to 2015, distributed in the Brazilian territory, per state.

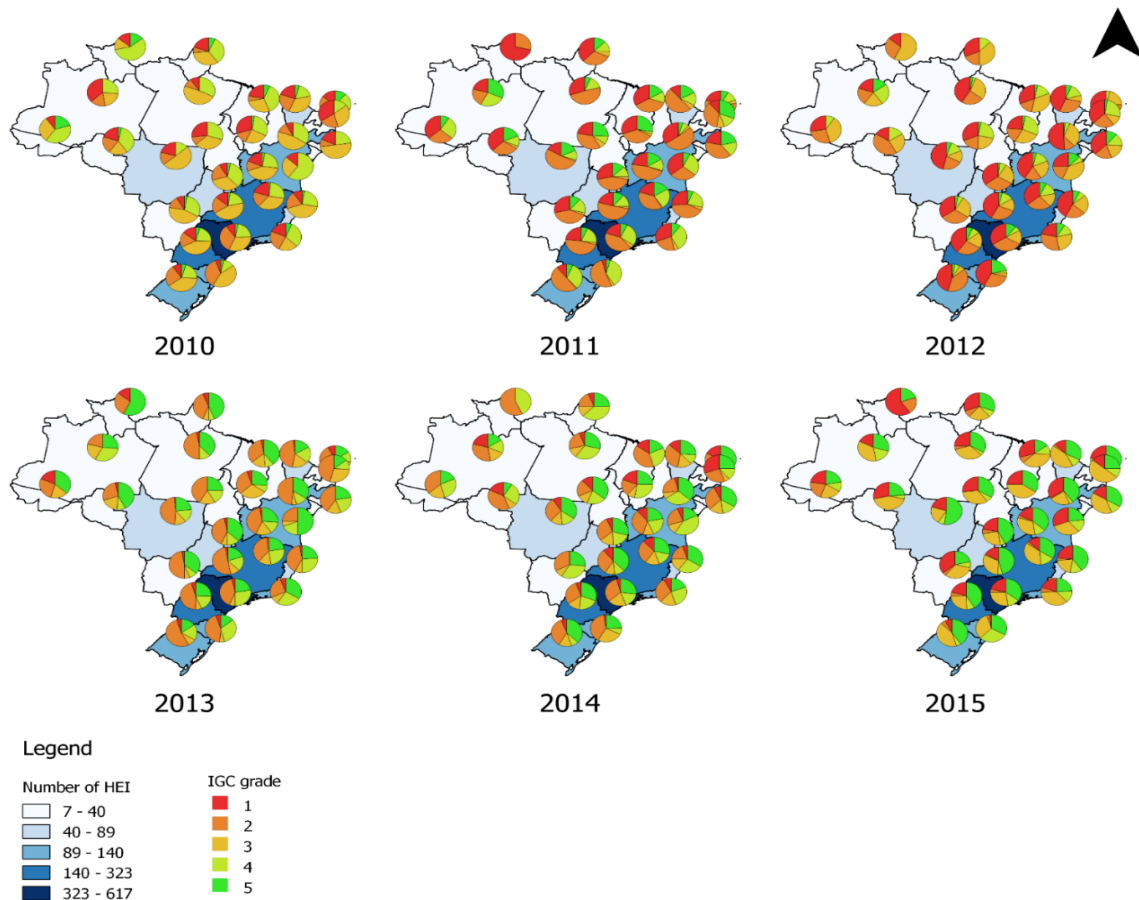


Fig. 60 HEIs and their IGC Index, per state, in Brazil, from 2010 to 2015

6.2.5. The specialized institutions and their quality evaluation

The results came across two different groups of HEIs. The first depicted the institutions which scored a 5-grade in the *IGC Index* (Table 63). The following scenery during the 2010-2015 period was achieved.

Considering the registers of 2,465 (100%) HEIs, on a consolidated dataset, it was depicted that 150 HEIs achieved a 5-score in the *IGC Index*. They represent 43 institutions, as many of them repeated the evaluation result in a subsequent year. From this total, 26 (60.5%)

were faculties, and 23 (53.5%) were a public institution. Of these, 20 (77%) were private faculties. There were 32 (74.4%) universities, and they were all public institutions. From the 43 represented institutions, 19 (44.2%) are in the State of São Paulo.

It is observed that most of these institutions are concentrated in the Southeast, South, and Midwest regions. The maps (*Figure 61*) identify the specialized (*niche*) institutions and their *IGC Index*.

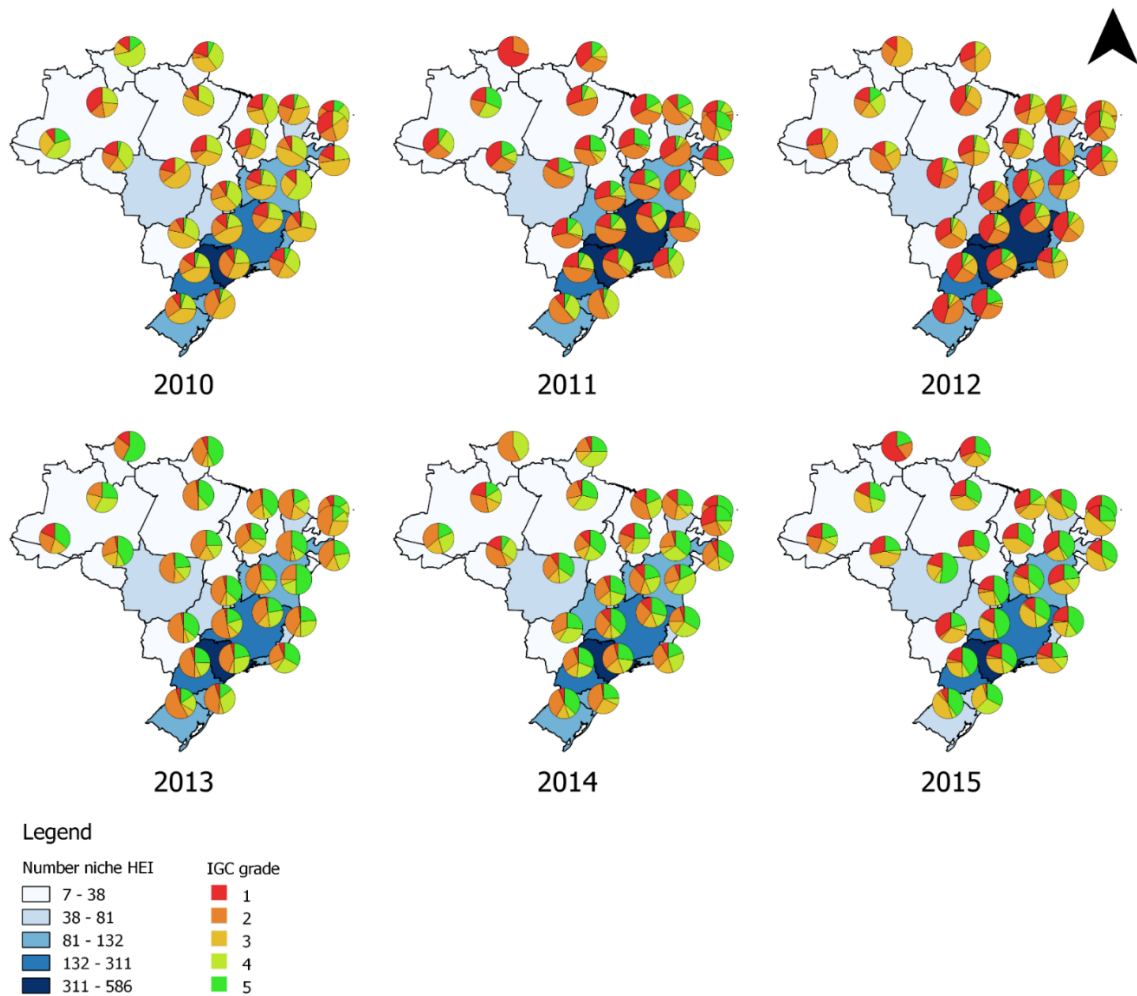


Fig. 61 IGC Index of the niche HEIs in Brazil, from 2010 to 2015

Complementarily, and characterizing the second group, the institutions which scored a 5-grade in the *IGC Index* among the HEIs which offered courses exclusively (100%) in a specific area, denominated *niche* institutions (*Table 63*). The following scenery was achieved.

Table 63 Niche HEIs 5-scored in the IGC Index, 2010-2015

		University Center		Faculty		University		Subtotal		TOTAL
		Private	Public	Private	Public	Private	Public	Private	Public	
2010	Cluster 1	0	0	1	1	0	0	1	1	2
	Cluster 2	0	0	0	2	0	0	0	2	2
	Cluster 3	0	0	8	1	0	0	8	1	9
	Cluster 4	0	0	0	0	0	0	0	0	0
	Cluster 5	0	0	0	0	0	0	0	0	0
2011	Cluster 1	0	0	0	0	0	0	0	0	0
	Cluster 2	0	0	9	0	0	0	6	1	7
	Cluster 3	0	0	0	0	0	0	0	0	0
	Cluster 4	0	0	0	2	0	0	0	2	2
	Cluster 5	0	0	1	1	0	0	1	1	2
2012	Cluster 1	0	0	4	0	0	0	4	0	4
	Cluster 2	0	0	0	0	0	0	0	0	0
	Cluster 3	0	0	0	0	0	0	0	0	0
	Cluster 4	0	0	1	1	0	0	1	1	2
	Cluster 5	0	0	0	2	0	0	0	2	2
2013	Cluster 1	0	0	0	0	0	0	0	0	0
	Cluster 2	0	0	5	1	0	0	5	1	6
	Cluster 3	0	0	0	0	0	0	0	0	0
	Cluster 4	0	0	0	2	0	0	0	2	2
	Cluster 5	0	0	0	0	0	0	0	0	0
2014	Cluster 1	0	0	0	0	0	0	0	0	0
	Cluster 2	0	0	0	0	0	0	0	0	0
	Cluster 3	0	0	0	2	0	0	0	2	2
	Cluster 4	0	0	1	0	0	0	1	0	1
	Cluster 5	0	0	5	0	0	0	5	0	5
2015	Cluster 1	0	0	1	0	0	0	1	0	1
	Cluster 2	0	0	0	0	0	0	0	0	0
	Cluster 3	0	0	0	0	0	0	0	0	0
	Cluster 4	0	0	0	2	0	0	0	2	2
	Cluster 5	0	0	6	0	0	0	6	0	6
	TOTAL	0	0	39	18	0	0	39	18	57

Among these *focused* HEIs, 17 HEIs obtained a 5-grade score in the *IGC Index* along the period. These institutions are all (100%) faculties, and 13 (76.5%) are private. Their courses are concentrated in the areas of Social Sciences, Business and Law; Health and Social Welfare; Engineering, Production, and Construction and Education. It is observed that these institutions are concentrated in the Southeast, South and Midwest regions, as already demonstrated in *Figures 60* and *61*; and ten institutions (58.8%) are in the State of São Paulo.

The number of HEIs which obtained a 3 and 4-score grades in the *IGC Index*, in both groups, and their areas, is also indicated in *Table 61*.

6.3. Knowledge Discovery through the Higher Education Students' Census Data

This section presents the findings which were obtained from the student's dataset analysis of the Higher Education Census data for 2014 (see item 3.2.2.3). In our data set, each data item was associated with a variable. The variables x_1-x_{16} , disposed of in *Table 6*, were used for the analysis and visualization of each proposed dimension of SOM, students, and undergraduate courses, independently, mapping the input vector into a 2-dimensional output space (grid).

As already mentioned, we used some quantitative auxiliary tools, as the Davies-Bouldin Index to find the optimal number of clusters for each U-matrix and applied the *k-means* algorithm to SOM units. The results from these two operations are then mapped for each U-matrix with their respective number of clusters.

The two most essential visualization tools of SOM are the U-matrix and the component planes, as already explained in section 3.6.1. In the next subsection, we interpret the component planes to evaluate the data distribution for the students' SOM dimension, to identify correlations among the studied variables. Moreover, we identify, through the U-matrix, the sets of units that are like each other or are dissimilar.

The students (N=7,805,727) in Brazil can be grouped into five different clusters, as illustrated in *Table 64* of the data processed. These clusters were achieved through the methodology mentioned above and are identified by their labels, from number 1 to 5. The variables considered for the student's analysis are also indicated in *Table 64*.

It is observed that clusters 3 (38.9%) and 4 (39.0%) have the highest proportion of entrants, even though cluster 3 does not have the highest number of total students. Moreover, cluster 5 distinguishes itself as it has most of (49.0%) undergraduate students. There is a predominance of female students, except in cluster 1.

Table 64 Clusters' variables for student's dataset

Cluster	Students (average)							Students per course
	TOTAL Students	TOTAL HEIs	TOTAL Courses	Entrant	Ugraduate	Financing	Female	
1	1484	126	7.7	9.0%	14.0%	52%	26%	185
2	4784	1052	16.6	35.4%	8.0%	46%	56%	250
3	1586	388	7.2	38.9%	16.0%	65%	72%	201
4	3007	727	17	39.0%	15.0%	4%	50%	155
5	373	170	2.38	15.0%	49.0%	9%	75%	122

Complementarily, the distributions of the student's age, genre, academic status, and dependence on financial funding by cluster and each OECD Main³⁶ Areas of knowledge is identified in *Table 65*.

The OECD Main Areas 4 (Science, Mathematics, and Computing), 6 (Agriculture and Veterinary) and 8 (Services) are the less explored in the country. Moreover, many students have a high dependence on financial funding.

Also, it is observed that the age considered "ideal" for undergraduate courses of 18–24 years old has changed when observing the age of students enrolled in undergraduate courses in 2014. There is a significant contingent of students older than 24 years old, coherent to what is named "late entry population" (Corbucci, 2014) and consistent with the recent literature (Sílvia Regina Machado de Campos et al., 2017).

³⁶ OECD 1 Education; OECD 2 Humanities & Arts; OECD 3 Social Sciences, Business and Law; OECD 4 Science, Math and Computing; OECD 5 Engineering, Production and Construction; OECD 6 Agriculture and Veterinary; OECD 7 Health and Welfare; and OECD 8 Services.

Table 65 Students' distribution according to OECD main areas, per cluster

	OECD 1					OECD 2					OECD 3					OECD 4				
Clusters	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Entrants	3%	10%	26%	18%	36%	9%	0%	2%	9%	2%	18%	39%	36%	36%	15%	15%	4%	3%	8%	1%
Ugraduate	3%	3%	24%	18%	48%	9%	59%	1%	7%	3%	22%	5%	37%	35%	24%	14%	6%	4%	9%	3%
Age	28	26	29	29	32	28	26	27	29	35	26	25	27	27	29	25	25	25	25	27
Female	4%	13%	29%	21%	54%	10%	4%	3%	9%	2%	28%	60%	34%	40%	24%	14%	5%	3%	7%	2%
Financing	3%	4%	28%	5%	22%	9%	56%	2%	1%	0%	18%	5%	36%	16%	15%	15%	12%	3%	2%	2%
	OECD 5					OECD 6					OECD 7					OECD 8				
Clusters	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Entrants	48%	0%	4%	13%	0%	2%	0%	1%	3%	0%	1%	47%	26%	7%	7%	2%	0%	4%	2%	3%
Ugraduate	35%	2%	2%	9%	3%	2%	12%	1%	3%	0%	1%	4%	23%	7%	8%	2%	0%	3%	3%	2%
Age	26	23	25	25	29	23	26	24	24	31	26	28	27	26	30	28	0	29	28	30
Female	39%	8%	2%	11%	2%	2%	2%	1%	3%	0%	5%	15%	29%	10%	11%	3%	3%	7%	2%	3%
Financing	50%	2%	3%	4%	2%	2%	13%	1%	1%	0%	1%	4%	28%	4%	7%	2%	0%	1%	0%	1%

7. MAIN DISCUSSIONS AND IMPLICATIONS FROM THE KNOWLEDGE GENERATION PHASE

7.1. The HEIs and the annual and global approaches

Based on the data analyzed some relevant information can be depicted, contributing to a more prospective and strategic view of the Brazilian Higher Education and generating some useful insights concerning trends and future challenges for Higher Education.

During the period, it was observed that the total number of HEIs varied slightly, but the number of undergraduate courses increased. The HEIs which were specialized in a specific knowledge area, constituting what was called a *niche*, on the contrary, suffered a decrease during the same period, in all areas, going in the opposite direction of the world trend.

Despite this fact, the literature points out that the niche market (Blackboard, 2017), which constitutes a tendency, would allow HEIs to compete in a more demanding, fast-changing, and threatening environment.

Some other trends were observed concerning the data analyzed along 2010-2015: the areas of Education and Social Sciences, Business and Law, predominate in Brazil along the period. On the contrary, the areas of Science, Mathematics, and Computing; Humanities and Arts; and Engineering, Production and Construction are the ones with the lowest number of specialized (*niche*) institutions which is opposite to other OECD countries (OECD, 2016a).

The Agriculture and Veterinary and Services are smaller and not representative of the data group. In addition, they have the lowest IGC Index scores among all the areas evaluated.

Most of the HEIs that compose the *niches* were also private institutions characterized mainly as faculties, smaller institutions dedicated to teaching. Complementarily, on the contrary to what was expected, a very few of them were evaluated with a 5-score IGC Index, the highest grade possible, which gives a parameter about these institutions' quality of courses. Most of the institutions obtained a 4 or 3-scores in this evaluating index. Thus, despite some HEIs concentrate their offer in a specific area, constituting the specialized niches, among them, a very few have achieved the maximum score and can be, in fact, considered differentiated, specialized and of high-quality (excellence) undergraduate courses.

Based on the data, it was also observed the specialized niches had joined themselves in ever-smaller groups of HEIs along the time (got smaller). On the other hand, a group of faculties delivering a great variety of courses, in different areas, simultaneously (so-called *comprehensive*) appeared. These two groups with different segmentation strategies coexist. The first group illustrates the niche specialization, while the second group illustrates the opposite trend, the diversification.

The current political and economic Brazilian situation still propitiates opportunities as the HEIs can dispose of different funding and administrative arrangements, in a more

collaborative manner, considering that the planning and establishment of new courses can be time-consuming.

As in Brazil the Higher Education is mainly provided by the private sector, this will require from them new mechanisms of management to grant their sustainability to long term. It is more evident that the HEIs will compete for students and financial resources, quality, and variety of services offered, diversifying, and adapting themselves according to competitive forces to new constraints and opportunities.

Considering the results, the challenge will be to restate the HE`s mission to be more focused on quality and to pursue student`s outcomes.

7.2. The clusters and the RBV Theory implication

HEIs have increasingly accumulated huge amounts of data due to the proliferation of information systems and technology. However, much of this information is mostly hidden, untapped, or underused. This scenery is highly expanded as we consider the universe of Census data, where public data is available but does not generate knowledge. Thus, the use the SOM promoted a better visualizing of the HEIs attributes, bringing up hidden patterns, and in this special case, detecting clusters of HEIs with similar characteristics and identifying important discriminating variables, thus generating information and new knowledge with the purpose of identifying the HEIs internal dynamics and their clusters implications according to their internal resources.

The variables used in the SOM analysis represent, according to the RBV Theory, some **tangible resources** as, per example, the *financial* and the *process*, and **intangible resources** as, per example, the *human capital*.

Table 6666 illustrates each SOM dimensions which was analyzed, and their variables, according to the RBV Theory of tangible or intangible resources.

Table 66 Resources variables for the SOM analysis according to the RBV, 2014

Type of resource		Tangible	Intangible
SOM dimensions		Financial	Process
		Incomes	Human ³⁷
Higher Education Institutions		Transferences	Administrative staff
		Investments	Professors
		Expenses	Students
		Remuneration	
Undergraduate Courses		Public Funding	Number of courses ³⁸
			Degree
			Area of knowledge
			Students
			Modality
Professors			Type
			Degree
			Sex

³⁷ Considered as human capital.

³⁸ As related to the course pedagogical process.

			Working conditions
Students	Financial dependence	Number of courses	Type
			Degree status
			Sex

Due to this approach (*Table 66*), in the SOM analysis of the Higher Education Institutions, it was possible to identify the HEIs which had similar resources, through the discovered patterns, as they were grouped in the same cluster; and to distinguish them from the other groups of HEIs, with different or complementarily resources. Therefore, the seven different clusters share similar and dissimilar resources among them, which can be visualized according to their patterns (positive and/or negative) (*Table 67*).

The same can be depicted when interpreting the undergraduate courses, the professors, and the students' SOM analysis. It was also possible to identify different clusters that shared similar and dissimilar resources, through their discovered patterns and visualize them accordingly (See *Table 5554, 55, 56 and 57*, respectively).

Thus, as a result of the SOM analysis, it was possible to make up the Brazilian Higher Education scenario and to depict the discovered patterns among each group of HEIs, courses, professors, and students, grouping them into different clusters, according to their main features or similar resources, called *discovered patterns*, which can distinguish them from other groups or clusters, as proposed in *Table 67*, identifying their combination of distinct or *complementary* resources that others do not have or share, based mainly on the financial (investments, expenses, funding, incomes or revenues), the processes (size, number of courses, courses in different knowledge areas, degree and modality) and the personal (professors, students and administrative staff) resources.

As indicated in *Table 67*, these similar resources can scale up their position and increase their competitive and sustainable advantage. On the other hand, their complementary resources can create synergies among them, through the accumulation of different resources which would be difficult to obtain in isolation. *Table 67* illustrates the HEIs resources – similar and complimentary - which were identified through the SOM findings, per cluster, according to the RBV Theory. The up blue arrow (↑) indicates the clusters whose HEIs have the highest values for that resource, according to the data analyzed; and the red down arrow (↓) indicates the opposite: the ones without or with the lowest values in each resource.

Thus, for each SOM dimension (HEIs, Courses, Professors, and Students) it was identified the appropriate number of clusters whose resources are grouped according to the RBV Theory, distinguishing the most relevant variables and the most relevant discovered patterns.

Table 67 Clusters implications based on SOM resources' identification, per dimension, according to RBV Theory

Resources		SOM Dimensions																			
		HEIs' clusters							Courses' clusters				Professors' clusters					Students' clusters			
		1	2	3	4	5	6	7	1	2	3	4	1	2	3	4	5	1	2	3	4
Tangible																					
Economic or Financial	Investments		↓		↑		↑														
	Expenses (remuneration, research)	↑		↑		↑		↑													
	Incomes / Revenues				↑		↓	↑													
	Public Funding dependence		↑						↓		↑							↑		↑	↓
Processes	Group size (number of HEIs)			↑		↓				↑		↓		↑		↑		↑		↓	
	Courses (number of)				↑	↓		↓	↑	↑	↓	↓	↑							↑	↓
Intangible																					
Human	Professors (total number)	↓																			
	Undergraduate Professors					↑															
	Specialist Professors			↓	↑								↑								
	M.D. Professors				↑		↓						↓	↑							
	Ph.D. Professors	↓						↑					↓	↑							
	Absent Professors													↑	↓						
	Female Professors												↑		↓	≈					
	Administrative staff	↓											↓	↑							
	Students (total number)				↑		↓														↓
	Entrants																	↓			↑
	Enrolled										↓		↑						↑		
	Graduate																		↓		↑
	Female Students												↑			↓		↓			↑

Thus, each SOM dimension was divided into its appropriate number of clusters, grouping the institutions which similar characteristics, in this case, similar resources. The HEIs dimension has 7 clusters, the Undergraduate courses dimension has 4 clusters, the professor's dimension has five clusters, and the students' dimension also has five clusters.

This approach can be interpreted in two different manners: vertically or horizontally.

Vertically, the resources can be combined between or among institutions at the same SOM dimension and from the same or different clusters, to aggregate their resources to scale up and increase their competitive position.

Moreover, horizontally to combine resources between or among institutions at different SOM dimensions and from the same or different clusters to achieve synergies, accumulating different resources, which would be difficult to obtain in isolation.

For example, the group of institutions, from the HEIs dimension, which belongs to cluster 2 has the lowest rates of investment. There is a group of HEIs from cluster 6 which has the lowest number of courses. The former – the institutions which belong to cluster 2 - can cooperate to innovate and improve their investments together by sharing their physical infrastructure, constructing joint-laboratories and even associating themselves to become competitive. The latter – the group of HEIs which belong to cluster 6 - can improve their offering condition by diversifying their courses through the adoption of different modalities, double diploma, different knowledge areas combination, teacher experience and so on.

It can also be done through the resource's combination from HEIs of different clusters but still in the same SOM Dimension. A group of institutions, from the Undergraduate Courses Dimension, has a limited number of courses (as in cluster 4), but a higher number of enrolled students. On the contrary, there is another group of institutions, from the same dimension, with a high number of courses (as in cluster 2), but the lowest number of enrolled students. They may have an interest in associating themselves to share knowledge, experience, and to improve their offering innovatively, as they have precisely the opposite conditions which complement each other.

Table 67 can also be interpreted horizontally to combine resources among different clusters from different SOM dimensions. In this case, the possibilities are vast and can join the institutions which scarce or abundant resources depending on their purposes.

Then, through this new approach, the HEIs can understand their internal dynamics through the identification of their resources. Moreover, they can combine only scarce (↓) resources, only abundant (↑) resources, which are similar, to scale them up and gain competitiveness. Alternatively, they can combine a mixture of both, scarce (↓) with abundant (↑), which are complementary, to obtain synergy. In both cases, they will behave in a more collaborative and innovative way, to gain sustainability in this fiercely competitive environment; and will become more entrepreneurial to accomplish their mission.

This approach raises the possibility of combining resources according to the HEIs' own interests, developing a more cooperative and entrepreneurial behavior, for all other SOM dimensions, which we nominated as strategic relationships based on internal resources.

As another example, HEIs with a low number of courses in undergraduate courses dimension, Clusters 1 and 4, could join themselves to propose new courses, as they have similar resources. On the contrary, also they could join themselves with other HEIs which have a higher number of courses with complementary resources, as in Clusters 2 and 3, to improve their area of abrangence.

The same interpretation could be depicted for all other SOM dimensions, their clusters, and resources, generating different possibilities of internal resources' combination.

Considering that the concept of strategy, linked to the notion of a sustainable competitive advantage, is based precisely on "difference" (Jacobsen, 2013; Whittington, 1993), the

distance among clusters visualized through the use of SOM (as a technique), which was applied as an innovative way in the area of Education, detach and reinforce the HEIs with dissimilar features, evidencing the HEIs differences and contrasting them (Jay B. Barney, 2008; V. A. Castro, Júnior, & Pinto, 2012; Wernerfelt, 1984; Whittington, 1993).

This perspective draws attention to the possibility of approaching the strategy from a complementary inside-out perspective and encourages collaborative arrangements among different institutions from different clusters (Horta & Blasi, 2016; Leisyte & Horta, 2011), identifying not only their similar, but their additional or dissimilar resources to achieve synergies (Kraaijenbrink, Spender, & Groen, 2009), at local, regional and national levels, as their competitiveness is evaluated, not only based on its individual resources or even grouped similarly in each cluster, but through their shareable and non-shareable resources (Lavie, 2006).

It is already known that "the strategic value of resources increases even more if they are integrated or combined" (Hitt et al., 2002; Josefy et al., 2015) with resources from other HEIs or stakeholders.

The similarities and dissimilarities of resources among different clusters and the identification of their similar or complementary resources, therefore, among Brazilian Higher Education institutions play a significant role in the joint implementation of effective competitive responses or decisions to take. The availability or need for resources - financial, technical, essential skills or competencies - compel HEIs to seek them outwardly to collaborate in their local, national or, even, global markets by adopting a strategy based on cooperation.

Besides that, the mapping of the scarce (↓) or abundant (↑) resources, their understanding of internal dynamics, and this new approach of sharing resources can help them in their future planning, be it financial, human and concerned to their pedagogical or procedural resources.

It is worth pointing out that there are different forms of associations. These forms depend on the legal, regulatory requirements of the country's education and its legislation in force, which shall be considered.

Resources identification have been pointed out as a first step in the understanding the HEIs internal dynamics and a contributor to the development of the HEIs entrepreneurship as they can enhance capabilities or core competencies to transfer knowledge and technology (Agarwal & Shah, 2014; Finia, Grimaldi, Santoni, & Sobrero, 2011) into a more collaborative perspective. They also can contribute to fulfilling their third mission, thus facing the current environmental challenges, and to cover a gap concerning the internal resources analyses of the HEIs, according to the extant literature and RBV theory.

It also encourages institutions to become more entrepreneurial through the association among themselves or the combination of their resources, suggesting that their triple-helix

representation (*Figure 62*) could be supplemented and deployed (*Figure 63*), englobing the hub of HEIs, the government, the enterprises under national and international perspectives and that the strategic relationship among them can improve their sustainable conditions in a more fierce, competitive and global environment.

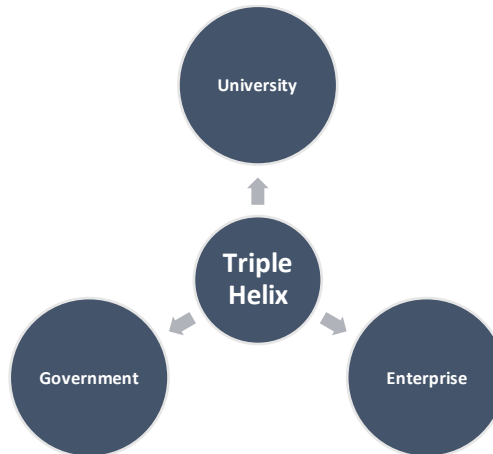


Fig. 62 Triple Helix

On a national level, the HEIs can cooperate among themselves, and associate with other enterprises and governments, generating an enhanced triple helix (*Figure 63*).

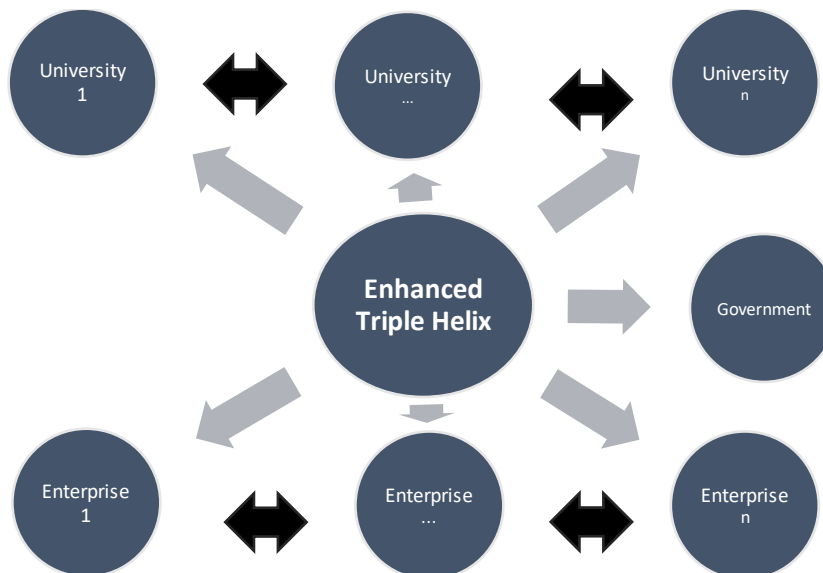


Fig. 63 Enhanced Triple Helix

Considering the globalization and the internationalization processes, an enhanced triple helix (*Figure 63*) can expand their entrepreneurial activities to englobe other enhanced triple helix, constituting national and international enhanced triple helix, where hubs of HEIs and enterprises and governments can associate themselves in a more entrepreneurial way.

8. CONCLUSIONS

Considering that the research question of this thesis was to *Explore the Brazilian Higher Education Census, from 2010 to 2015, and other correlated official and public databases to generate new knowledge* and to investigate the following hypothesis:

H1 – The use of special techniques that promote the visualization and understanding of hidden and unknown patterns through Higher Education public and official data can produce new knowledge.

H2 – The analysis of Higher Education public and official data and the classification of Brazilian Higher Education Institutions generate strategic information.

Summarizing the key points:

In Brazil, where the Higher Education is mainly provided by the private sector, the HEIs compete for students and financial resources, through the undergraduate courses' quality and the services offered. The offer conditions are diverse, and demand is increasingly limited for the population considered ideal for undergraduate courses.

From 2008 to 2015, the number of Higher Education Institutions varied slightly. On the other hand, the number of courses increased, but not reflected in the number of enrolled students when compared to the demographic, young population data. If, in the 60s, there were many students concurring to a place in the HEIs (Reale, 2014b), nowadays, the situation inverted. There is a high number of vacant or unfilled places for each potential student. In addition, the number of candidates improved but as already said, was not converted into enrolled students as the same candidate can enroll for more than one selective process in different HEIs.

The number of undergraduate students is lowermost if compared to the enrolled ones, calling attention to the fact that, despite all the efforts of the expansion and internalization of the HEIs, it has little effect in practice, since the undergraduate does not occur effectively.

Besides that, the information generated from the analysis of microdata of the Higher Education Census, associated with the Demographic Census data (2010), points to a drastic reduction in the population of young people aged 18-24 years, which is going to be scarce in a short period. Today Brazil has the largest number of young people in its history (Braghini, 2014). However, as studies indicate (Guimbert et al., 2008), from 2022 onwards this figure will be reduced drastically.

Both conditions – reduced number of enrolled and undergraduate students added to the reduction of the youth population considered ideal for undergraduate courses – will impact the higher education institutions' sustainability conditions. Nowadays, HEIs already have more places offered than the number of enrolled students.

On the one hand, this scenery calls attention to the practical implications of this study like the necessity to retain the enrolled students, avoiding evasion and promoting permanence in the HEIs to improve the number of enrolled and undergraduate students. Besides that, the countries' education level has a great impact on its development. Therefore, it would be of great interest and relevance to improve and enlarge the number of undergraduate people. As a result, the HEIs will need to enhance the discussion of forms, models and mechanisms of governance to grant their future maintenance and sustainability.

At the same time, they will need to identify new target groups as potential entrants, as they are faced with the falling birth rate and the increasing of an aging population. Concerning this subject, some potential target entrants, despite the one considered ideal for undergraduate courses, is the so-called "late entry" population (Guimbert et al., 2008); the stranded midway younger students (Hirsch, 1969), and the "academic second-training professional" already undergraduate which would like to embrace a new profession. The HEIs will need to estimate these groups correctly and to evaluate its impact on their offer conditions and proper ways of implementation.

Complementary, price concurrence varies in a high range in the country, depending on knowledge area, country regions, HEIs price, and discount policies and government subsidies. Important to remember that Public Education for undergraduate courses is free of charge. Even though the number of unfilled places continues for the vast majority of undergraduate courses.

On the other hand, focusing on the **knowledge discovery** among data from the Brazilian Higher Education Census, **we conclude that:**

HEIs have some similarities and dissimilarities of resources. Based on them, they were grouped into different clusters, independently of their preliminary classification. This new RBV approach promotes a different kind of strategy, based in a collaborative relationship. Considering that, the HEIs were gathered according to their resources, in order to minimize their weaknesses, and enhance their strengths; or to combine them in different ways. The discovered patterns that generated new knowledge are:

(a) Considering the HEIs dataset (*Table 54*):

- The HEIs with the highest research expenses.
- The HEIs with the highest and the lowest expenses with teachers and technical-administrative staff remuneration.
- The HEIs with the highest and the lowest incomes and investments.
- The HEIs with no investment at all, and
- The ones with all the above attributes.

(b) Considering the Undergraduate Courses dataset (*Table 55*):

- The HEIs with the highest number of courses.
- The HEIS with the lowest number of courses.
- The HEIs with the lowest number of enrolled students; and

- The HEIs with the highest number of students depending on public financing.
- (c) Considering the Professors dataset (*Table 56*):
- The HEIs with the highest proportion of Ph.D. or master's degree or Specialist professors.
 - The HEIs with the fewest proportion of Ph.D. professors, and
 - The HEIs with their respective teacher's proportion of genre.
- (d) Considering the Students dataset (*Table 57*):
- The HEIS with the greatest number of entrants, enrolled and graduates.
 - The HEIS with the lowest number of entrants, enrolled and graduates.
 - The HEIs whose students most depend on public funding, and
 - The HEIS with their sex prevalence.
- (e) Considering all datasets under the Global SOM technique:
- **Cluster 1** dedicated to the Education area (OECD 1) and with the highest number of licentiate (teacher training) courses.
 - **Cluster 2** dedicated to the courses in the Humanities and Arts area (OECD 2).
 - **Cluster 3** which concentrates its offer in the Science, Math's and Computing and Engineering, Production and Construction areas.
 - **Cluster 4** with the highest number of public institutions and most of the universities. It has the highest number of courses in the Health and Wellness area (OECD 7) and Agriculture and Veterinary (OECD 6). It is the biggest one.
 - **Cluster 5** with the highest number of private institutions, both for-profit and non-profit and most of the faculties. It concentrates its offer in the Social Sciences, Business, and Law areas (OECD 3).
 - **Cluster 6** comprises the HEIs with the highest values of incomes, other revenues, the highest investment expenses, the highest values with professor and staff remuneration and the greatest number of students; also, they are the ones with no resources from transference. It groups the HEIs which are eminently private institutions (99%).

These discovered patterns, which consider all the variables of the dimension beforehand analyzed, increment the ones achieved only for the independent annual SOM components and allows a more detailed view of all HEIs, their undergraduate courses, professors and students in the country.

The exploratory studies added to the discovered patterns allowed us to advance in the RBV Theory, as based on the results of the SOM analysis, it was possible to make up the Brazilian Higher Education scenario and to depict the discovered patterns among each group of HEIs, courses, professors, and students, grouping them into different clusters, according to their main features or similar resources, called discovered patterns, which can distinguish them from other groups or clusters, identifying their combination of distinct or complementary resources that others do not have or share, based mainly on the financial

(investments, expenses, funding, incomes or revenues), the processes (size, number of courses, courses in different knowledge areas, degree and modality) and the personal (professors, students and administrative staff) resources.

Thus, for each SOM dimension (HEIs, Courses, Professors, and Students) it was identified the number of clusters, whose resources are grouped according to the RBV Theory, distinguishing the most relevant variables and the most relevant discovered patterns. If combined, these similar resources can scale up the HEIs position and increase their competitive and sustainable advantage. On the other hand, the identification of their distinct or complementary resources, that others do not have, can create synergies among them, through the accumulation of different resources which would be difficult to obtain in isolation.

The knowledge generated plays a significant role in the implementation of competitive responses or decisions to take, affecting in the HEIs' sustainability and also contributes to advance the Resource-Based View (RBV) theory, which was used to identify the HEIs resources, proposing a new way of combining them.

Signaling the previous hypotheses:

H₁ – The use of special techniques that promote the visualization and understanding of hidden and unknown patterns through Higher Education public and official data can produce new knowledge.

Yes, the Higher Education official and public data, if analyzed under special techniques, can generate new knowledge as it revealed the patterns discovered through SOM.

H₂ – The analysis of Higher Education public and official data and the classification of Brazilian Higher Education Institutions generate strategic information.

No, the Higher Education official (and public) data and the actual classification of Brazilian Higher Education Institutions, in its raw form, do not produce new knowledge nor generate strategic information. Even when the data is available, it is mostly unexplored.

The consecrated taxonomy which groups the Brazilian Higher Education Institutions based on an administrative (public or private) and academic classification (universities, academic centers, faculties, federal technological institutes, and centers) does not create knowledge nor promotes strategic information.

However, on the contrary, as a result of this research, the use of the SOM technique allowed us to group the data into different clusters, according to other common characteristics, thus generating new knowledge.

9. CONTRIBUTIONS

Whereas the aim of this research was to answer the following research question “*How can the annual and temporal analysis of the Brazilian Higher Education Census and other public official databases generate new knowledge and deliver strategic information to ensure the accomplishment of Higher Education Institutions core mission?*” and, as a consequence, to explore, discover hidden patterns in the data and generate new knowledge, it also identified the HEIs internal resources, evaluating strategically their implications according to the RBV Theory, and proposed a more collaborative way of relationship. Considering that, this study has four main contributions:

The first is the adoption of an innovative methodological approach – use of SOM, in terms of application, which was well succeeded; and the use of public and official datasets focused on the Higher Education institutions, based on cluster analysis in an area of limited quantitative studies. The use of SOM to analyze and understand hidden patterns in a huge amount of data also can be depicted, as it can contribute to public policy development and evaluation.

The second is its implication for the understanding of the internal dynamics of the RBV theory, which is a relevant gap, as the findings can improve the theory itself and evolve it to a more strategic cross-country analysis. In addition, another typology for clustering HEIs, students, teachers, and undergraduate courses, based on their tangible and intangible resources, was suggested.

The third is the research itself, which contributes to the Education Area, where there is a lack of comparative and quantitative studies. Therefore, we propose a quantitative method to analyze large amounts of Higher Education data, in a national comparative perspective, which is also a gap in the Area.

The fourth, the possibility to extend the triple helix concept to an enhanced version, englobing the relations among HEIs (universities), governments and enterprises, organized like hubs, based on their similar or complementary resource combinations, in a national and international level.

As a result, it is inferred that the newly generated knowledge from the SOM analysis which pointed out the attributes and resources of the HEIs are essential elements to manage and support their decisions and to face some of the most recurrent strategic problems like 1) entering or leaving a given market based on supply and demand conditions (local, regional, global); 2) acquiring similar or complementary capacities and resources, based on professors and administrative staff; 3) investing in new technologies and research; 4) reducing costs; 5) sharing information; 6) dividing responsibilities and making joint decisions; 7) improving inter-organizational coordination and control mechanisms; 8) improving performance; 8) facing technological development; 9) innovating; and 10) expanding interactions and co-creating value (Pucciarelli & Kaplan, 2016) with other HEIs or stakeholders.

Thus, it concludes that HEIs have some similarities and dissimilarities of resources which can group them among different clusters, promoting a future relationship strategy where the HEIs can minimize their weaknesses and enhance their strengths. This new knowledge contributes to the problems faced by the HEIs differently. Thus, it plays a significant role in the implementation of competitive responses or decisions to take, influencing in their sustainability, when exposed to a fiercer competition, in a more collaborative way, and improving their entrepreneurial competencies.

From a broader point of view, these findings contribute to future planning, concerning the development of new courses, the identification of the professors, administrative staff and students' profile and the prospection of teaching modalities; it gives subsidies to a better assessment of the Brazilian Higher Education as, through the mapping and of their internal resources and the understanding of their internal dynamics, the HEIs can identify their abundant (↑) or scarce (↓) resources and plan to share or combine them in a more innovative way to gain a more sustainable and competitive position, based on a cooperative strategy, improving their entrepreneurial characteristics. It is already known that knowledge networks among HEIs and other stakeholders are associated with the rate of innovation and economic development of the region in which network actors are spatially located (Huggins & Prokop, 2016).

Besides that, we believe that these findings contribute to a perspective shift, promoting a future cooperative and collaborative strategic relationship among HEIs, not only on a local or regional basis but in a global way, improving their entrepreneurship and also fostering the so-called internationalization, which deals with academic cooperation, individuals' mobility and knowledge transfer (Heitor, 2015; Horta & Yonezawa, 2013; Leisyte & Horta, 2011), which should be in line with an appropriate development of a proper, efficient and effective Public Policy for the Higher Education sector. Consequently, we believe it can be expanded to different sectors analogously.

Despite the fact that this innovative methodological approach – use of SOM – and the datasets focused on the Higher Education environment, the proposed approach, based on cluster analysis and its implication for the understanding of the internal dynamics of the RBV Theory, can support cross-country studies, as according to Teichler (Teichler, 1996) there is a lack of comparative studies among countries in the Education Area. Besides, it can be expanded to different sectors analogously.

10. FUTURE RESEARCH

Two main questions arise from this research: 1) Can the SOM technique be applied similarly to other countries' datasets? Also, 2) Would the proposed approach concerning RBV Theory and its internal resources' identification succeed in a different sector?

Based on the above-mentioned questions, we intend to use SOM to other Higher Education datasets, in other countries, due to its specific and efficient power of classification, creating new knowledge that can promote a deeper understanding of HEIs resources, and be used as a reference for comparative studies (which is also a gap).

In addition, we propose to apply this approach to different sectors, which also disposes of the public and official datasets, to evaluate their results comparatively.

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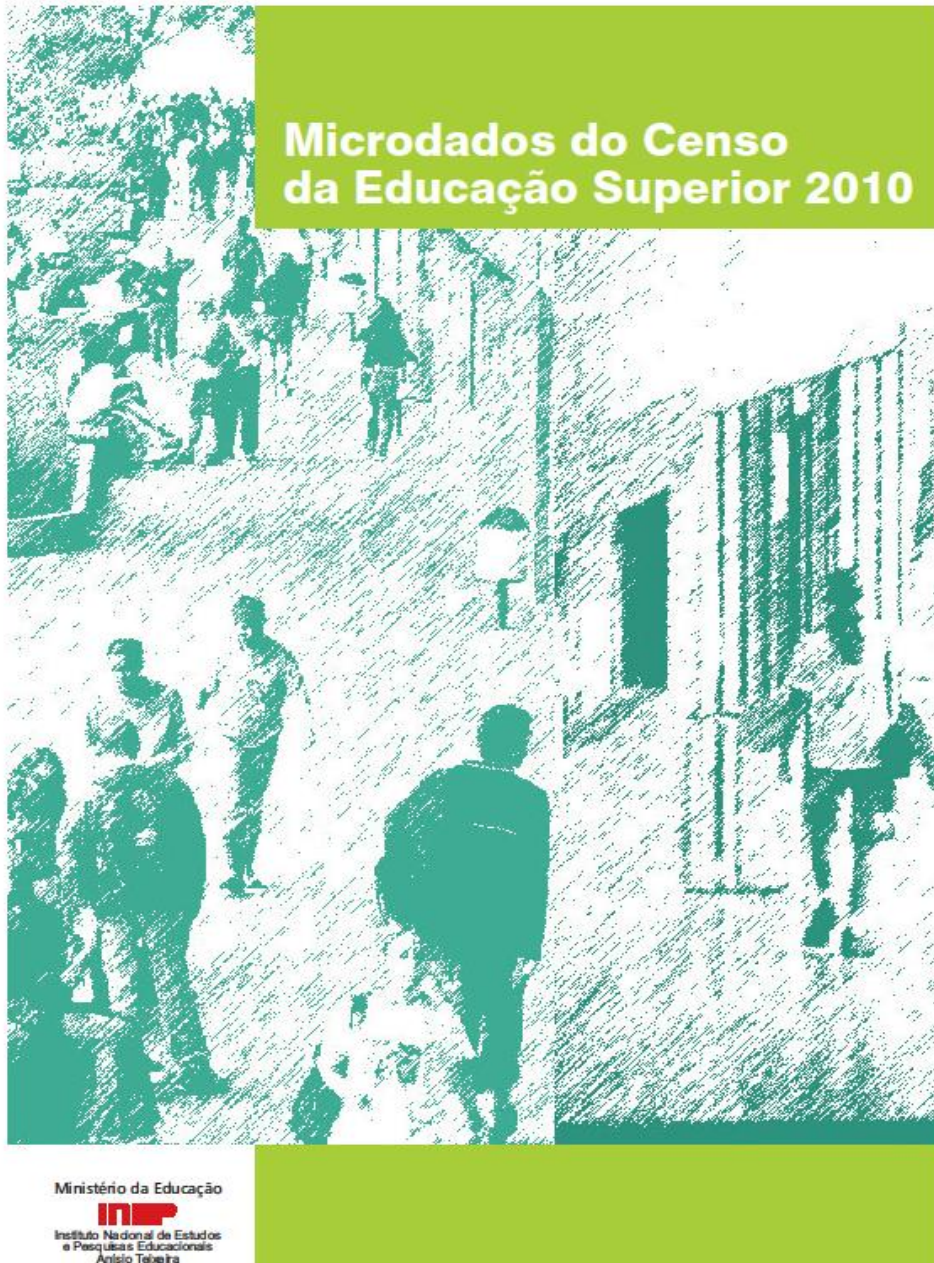
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ANNEX A – Higher Education Census Microdata, 2010



Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

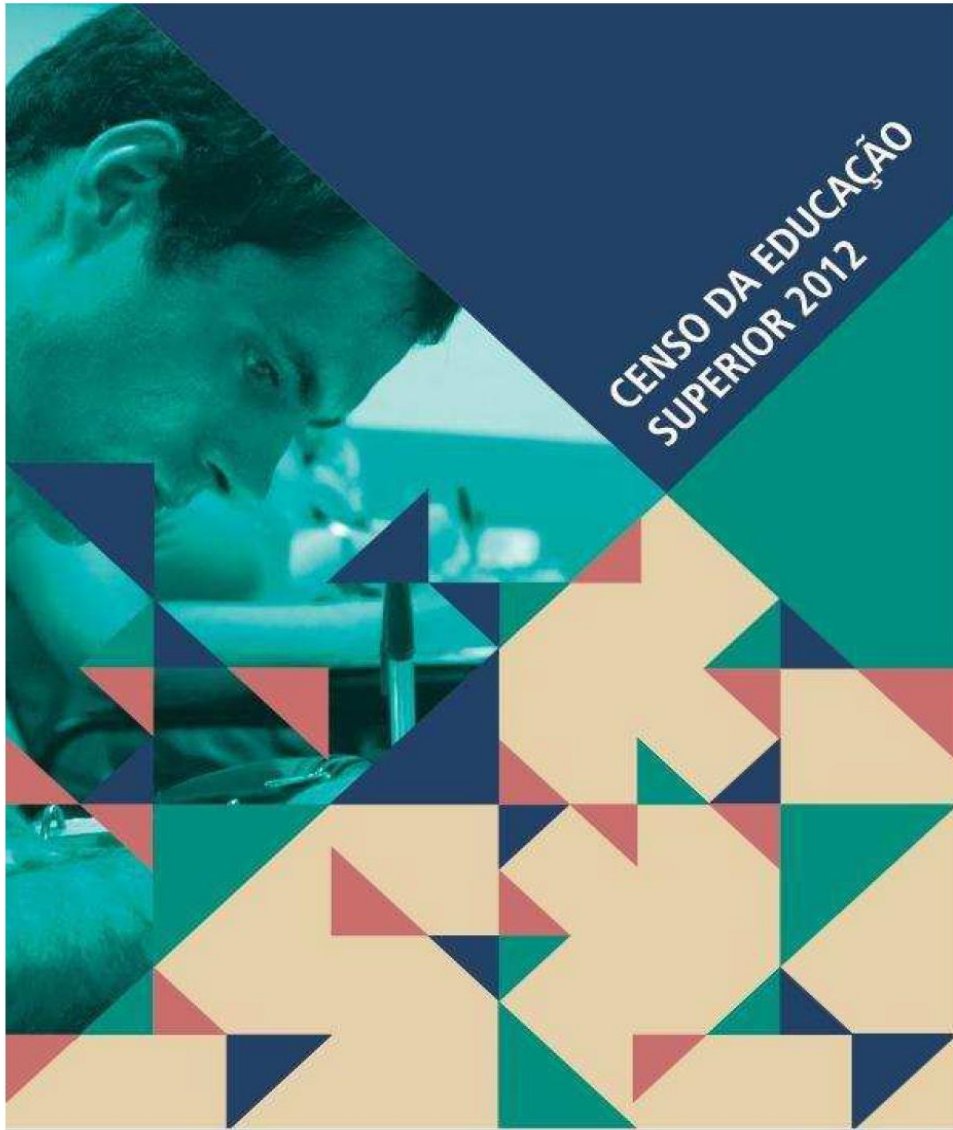
ANNEX B – Higher Education Census Microdata, 2011



Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

ANNEX C – Higher Education Census Microdata, 2012



Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

ANNEX D – Higher Education Census Microdata, 2013

Ministério da Educação
Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira

Microdados do Censo da Educação Superior 2013

Manual do Usuário

Versão 1

Dezembro de 2014

Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

ANNEX E – Higher Education Census Microdata, 2014

Ministério da Educação
Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira – INEP
Diretoria de Estatísticas Educacionais

**Microdados do Censo da
Educação Superior 2014**
Manual do Usuário

Janeiro de 2016

Página 1 de 38

Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

ANNEX F – Higher Education Census Microdata, 2015

Ministério da Educação
Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira – INEP
Diretoria de Estatísticas Educacionais

Microdados do Censo da
Educação Superior 2015
Manual do Usuário

Novembro de 2016

Página 1 de 43

Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

ANNEX G – Higher Education Census Microdata, 2016

Ministério da Educação
Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira – INEP
Diretoria de Estatísticas Educacionais

Microdados do Censo da
Educação Superior 2016
Manual do Usuário

Setembro de 2017

Página 1 de 18

Available at <<http://portal.inep.gov.br/web/guest/microdados>>

Access on: October 2018.

ANNEX H – Extract from the Higher Education Institutions Variables, Higher Education Census, 2014

IES (DM IES)					
N	Nome da Variável	Descrição da Variável	Tipo	Tam. ¹⁰⁰	Categorias
DADOS DA IES					
1	CO_IES	Código único de identificação da IES	Num	8	
2	NO_IES	Nome da IES	Char	200	
3	SGL_IES	Sigla da IES	Char	20	
4	CO_MANTENEDORA	Código único de identificação da mantenedora	Num	8	
5	CO_CATEGORIA_ADMINISTRATIVA	Código da Categoria Administrativa	Num	8	1. Pública Federal 2. Pública Estadual 3. Pública Municipal 4. Privada com fins lucrativos 5. Privada sem fins lucrativos 7. Especial
6	DS_CATEGORIA_ADMINISTRATIVA	Nome da Categoria Administrativa	Char	100	
7	CO_ORGANIZACAO_ACADEMICA	Código da Organização Acadêmica	Num	8	1. Universidade 2. Centro Universitário 3. Faculdade 4. Instituto Federal de Educação, Ciência e Tecnologia 5. Centro Federal de Educação Tecnológica
8	DS_ORGANIZACAO_ACADEMICA	Nome da Organização Acadêmica	Char	100	
9	CO_MUNICIPIO_IES	Código do município da IES (reitoria/sede administrativa)	Num	8	
10	NO_MUNICIPIO_IES	Nome do município da IES (reitoria/sede administrativa)	Char	150	
11	CO_UF_IES	Código da UF da IES (reitoria/sede administrativa)	Num	8	
12	SGL_UF_IES	Sigla da UF da IES (reitoria/sede administrativa)	Char	2	
13	NO_REGIAO_IES	Nome da Região Geográfica da IES (reitoria/sede administrativa)	Char	30	
14	IN_CAPITAL_IES	Informa se a IES (reitoria/sede administrativa) está localizada na capital	Num	8	0. Não 1. Sim
15	QT_TEC_TOTAL	Número de funcionários técnico-administrativos	Num	8	
16	QT_TEC_FUND_INCOMP_FEM	Número de funcionários técnico-administrativos do sexo feminino com Ensino Fundamental incompleto	Num	8	
17	QT_TEC_FUND_INCOMP_MASC	Número de funcionários técnico-administrativos do sexo masculino com Ensino Fundamental incompleto	Num	8	
18	QT_TEC_FUND_COMP_FEM	Número de funcionários técnico-administrativos do sexo feminino com Ensino Fundamental completo	Num	8	
19	QT_TEC_FUND_COMP_MASC	Número de funcionários técnico-administrativos do sexo masculino com Ensino Fundamental completo	Num	8	
20	QT_TEC_MEDIO_FEM	Número de funcionários técnico-administrativos do sexo feminino com Ensino Médio	Num	8	
21	QT_TEC_MEDIO_MASC	Número de funcionários técnico-administrativos do sexo masculino com Ensino Médio	Num	8	
22	QT_TEC_SUPERIOR_FEM	Número de funcionários técnico-administrativos do sexo feminino com nível superior	Num	8	
23	QT_TEC_SUPERIOR_MASC	Número de funcionários técnico-administrativos do sexo masculino com nível superior	Num	8	
24	QT_TEC_ESPECIALIZACAO_FEM	Número de funcionários técnico-administrativos do sexo feminino com especialização	Num	8	
25	QT_TEC_ESPECIALIZACAO_MASC	Número de funcionários técnico-administrativos do sexo masculino com especialização	Num	8	
26	QT_TEC_MESTRADO_FEM	Número de funcionários técnico-administrativos do sexo feminino com mestrado	Num	8	
27	QT_TEC_MESTRADO_MASC	Número de funcionários técnico-administrativos do sexo masculino com mestrado	Num	8	
28	QT_TEC_DOUTORADO_FEM	Número de funcionários técnico-administrativos do sexo feminino com doutorado	Num	8	
29	QT_TEC_DOUTORADO_MASC	Número de funcionários técnico-administrativos do sexo masculino com doutorado	Num	8	
30	IN_ACESSO_PORTAL_CAPES	Informa se a IES tem acesso ao portal Capes de periódicos	Num	8	0. Não 1. Sim
31	IN_ACESSO_OUTRAS_BASES	Informa se a IES tem acesso a outras bases de dados licenciadas ou compradas	Num	8	0. Não 1. Sim
32	IN_REFERENTE	Informa se os dados financeiros são referentes à mantenedora ou a IES	Num	8	1. Mantenedora 2. Instituição
33	VL_RECEITA_PROPRIA	Informa o valor das receitas próprias auferidas pela mantenedora ou pela IES no ano de referência	Num	8	
34	VL_TRANSFERENCIA	Informa o valor de transferências auferidas pela mantenedora ou pela IES no ano de referência	Num	8	
35	VL_OUTRA_RECEITA	Informa o valor de outras receitas auferidas pela mantenedora ou pela IES no ano de referência	Num	8	

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ANNEX I – Extract from the Undergraduate Courses Variables, Higher Education Census, 2014

CURSO (DM_CURSO)						
N	Nome da Variável	Descrição da Variável	Tipo	Tam. ⁽¹⁾	Categorias	Obs.
DADOS DA IES						
1	CO_IES	Código único de identificação da IES	Num	8		
2	NO_IES	Nome da IES	Char	200		
3	CO_CATEGORIA_ADMINISTRATIVA	Código da Categoria Administrativa	Num	8	1. Pública Federal 2. Pública Estadual 3. Pública Municipal 4. Privada com fins lucrativos 5. Privada sem fins lucrativos 7. Especial	
4	DS_CATEGORIA_ADMINISTRATIVA	Nome da Categoria Administrativa	Char	100		
5	CO_ORGANIZACAO_ACADEMICA	Código da Organização Acadêmica	Num	8	1. Universidade 2. Centro Universitário 3. Faculdade 4. Instituto Federal de Educação, Ciência e Tecnologia 5. Centro Federal de Educação Tecnológica	
6	DS_ORGANIZACAO_ACADEMICA	Nome da Organização Acadêmica	Char	100		
DADOS DO CURSO						
7	CO_MUNICIPIO_CURSO	Código do município do local de oferta do curso gerado pelo E-MEC	Num	8		
8	NO_MUNICIPIO_CURSO	Nome do município do local de oferta do curso gerado pelo E-MEC	Char	150		
9	CO_UF_CURSO	Código da UF do local de oferta do curso gerado pelo E-MEC	Num	8		
10	SGL_UF_CURSO	Sigla da UF do local de oferta do curso gerado pelo E-MEC	Char	2		
11	NO_REGIAO_CURSO	Nome da Região Geográfica do local de oferta do curso gerado pelo E-MEC	Char	12		
12	IN_CAPITAL_CURSO	Informa se o local de oferta do curso presencial está localizado na capital	Num	8	0. Não 1. Sim (.) Não aplicável (cursos com modalidade de Ensino a Distância)	Mudança de código das categorias
13	CO_CURSO	Código único de identificação do curso	Num	8		
14	NO_CURSO	Nome do curso	Char	200		
15	CO_SITUACAO_CURSO	Código da situação de funcionamento do curso	Num	8	1. Em atividade 2. Extinto 3. Em extinção	Mudança de código das categorias
16	DS_SITUACAO_CURSO	Descreve a situação de funcionamento do curso	Char	100		
17	CO_OCDE	Código de identificação do curso a partir de uma adaptação da metodologia internacional de classificação Eurostat/Unesco/OCDE	Char	12		
18	NO_OCDE	Nome do curso a partir da tabela OCDE (Programas e/ou Cursos)	Char	120		
19	CO_OCDE_AREA_GERAL	1º caractere da variável CO_OCDE (corresponde à área geral)	Num	8		
20	NO_OCDE_AREA_GERAL	Nome da área geral conforme adaptação da classificação internacional Eurostat/Unesco/OCDE	Char	36		
21	CO_OCDE_AREA_ESPECIFICA	1º e 2º caracteres da variável CO_OCDE (corresponde à área específica)	Num	8		
22	NO_OCDE_AREA_ESPECIFICA	Nome da área específica conforme adaptação da classificação internacional Eurostat/Unesco/OCDE	Char	44		
23	CO_OCDE_AREA_DETALHADA	1º, 2º e 3º caracteres da variável CO_OCDE (corresponde à área detalhada)	Num	8		
24	NO_OCDE_AREA_DETALHADA	Nome da área detalhada conforme adaptação da classificação internacional Eurostat/Unesco/OCDE	Char	64		
25	CO_GRAU_ACADEMICO	Código do grau acadêmico conferido ao aluno pela conclusão dos requisitos exigidos pelo curso	Num	8	1. Bacharelado 2. Licenciatura 3. Tecnológico (.) Não aplicável (cursos com nível acadêmico igual a Sequencial de formação específica ou cursos com Área básica de curso identificada pela variável	

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ANNEX J – Extract from the Professors Variables, Higher Education Census, 2014

DOCENTE (DM_DOCENTE)						
N	Nome da Variável	Descrição da Variável	Tipo	Tam. ⁽¹⁾	Categorias	Obs.
DADOS DA IES						
1	CO_IES	Código único de identificação da IES	Num	8		
2	NO_IES	Nome da IES	Char	200		
3	CO_CATEGORIA_ADMINISTRATIVA	Código da Categoria Administrativa	Num	8	1. Pública Federal 2. Pública Estadual 3. Pública Municipal 4. Privada com fins lucrativos 5. Privada sem fins lucrativos 7. Especial	
4	DS_CATEGORIA_ADMINISTRATIVA	Nome da Categoria Administrativa	Char	100		
5	CO_ORGANIZACAO_ACADEMICA	Código da Organização Acadêmica	Num	8	1. Universidade 2. Centro Universitário 3. Faculdade 4. Instituto Federal de Educação, Ciência e Tecnologia 5. Centro Federal de Educação Tecnológica	
6	DS_ORGANIZACAO_ACADEMICA	Nome da Organização Acadêmica	Char	100		
7	IN_CAPITAL_IES	Informa se a IES (reitoria/sede administrativa) está localizada na capital	Num	8	0. Não 1. Sim	
DADOS DO DOCENTE						
8	CO_DOCENTE_IES	Código gerado pelo Inep para o vínculo do docente à IES	Num	8		
9	CO_DOCENTE	Código de identificação gerado pelo Inep para o docente no Censo da Educação Superior	Num	8		
10	CO_SITUACAO_DOCENTE	Informa a situação do docente na IES	Num	8	1. Em exercício 2. Afastado para qualificação 3. Afastado para exercício em outros órgãos/entidades 4. Afastado por outros motivos 5. Afastado para tratamento de saúde	
11	DS_SITUACAO_DOCENTE	Nome da situação do docente na IES	Char	50		
12	CO_ESCOLARIDADE_DOCENTE	Informa o grau de escolaridade do docente	Num	1	1. Sem graduação 2. Graduação 3. Especialização 4. Mestrado 5. Doutorado	
13	DS_ESCOLARIDADE_DOCENTE	Informa o nome do grau de escolaridade do docente	Char	14		
14	CO_REGIME_TRABALHO	Informa o regime de trabalho do docente	Num	8	1. Tempo Integral com dedicação exclusiva 2. Tempo Integral sem dedicação exclusiva 3. Tempo Parcial 4. Horista	
15	DS_REGIME_TRABALHO	Nome do regime de trabalho do docente	Char	38		
16	IN_SEXO_DOCENTE	Sexo do docente	Num	8	0. Masculino 1. Feminino	
17	DS_SEXO_DOCENTE	Nome do sexo do docente	Char	9		
18	NU_ANO_DOCENTE_NASC	Ano de nascimento do docente	Num	8		
19	NU_MES_DOCENTE_NASC	Mês de nascimento do docente	Num	8		
20	NU_DIA_DOCENTE_NASC	Dia de nascimento do docente	Num	8		
21	NU_IDADE_DOCENTE	Idade que o docente completa no ano de referência do Censo	Num	8		
22	CO_COR_RACA_DOCENTE	Cor/raça do docente	Num	8	1. Branca 2. Preta 3. Parda 4. Amarela 5. Indígena 6. Não dispõe da informação 0. Docente não quis declarar cor/raça	Mudança de nome nas categorias
23	DS_COR_RACA_DOCENTE	Nome da cor/raça do docente	Char	34		
24	CO_PAIS_DOCENTE	Código do país de nascimento ou de naturalização do docente	Num	8	Seleção do país a partir de uma lista	
25	CO_NACIONALIDADE_DOCENTE	Código da nacionalidade do docente	Num	8	1. Brasileira 2. Brasileira - nascido no exterior ou naturalizado 3. Estrangeira	
26	DS_NACIONALIDADE_DOCENTE	Nome da nacionalidade do docente	Char	48		

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ANNEX K – Extract from the Students Variables, Higher Education Census, 2014

ALUNO (DM_ALUNO)						
N	Nome da Variável	Descrição da Variável	Tipo	Tam. ⁽¹⁾	Categorias	Obs.
DADOS DA IES						
1	CO_IES	Código único de identificação da IES	Num	8		
2	NO_IES	Nome da IES	Char	200		
3	CO_CATEGORIA_ADMINISTRATIVA	Código da Categoria Administrativa	Num	8	1. Pública Federal 2. Pública Estadual 3. Pública Municipal 4. Privada com fins lucrativos 5. Privada sem fins lucrativos 7. Especial	
4	DS_CATEGORIA_ADMINISTRATIVA	Nome da Categoria Administrativa	Char	100		
5	CO_ORGANIZACAO_ACADEMICA	Código da Organização Acadêmica	Num	8	1. Universidade 2. Centro Universitário 3. Faculdade 4. Instituto Federal de Educação, Ciência e Tecnologia 5. Centro Federal de Educação Tecnológica	
6	DS_ORGANIZACAO_ACADEMICA	Nome da Organização Acadêmica	Char	100		
DADOS DO CURSO						
7	CO_CURSO	Código único de identificação do curso gerado pelo E-MEC	Num	8		
8	NO_CURSO	Nome do curso	Char	200		
9	CO_CURSO_POLO	Código de identificação do polo vinculado ao curso	Num	8		
10	CO_TURNO_ALUNO	Código do turno do curso ao qual o aluno está vinculado	Num	8	1. Matutino 2. Vespertino 3. Noturno 4. Integral (.) Não aplicável (cursos com modalidade de Ensino a Distância)	
11	DS_TURNO_ALUNO	Nome do turno do curso ao qual o aluno está vinculado	Char	13		
12	CO_GRAU_ACADEMICO	Código do grau acadêmico conferido ao diplomado pelo curso	Num	8	1. Bacharelado 2. Licenciatura 3. Tecnológico (.) Não aplicável (cursos com nível acadêmico igual a Sequencial de formação específica ou cursos com Área básica de curso identificada pela variável TP_ATRIBUTO_INGRESSO)	
13	DS_GRAU_ACADEMICO	Nome do grau acadêmico conferido ao diplomado pelo curso	Char	13		
14	CO_MODALIDADE_ENSINO	Código da modalidade de ensino do curso	Num	8	1. Presencial 2. Curso a distância	
15	DS_MODALIDADE_ENSINO	Nome da modalidade de ensino do curso	Char	17		
16	CO_NIVEL_ACADEMICO	Código do nível acadêmico do curso	Num	8	1. Graduação 2. Sequencial de formação específica	
17	DS_NIVEL_ACADEMICO	Nome do nível acadêmico do curso	Char	33		
18	CO_OCDE	Código de identificação do curso a partir de uma adaptação da metodologia internacional de classificação Eurostat/Unesco/OCDE	Char	12		
19	NO_OCDE	Nome do curso a partir da tabela OCDE (Programas e/ou Cursos)	Char	83		
20	CO_OCDE_AREA_GERAL	1º caractere da variável CO_OCDE (corresponde à área geral)	Num	1		
21	NO_OCDE_AREA_GERAL	Nome da área geral conforme adaptação da classificação internacional Eurostat/Unesco/OCDE	Char	36		

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ANNEX L – Extract from the Place of Offer Variables, Higher Education Census, 2014

LOCAL DE OFERTA (DM_LOCAL_OFERTA)					
N	Nome da Variável	Descrição da Variável	Tipo	Tam. ⁽¹⁾	Categoria
1	CO_LOCAL_OFERTA_IES	Código de identificação do local de oferta	Num	8	
2	NO_LOCAL_OFERTA	Nome do local de oferta definido pela Instituição	Char	255	
3	CO_IES	Código único de identificação da IES	Num	8	
4	CO_UF_LOCAL_OFERTA	Código da UF do local de oferta	Num	8	
5	SGL_UF_LOCAL_OFERTA	Sigla da UF do local de oferta	Char	2	
6	CO_MUNICIPIO_LOCAL_OFERTA	Código do município do local de oferta	Num	8	
7	NO_MUNICIPIO_LOCAL_OFERTA	Nome do município do local de oferta	Char	150	
8	IN_SEDE	Informa se o endereço é o principal da IES	Num	8	0. Não 1. Sim
9	CO_CURSO_POLO	Código de identificação do polo vinculado ao curso	Num	8	
10	CO_CURSO	Código único de identificação do curso	Num	8	
11	IN_LOCAL_OFERTA_NEAD	Informa se o tipo de local de oferta é Núcleo de Educação a Distância (NEAD)	Num	8	0. Não 1. Sim
12	IN_LOCAL_OFERTA_UAB	Informa se o tipo de local de oferta é Polo Universidade Aberta do Brasil (UAB)	Num	8	0. Não 1. Sim
13	IN_LOCAL_OFERTA_REITORIA	Informa se o tipo de local de oferta é Unidade Administrativa/Reitoria	Num	8	0. Não 1. Sim
14	IN_LOCAL_OFERTA_POLO	Informa se o tipo de local de oferta é Polo de apoio presencial	Num	8	0. Não 1. Sim
15	IN_LOCAL_OFERTA_UNID_ACADEMICA	Informa se o tipo de local de oferta é Unidade Acadêmica	Num	8	0. Não 1. Sim
16	DT_INICIO_FUNCIONAMENTO	Data de início de funcionamento do local de oferta dos cursos EaD	Data	8	

Nota: (1) Tamanho da variável. Não é o tamanho do campo.

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APPENDIX A – Panel Dataset, 2008-2013, Brazil

Table 1 - Number of Higher Education Institutions, 2008-2013, Brazil													
	North		Northeast		South		Southeast		Midwest		BRAZIL		
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private	TOTAL
2008	18	121	59	373	39	331	104	965	16	226	236	2.016	2.252
2009	19	128	61	387	39	347	110	980	16	227	245	2069	2.314
2010	25	121	64	369	41	345	131	1038	17	227	278	2100	2.378
2011	27	125	63	369	42	347	134	1.023	18	217	284	2081	2.365
2012	28	126	65	379	49	360	143	1.030	19	217	304	2112	2.416
2013	26	120	68	378	47	366	141	1.004	19	222	301	2090	2.391
Table 2 - Number of Undergraduate Courses, 2008-2013, Brazil													
2008	946	856	2.187	2.028	1.235	3.423	1.616	10.093	788	1.547	6.772	17.947	24.719
2009	1.041	963	2.288	2.367	1.582	3.804	2.424	10.854	893	1.611	8228	19599	27.827
2010	1.148	918	2.496	2.398	1.642	3.964	2.587	10.894	948	1.582	8821	19756	28.577
2011	1.221	970	2.550	2.522	1.874	3.879	2.737	11.029	986	1.608	9368	20008	29.376
2012	1.337	1.000	2.911	2.633	2.291	3.623	2.862	11.441	993	1.627	10394	20324	30.718
2013	1.293	1.006	2.889	2.818	2.295	3.685	2.845	11.275	1.022	1.663	10344	20447	30.791
Table 3 - Number of Places Offered, 2008-2013, Brazil													
2008	29.185	127.397	100.014	328.740	61.339	328.685	117.215	328.685	36.285	258.449	344.038	1.371.956	1.715.994
2009	33.919	135.400	117.260	354.929	73.868	360.114	128.289	1.659.846	40.546	260.508	393.882	2.770.797	3.164.679
2010	37.866	119.679	128.415	372.356	78.356	359.773	150.649	1.543.319	50.051	279.728	445.337	2.674.855	3.120.192
2011	43.628	129.236	140.828	383.875	86.047	360.310	164.781	1.611.482	49.659	258.825	484943	2743728	3.228.671
2012	50.498	136.799	160.965	399.328	103.837	362.966	171.822	1.634.829	52.526	250.837	539648	2784759	3.324.407
2013	46.134	139.453	147.281	432.511	102.498	395.689	177.679	1.678.988	52.341	257.141	525933	2903782	3.429.715
Table 4 - Number of Candidates, 2008-2013, Brazil													
2008	263.967	188.275	613.817	437.274	364.788	370.554	954.106	1.818.774	256.983	266.151	2.453.661	3.081.028	5.534.689
2009	252.405	216.669	804.648	632.738	367.632	383.239	931.454	2.065.646	232.958	336.041	2589097	3634333	6.223.430

2010	272.296	203.914	1.132.222	487.156	482.318	387.186	1.194.311	1.870.832	283.696	384.971	3364843	3334059	6.698.902
2011	405.242	323.094	1.683.793	628.397	716.773	428.989	1.908.545	2.238.711	423.783	409.260	5138136	4028451	9.166.587
2012	572.238	288.111	2.374.894	726.025	891.006	430.282	2.224.498	2.494.056	514.847	411.818	6577483	4350292	10.927.775
2013	747.723	307.877	2.288.628	783.392	979.760	485.215	2.681.688	2.645.320	534.847	490.629	7232646	4712433	11.945.079

Table 5 - Number of Entrants, 2008-2013, Brazil

2008	27.427	63.960	91.756	165.883	55.619	178.326	99.541	688.728	32.970	101.609	307.313	1.198.506	1.505.819
2009	33.117	63.550	101.761	159.664	67.029	149.738	116.168	673.595	36.256	110.510	354331	1157057	1.511.388
2010	38.986	58.970	121.333	178.617	69.406	161.711	138.168	669.136	40.669	113.216	408562	1181650	1.590.212
2011	37.484	73.529	120.757	195.674	76.104	176.284	150.252	697.724	42.000	117.046	426597	1260257	1.686.854
2012	42.851	84.292	126.848	236.738	90.031	190.773	156.455	848.601	45.912	147.891	462097	1508295	1.970.392
2013	40.498	85.098	127.660	249.482	86.306	190.756	159.864	807.746	42.878	161.408	457206	1494490	1.951.696

Table 6 - Number of Enrolled Students, 2008-2013, Brazil

2008	136.519	186.671	383.539	529.154	237.384	649.798	394.903	2.117.657	121.620	322.811	1.273.965	3.806.091	5.080.056
2009	128.689	185.270	409.393	556.109	246.882	619.054	441.800	2.074.912	124.404	329.383	1351168	3764728	5.115.896
2010	152.469	199.889	438.090	614.071	242.367	650.763	493.881	2.162.350	134.889	360.351	1461696	3987424	5.449.120
2011	168.327	217.390	471.209	667.749	277.696	651.750	533.355	2.222.280	144.804	392.202	1595391	4151371	5.746.762
2012	180.017	224.710	499.721	713.798	328.001	613.737	558.899	2.257.187	149.114	398.654	1715752	4208086	5.923.838
2013	185.753	237.812	511.825	775.727	335.968	626.716	590.242	2.312.847	154.186	421.329	1777974	4374431	6.152.405

Table 7 - Number of Undergraduate Students, 2008-2013, Brazil

2008	19.242	23.114	48.140	68.480	36.367	97.057	64.081	370.071	19.928	53.838	187.758	612.560	800.318
2009	18.241	25.351	50.242	80.587	39.152	97.185	61.427	386.384	18.742	49.617	187804	639124	826.928
2010	16.287	28.392	48.172	85.662	33.145	99.660	62.988	384.381	17.815	52.784	178407	650879	829.286
2011	18.393	36.413	53.799	94.342	34.525	100.832	68.263	377.352	19.686	61.556	194666	670495	865.161
2012	17.418	33.964	53.259	95.541	42.224	93.431	71.125	385.158	18.368	65.603	202394	673697	876.091
2013	17.453	35.904	53.457	95.913	43.226	87.933	73.321	345.192	18.804	58.735	206261	623677	829.938

Source: MEC/INEP; Higher Education Census - 2008-2013.

APPENDIX B - Template worksheet with the selected Higher Education Institutions' variables, 2010-2015

CO_IES	NO_JES	Status at IGC	Sigla	CATADM	QT_TEC	QuantProceita	PROPRIA	TRANSFERENCIA	OUTRA_RECEITA	
1	UNIVERSIDADE FEDERAL DE MATO GROSSO	Ativa	4	UFMT	1	1581	0.0809	7337074.00	740272894.34	0.00
2	UNIVERSIDADE DE BRASÍLIA	Ativa	5	UNB	1	3024	0.0917	137778138.25	0.00	40300498.20
3	UNIVERSIDADE FEDERAL DE SERGIPE	Ativa	4	UFS	1	1478	0.0527	2502993.57	606251431.87	9699793.61
4	UNIVERSIDADE FEDERAL DO AMAZONAS	Ativa	3	UFAM	1	1672	0.0497	7310546.06	733540076.60	671133.37
5	UNIVERSIDADE FEDERAL DO PIAUÍ	Ativa	3	UFPI	1	1221	0.0414	4637218.61	638589922.59	0.00
6	UNIVERSIDADE FEDERAL DE OURO PRETO	Ativa	4	UFOP	1	823	0.0629	2824822.41	375028963.94	5886463.13
7	UNIVERSIDADE FEDERAL DE SÃO CARLOS	Ativa	5	UFSCAR	1	1013	0.0790	5062076.98	22102391.17	539920716.85
8	UNIVERSIDADE FEDERAL DE WÇOSA	Ativa	5	UFV	1	2488	0.1937	3729254.39	802065880.25	3254077.11
9	UNIVERSIDADE ESTADUAL DE LONDRINA	Ativa	4	UEL	2	1617	0.1257	14925542.00	650270866.00	4586416.00
10	PONTIFÍCA UNIVERSIDADE CATÓLICA DO PARANÁ	Ativa	3	PUCPR	5	1182	0.0470	584561677.98	6488919.01	5071696.79
11	UNIVERSIDADE CATÓLICA DE PERNAMBUCO	Ativa	3	UNICAP	5	456	0.0471	110452801.00	610696.70	31029749.00
12	UNIVERSIDADE FEDERAL DO RIO GRANDE	Ativa	4	FURG	1	1206	0.1303	3922419.43	477042165.06	358179.48
13	UNIVERSIDADE DE CAXIAS DO SUL	Ativa	3	UCS	5	1085	0.0407	314409431.00	0.00	35528013.00
14	UNIVERSIDADE DO VALE DO RIO DOS SINOS	Ativa	4	UNISINOS	5	1102	0.0413	405640615.50	3081761.80	74718104.10
15	UNIVERSIDADE CATÓLICA DE PETRÓPOLIS	Ativa	3	UCP	5	228	0.0487	3541308.62	0.00	107259.18
17	UNIVERSIDADE FEDERAL DE UBERLÂNDIA	Ativa	4	UFU	1	1827	0.0895	4712878.25	80601182.44	14407953.60
18	UNIVERSIDADE CATÓLICA DE PELOTAS	Ativa	4	UCPEL	5	321	0.0722	84852820.12	0.00	5030217.61
19	PONTIFÍCA UNIVERSIDADE CATÓLICA DE CAMPINAS	Ativa	3	PUC-CAM 5	1447	0.0822	241927704.48	8296767.69	32034992.53	5071696.79
20	UNIVERSIDADE DE PASSO FUNDO	Ativa	3	UPF	5	1261	0.0735	286050912.38	3394245.22	7587448.85
21	PONTIFÍCA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO	Ativa	4	PUCRS	5	1964	0.0901	419381684.61	13482923.35	157822251.23
22	UNIVERSIDADE PRESBITERIANA MACKENZIE	Ativa	3	MACKENZIE	5	1764	0.0512	620197760.87	0.00	47273639.17
23	UNIVERSIDADE FEEDVALE	Ativa	4	FEEDVALE	5	912	0.0558	169850407.98	0.00	60046415.49
24	UNIVERSIDADE ESTADUAL DE GOIÁS	Ativa	4	UEG	2	1427	0.0661	3854308.49	3496213.25	222740438.27
26	ESCOLA NACIONAL DE CIÊNCIAS ESTADÍSTICAS	Ativa	4	ENCE	1	89	0.3560	0.00	2159766836.90	17752097.00
27	UNIVERSIDADE VALE DO RIO VERDE	Ativa	3	UNINCOR 5	307	0.1102	35281221.31	0.00	405160.62	0.00
29	UNIVERSIDADE ESTADUAL DO CEARÁ	Ativa	4	UECE	2	880	0.0471	8718462.64	216017528.04	0.00
30	UNIVERSIDADE JOSÉ DO ROSÁRIO VELLANO	Ativa	3	UNIFENAS	5	755	0.0969	162169465.77	2299222.22	63859948.72
31	CENTRO DE EDUCAÇÃO TÉCNICA DA UTRAMIG	Ativa	-	UTRAMIG 2	6	0.0769	260910.00	0.00	0.00	0.00
32	UNIVERSIDADE ESTADUAL DE CIÊNCIAS DA SAÚDE DE ALAG	Ativa	3	UNICISA	2	502	0.2742	5245562.33	210969171.68	52209.30
33	FACULDADE DE TECNOLOGIA DE SOROCABA	Ativa	3	FATEC SO 2	74	0.0288	0.00	0.00	464898810.60	0.00
34	FACULDADE DE TECNOLOGIA DE SÃO PAULO	Ativa	3	FATEC-SP	107	0.0130	22626333.52	197858020.38	2064238.72	0.00
35	FACULDADE DE TECNOLOGIA DE AMERICANA	Ativa	3	FATEC-AN 2	31	0.0149	0.00	0.00	464898810.60	0.00
36	FACULDADE DE TECNOLOGIA RUBENS LARA	Ativa	2	FATEC-BS 2	26	0.0154	0.00	0.00	464898810.60	0.00
37	FACULDADE DE TECNOLOGIA DE IAHU	Ativa	3	FATEC-IA 2	34	0.0228	0.00	0.00	464898810.60	0.00
38	UNIVERSIDADE DO ESTADO DO PARÁ	Ativa	SC	UEPA	2	1278	0.1014	2789011.93	247630702.57	5876900.71
40	UNIVERSIDADE DO ESTADO DA BAHIA	Ativa	3	UNEB	2	1706	0.0558	17523414.66	19068763.16	481999607.05
43	FUNDAÇÃO UNIVERSIDADE DO ESTADO DE SANTA CATARINA	Ativa	4	UDESC	2	778	0.0580	4774953.94	389770731.07	505751.30
47	UNIVERSIDADE ESTADUAL DE GOIÁS	Ativa	3	UEG	2	1427	0.0661	3854308.49	3496213.25	222740438.27
54	UNIVERSIDADE ESTADUAL DE CAMPINAS	Ativa	5	UNICAMP 2	4496	0.2638	0.00	0.00	1263813793.73	1178406.52
55	UNIVERSIDADE DE SÃO PAULO	Ativa	-	USP	2	17303	0.3003	912481297.93	4575208137.14	11660132.66
56	UNIVERSIDADE ESTADUAL PAULISTA JÚLIO DE MESQUITA F	Ativa	5	UNESP	2	6766	0.1920	405294209.00	2206305342.00	23695344.00
57	UNIVERSIDADE ESTADUAL DE MARINGÁ	Ativa	4	UEM	2	1616	0.0850	37504839.32	443450273.15	0.00
58	FACULDADE DE DIREITO DE SÃO BERNARDO DO CAMPO	Ativa	3	FDSBC	3	120	0.0495	2782171.85	0.00	3787673.33
59	FACULDADE DE DIREITO DE FRANCA	Ativa	4	DFD	7	21	0.0139	14690597.18	22740.00	740410.88
60	CENTRO UNIVERSITÁRIO MUNICIPAL DE FRANCA	Ativa	3	UNIFACE 7	35	0.0187	22058723.18	0.00	0.00	0.00
67	ESCOLA DE ENGENHARIA DE PIRACICABA	Ativa	3	EEF/FRM 3	19	0.0042	290156.09	0.00	0.00	392854.63
68	FACULDADE DE FILOSOFIA CIÊNCIAS E LETRAS DE PEÑÃOPO	Ativa	3	FAFPE	5	27	0.0672	2840316.46	0.00	407681.68
71	UNIVERSIDADE DO ESTADO DO RIO GRANDE DO NORTE	Ativa	3	UERN	2	837	0.0806	632320.33	26082736.39	18670.00
72	FACULDADE DE FORMAÇÃO DE PROFESSORES DA MATA SUL	Ativa	2	FAMASUL 3	69	0.0583	4810178.38	0.00	5069.52	0.00
73	CENTRO DE ENSINO SUPERIOR DE ARCOVERDE	Ativa	2	CESA	3	36	0.0265	4764450.79	2458900.00	76351.50
74	FACULDADE DE FILOSOFIA CIÊNCIAS E LETRAS DE SÃO JO	Ativa	2	FFCL	3	53	0.1683	1247341.74	1699350.00	37717.47
76	UNIVERSIDADE REGIONAL DE Blumenau	Ativa	3	FURB	7	559	0.0535	146712171.76	11601020.58	19840230.50
77	FACULDADE DA REGIÃO DOS LAGOS	Ativa	3	FERLAGO 5	22	0.0880	930156.09	0.00	0.00	0.00
78	FACULDADE DE FILOSOFIA CIÊNCIAS E LETRAS DE ALEGRE	Ativa	3	FAFIA	3	17	0.0402	1818945.56	0.00	100269.95
79	INSTITUTO MUNICIPAL DE ENSINO SUPERIOR DE CATANDUV	Ativa	3	IMES CAT 7	32	0.0256	7292752.95	0.00	0.00	0.00
80	CENTRO UNIVERSITÁRIO PARA O DESENVOLVIMENTO DO ALT	Ativa	4	UNIDAVI 7	135	0.0394	32143868.95	3898319.09	7848317.30	0.00
81	UNIVERSIDADE DA REGIÃO DE JOINVILLE	Ativa	3	UNIVILLE 5	480	0.0555	121590106.82	7703788.70	3395170.71	0.00
82	UNIVERSIDADE DO OESTE DE SANTA CATARINA	Ativa	3	UNOESC 5	666	0.0402	238030664.14	231946.28	17578100.10	0.00
83	UNIVERSIDADE DO VALE DO ITAÍAI	Ativa	4	UNIVALI 5	1106	0.0524	345337655.75	0.00	7189572.44	0.00
84	FACULDADE DE FILOSOFIA CIÊNCIAS E LETRAS DE MACAÉ	Ativa	3	FAPIMA 5	34	0.0856	3166989.45	0.00	823829.12	0.00
87	CENTRO UNIVERSITÁRIO DE BRUSQUE	Ativa	3	UNIFEBE 5	119	0.0404	27082084.61	164748.48	791664.64	0.00
93	FACULDADE DE MEDICINA DE JUNDIAÍ	Ativa	4	FMIJ	3	78	0.1707	20372773.18	0.00	1110568.61
94	ESCOLA SUPERIOR DE EDUCAÇÃO FÍSICA DE JUNDIAÍ	Ativa	-	ESEFJ	3	45	0.1122	6074830.15	221992.80	0.00
95	UNIVERSIDADE ESTADUAL DO VALE DO AÇARAÚ	Ativa	3	UVA	2	213	0.0209	3252007.40	68814455.28	306474.17
99	FACULDADE DE DIREITO DE CONSELHEIRO LAFAIETE	Ativa	3	FDCL	5	80	0.0910	7619985.20	0.00	60038.96
107	UNIVERSIDADE FEDERAL DE SÃO JOÃO DEL REI	Ativa	4	UFSJ	1	544	0.0408	694737.65	272.74	267629446.13
109	FACULDADES INTEGRADAS RUI BARBOSA	Ativa	3	FIRB	4	11	0.0141	5877833.51	0.00	74268.40
124	CENTRO UNIVERSITÁRIO DE ARARAQUARA	Ativa	3	UNIARA	5	311	0.0380	66242333.42	0.00	42205.54
125	CENTRO UNIVERSITÁRIO DE ARARAS	Ativa	3	UNAR	5	64	0.0297	10970367.28	0.00	52091.47
126	INSTITUTO NACIONAL DE TELECOMUNICAÇÕES	Ativa	3	INATEL	5	401	0.2230	74655996.98	0.00	18816920.47
131	FACULDADE DE EDUCAÇÃO FÍSICA DE BARRA BONITA	Ativa	3	FAEFI 5	22	0.1818	980556.51	0.00	22943.02	0.00
135	CENTRO UNIVERSITÁRIO CLARETIANO	Ativa	3	CEUCLAR 5	569	0.0239	89805969.35	487164.85	4651113.36	0.00
137	UNIVERSIDADE DO SAGRADO CORAÇÃO	Ativa	3	USC	5	250	0.0411	75075457.45	58190.00	3929371.21
138	CENTRO UNIVERSITÁRIO BARÃO DE MAUÁ	Ativa	3	CBM	5	392	0.0837	84796561.42	2149.33	1050654.55
139	FACULDADE DE CIÊNCIAS ECONÔMICAS DO TRIÂNGULO MIN	Ativa	2	FCETM	5	28	0.1296	5564384.20	0.00	3450.60
140	UNIVERSIDADE SEVERINO SOMBRA	Ativa	3	US	5	981	0.2843	67903888.82	0.00	31797931.52
141	FACULDADE DE DIREITO DE VARGINHA - FADIVA	Ativa	3	FADIVA	5	35	0.0288	10063806.90	0.00	77115.23
142	CENTRO UNIVERSITÁRIO DO TRIÂNGULO	Ativa	3	UNITRI 5	347	0.0479	75890349.83	0.00	249972.66	0.00
143	UNIVERSIDADE DE UBERABA	Ativa	3	UNIUBE 5	1344	0.0431	252198373.65	0.00	60068790.45	0.00
144	FACULDADE DE CIÊNCIAS HUMANAS DE OLINDA	Ativa	3	FACHO	5	41	0.0291	6246738.15	0.00	0.00
146	CENTRO UNIVERSITÁRIO DE RIO PRETO	Ativa	3	UNIRP	4	412	0.0474	84551527.70	0.00	271889.16
149	FACULDADE DE MEDICINA DE SÃO JOSÉ DO RIO PRETO	Ativa	4	FAMERP	2	219	0.3932	2405257.11	231102.58	0.00
150	UNIVERSIDADE DE SOROCABA	Ativa	3	UNISO	5	281	0.0294	9687221.50	0.00	7339981.89
151	ESCOLA DE ADMINISTRAÇÃO DE EMPRESAS DE SÃO PAULO	Ativa	4	FGEA-EA 5	96	0.0444	101229402.40	0.00	13380278.72	0.00
152	FACULDADE DE CIÊNCIAS CONTÁBEIS	Ativa	2	FACIC	5	97	0.0957	16690670.30	0.00	0.00
158	CONSERVATÓRIO BRASILEIRO DE MÚSICA - CENTRO UNIVER	Ativa	2	CBM/CEL 5	45	0.0491	4504798.63	25222.00	241794.74	0.00
159	FACULDADE DE FILOSOFIA CIÊNCIAS E LETRAS DE CARUAR	Ativa	3	FAFICA	5	63	0.0458	12057387.89	3233531.18	204717.74
160	FACULDADE FRASSINETTI DO RECIFE	Ativa	3	FAFIRE	5	89	0.0395	20534661.66	0.00	753355.00
161	CENTRO UNIVERSITÁRIO ASSUNÇÃO	Ativa	3	UNIFAI	5	62	0.0552	7425620.29	0.00	1103628.03

Dados_caracterização_IES_2010-2015 (vfinal1).xlsx

APPENDIX E – Template worksheet with the selected Students' Variables, 2010-2015

NAlunosF	NAlunosF	NumTOT/	NumTOT/	SexoFAlu	SexoFAlu	SexoMAI	SexoFAlu	SexoFAlu	SexoMAI	SexoFAlu	SexoFAlu	SexoMAI	SexoFAlu	SexoFAlu
0.000	0.000	0	0.000	2915	0.2766	1686	37	0.0035	63	2353	0.2232	1937	574	0.0545
0.000	0.000	0	0.000	4137	0.2344	2950	1172	0.0664	736	4743	0.2687	4329	941	0.0533
0.000	0.000	0	0.000	6436	0.4219	4174	251	0.0165	251	2449	0.1606	2299	906	0.0594
0.000	0.000	0	0.000	8591	0.4685	6158	161	0.0088	85	3488	0.1902	3105	1221	0.0666
0.000	0.000	0	0.000	9349	0.5581	5363	312	0.0186	76	2418	0.1443	2475	645	0.0385
0.000	0.000	0	0.000	2041	0.2811	847	257	0.0354	164	1423	0.1960	1014	326	0.0449
0.000	0.000	0	0.000	2214	0.3502	1372	221	0.0350	174	706	0.1117	607	794	0.1256
0.000	0.000	0	0.000	1440	0.2142	867	33	0.0049	13	1198	0.1782	1011	443	0.0659
0.000	0.000	0	0.000	1986	0.2728	1271	265	0.0364	131	2347	0.3224	1848	319	0.0438
0.013	0.000	12242	0.487	1215	0.0904	931	595	0.0443	725	5710	0.4251	3928	288	0.0214
0.003	0.000	3863	0.399	253	0.0492	251	57	0.0111	274	3144	0.6116	2211	87	0.0169
0.000	0.000	0	0.000	1452	0.2880	623	196	0.0389	163	1323	0.2624	960	386	0.0766
0.011	0.000	7645	0.287	1626	0.1131	643	549	0.0382	304	7905	0.5000	5354	276	0.0192
0.011	0.000	15577	0.583	1736	0.1267	767	360	0.0263	218	6610	0.4826	4551	714	0.0521
0.000	0.000	1119	0.239	274	0.1223	107	8	0.0036	42	1067	0.4761	800	154	0.0687
0.000	0.000	0	0.000	2204	0.2047	1119	313	0.0291	152	3031	0.2815	2408	959	0.0891
0.000	0.000	2298	0.517	246	0.0885	57	154	0.0554	78	1170	0.4209	758	12	0.0043
0.011	0.000	7162	0.407	1081	0.1081	595	139	0.0139	193	5222	0.5224	3703	349	0.0349
0.014	0.000	11303	0.659	1676	0.1732	671	184	0.0190	153	3819	0.3946	2474	224	0.0231
0.015	0.000	11027	0.506	999	0.0930	613	147	0.0137	281	5955	0.5546	4858	476	0.0443
0.006	0.000	10369	0.301	759	0.0438	330	604	0.0348	796	11324	0.6534	9199	668	0.0385
0.042	0.000	8193	0.502	858	0.0886	354	1164	0.1202	369	3747	0.3869	2573	416	0.0430
0.000	0.000	0	0.000	1593	0.4566	881	65	0.0186	53	651	0.1866	649	337	0.0966
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	0	0.0000	0	77	1.0000
0.033	0.000	940	0.337	237	0.1411	143	0	0.0000	0	501	0.2982	340	10	0.0060
0.000	0.000	0	0.000	7188	0.6851	5437	335	0.0319	307	1072	0.1022	1383	197	0.0188
0.000	0.000	4243	0.545	124	0.0269	3	0	0.0000	0	1468	0.3179	1034	344	0.0745
0.000	0.000	0	0.000	46	1.0000	32	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	129	0.1084	30	30	0.0252
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	116	0.2302	121	76	0.1508
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	1588	0.5735	1320	347	0.1253
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	384	0.5672	397	151	0.2230
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	301	0.5433	382	144	0.2599
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	188	0.3941	383	36	0.0755
0.000	0.000	0	0.000	4803	0.6357	3213	177	0.0234	118	113	0.0150	37	79	0.0105
0.000	0.000	0	0.000	15758	0.7365	5006	102	0.0048	79	3464	0.1619	2794	81	0.0038
0.000	0.000	0	0.000	3033	0.4025	867	378	0.0502	154	1035	0.1373	904	193	0.0256
0.000	0.000	0	0.000	6313	0.5980	2407	155	0.0147	65	1636	0.1550	1207	355	0.0336
0.000	0.000	0	0.000	1873	0.2390	1232	444	0.0567	361	1103	0.1407	1063	861	0.1099
0.000	0.000	0	0.000	4384	0.1579	3370	4289	0.1544	3115	5038	0.1814	6340	2491	0.0897
0.000	0.000	0	0.000	5375	0.2961	3506	1017	0.0560	850	2782	0.1533	2405	1684	0.0928
0.000	0.000	0	0.000	5173	0.4708	2066	221	0.0201	141	2254	0.2051	1967	429	0.0390
0.000	0.000	0	0.000	0	0.0000	0	0	0.0000	0	1441	1.0000	981	0	0.0000
0.000	0.000	217	0.144	0	0.0000	0	0	0.0000	0	880	1.0000	628	0	0.0000
0.015	0.000	943	0.505	124	0.1250	41	0	0.0000	0	684	0.6895	463	9	0.0091
0.000	0.000	776	0.328	0	0.0000	0	0	0.0000	0	134	0.2376	102	3	0.0053
0.000	0.000	0	0.000	93	0.3457	4	0	0.0000	0	176	0.6543	124	0	0.0000
0.000	0.000	0	0.000	3374	0.5562	1915	0	0.0000	0	1488	0.2453	1687	155	0.0256
0.000	0.000	913	0.771	760	1.0000	424	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	474	0.350	875	1.0000	481	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	1	0.003	162	0.8351	99	0	0.0000	0	25	0.1289	12	0	0.0000
0.002	0.000	2634	0.252	587	0.1018	339	294	0.0510	66	2047	0.3548	1462	362	0.0627
0.000	0.000	53	0.212	97	0.5951	44	0	0.0000	0	66	0.4049	43	0	0.0000
0.000	0.000	67	0.158	214	0.6848	87	0	0.0000	0	70	0.2273	14	4	0.0130
0.000	0.000	552	0.441	249	0.3051	59	0	0.0000	0	384	0.4706	281	7	0.0086
0.000	0.000	1780	0.519	231	0.1203	86	82	0.0427	26	1236	0.6438	797	5	0.0026
0.011	0.000	5138	0.594	467	0.0997	256	488	0.1042	272	2316	0.4947	1447	144	0.0308
0.000	0.000	7552	0.456	1330	0.1399	608	158	0.0166	107	4773	0.5022	2904	249	0.0262
0.039	0.000	12506	0.592	1193	0.0963	376	911	0.0736	600	6224	0.5025	4373	442	0.0357
0.000	0.000	153	0.385	338	1.0000	59	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	969	0.329	178	0.1206	114	135	0.0915	37	893	0.6050	619	4	0.0027
0.000	0.000	134	0.293	0	0.0000	0	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	16	0.040	32	0.2443	67	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	0	0.000	3662	0.6508	2125	62	0.0110	62	865	0.1537	895	216	0.0384
0.000	0.000	160	0.182	0	0.0000	0	0	0.0000	0	528	1.0000	351	0	0.0000
0.000	0.000	0	0.000	2110	0.2998	1039	77	0.0109	67	1098	0.1560	831	226	0.0321
0.000	0.000	674	0.864	120	0.3109	10	0	0.0000	0	150	0.3886	94	0	0.0000
0.024	0.000	2118	0.259	303	0.0674	102	103	0.0229	106	1631	0.3626	1087	242	0.0538
0.000	0.000	666	0.413	509	0.5618	138	2	0.0022	9	258	0.2848	213	0	0.0000
0.000	0.000	1109	0.617	0	0.0000	0	0	0.0000	0	0	0.0000	0	0	0.0000
0.000	0.000	43	0.355	23	0.5897	31	0	0.0000	0	0	0.0000	0	0	0.0000
0.031	0.000	5395	0.227	6525	0.5528	5061	171	0.0145	525	1613	0.1366	1438	240	0.0203
0.033	0.000	1771	0.291	547	0.1437	310	217	0.0570	152	997	0.2619	538	270	0.0709
0.072	0.000	1183	0.253	370	0.1166	143	74	0.0233	127	775	0.2442	441	271	0.0854
0.000	0.000	85	0.394	0	0.0000	0	0	0.0000	0	134	1.0000	82	0	0.0000
0.000	0.000	1825	0.529	180	0.0928	18	0	0.0000	0	474	0.2445	200	38	0.0196
0.000	0.000	166	0.137	0	0.0000	0	0	0.0000	0	666	1.0000	550	0	0.0000
0.051	0.000	7222	0.998	114	0.0257	171	3	0.0007	1	1390	0.3138	800	41	0.0093
0.000	0.000	11995	0.385	9688	0.5074	2146	79	0.0041	12	4475	0.2344	2637	28	0.0015

Dados_caracterização_IES_2010-2015 (vfinal1).xlsx

APPENDIX F – Template worksheet with the selected Ratios' Variables, 2010-2015

TotalRece	numDoc/	numTec/	TotalAlur	Ingressan	Concluint	Conc/Ingr	AlunosIE	NumDoc/	NumDoc/	NumDoc/	NumDoc/	NumDoc/	NumDoc/	DocFem/	DocMasc/
6.47	1.360	0.7353	160.22	1.05	0.44	0.41	0.003	0.29	0.57	0.05	0.09	0.00	1.00	0.48	0.52
0.82	0.959	1.0428	239.04	0.97	0.55	0.57	0.004	0.17	0.81	0.01	0.01	0.05	0.95	0.46	0.54
0.00	1.221	0.8193	222.40	1.10	0.41	0.37	0.004	0.28	0.61	0.05	0.06	0.02	0.98	0.48	0.52
5.91	1.118	0.8941	308.94	1.61	0.85	0.53	0.005	0.37	0.43	0.12	0.09	0.13	0.87	0.46	0.54
18.97	1.699	0.5887	212.12	2.42	1.64	0.68	0.004	0.39	0.42	0.15	0.04	0.09	0.91	0.49	0.51
4.10	1.156	0.8654	261.54	0.92	0.62	0.68	0.002	0.29	0.66	0.01	0.04	0.09	0.91	0.41	0.59
5.49	1.371	0.7293	168.78	1.84	1.01	0.55	0.002	0.08	0.91	0.00	0.00	0.01	0.99	0.46	0.54
6.58	0.502	1.9904	166.83	3.31	2.10	0.64	0.002	0.19	0.74	0.03	0.04	0.00	1.00	0.38	0.62
8.35	1.127	0.8875	191.97	1.21	0.89	0.73	0.002	0.25	0.69	0.05	0.01	0.02	0.98	0.52	0.48
4.70	1.479	0.6762	246.63	0.55	0.30	0.54	0.003	0.45	0.37	0.15	0.02	0.01	0.99	0.39	0.61
4.76	1.007	0.9935	261.92	0.52	0.27	0.51	0.001	0.48	0.42	0.10	0.00	0.02	0.98	0.41	0.59
7.15	0.769	1.2996	136.07	1.16	0.39	0.34	0.001	0.25	0.65	0.05	0.05	0.07	0.93	0.47	0.53
2.69	1.022	0.9784	177.76	0.61	0.30	0.49	0.004	0.53	0.33	0.14	0.00	0.01	0.99	0.48	0.52
5.16	0.994	1.0064	267.09	0.27	0.06	0.24	0.004	0.49	0.47	0.04	0.00	0.00	1.00	0.49	0.51
7.63	1.018	0.9828	120.05	0.35	0.08	0.24	0.001	0.55	0.30	0.15	0.00	0.03	0.97	0.35	0.65
5.87	1.030	0.9713	183.97	1.21	0.99	0.81	0.003	0.17	0.77	0.03	0.02	0.02	0.98	0.44	0.56
38.58	0.944	1.0594	134.73	0.17	0.18	1.04	0.001	0.45	0.30	0.25	0.00	0.00	1.00	0.53	0.47
7.82	0.688	1.4543	303.33	0.84	0.57	0.68	0.002	0.36	0.42	0.21	0.00	0.02	0.98	0.46	0.54
3.08	0.760	1.3163	171.50	0.75	0.41	0.55	0.002	0.49	0.30	0.21	0.00	0.04	0.96	0.45	0.55
5.21	0.699	1.4304	382.44	0.31	0.21	0.68	0.003	0.34	0.60	0.05	0.01	0.00	1.00	0.39	0.61
0.00	0.708	1.4123	749.20	1.09	0.66	0.60	0.005	0.39	0.58	0.03	0.00	0.00	1.00	0.37	0.63
3.62	0.629	1.5889	263.45	0.35	0.12	0.35	0.002	0.63	0.30	0.07	0.00	0.03	0.97	0.57	0.43
8.98	1.930	0.5180	143.30	1.17	0.40	0.34	0.001	0.33	0.58	0.07	0.02	0.05	0.95	0.48	0.52
8.12	0.607	1.6481	250.00	0.88	0.15	0.18	0.000	0.28	0.70	0.02	0.00	0.02	0.98	0.54	0.46
5.51	0.658	1.5198	87.09	0.40	0.16	0.40	0.000	0.47	0.20	0.33	0.00	0.02	0.98	0.48	0.52
5.61	1.400	0.7143	249.01	0.69	0.47	0.68	0.003	0.41	0.44	0.10	0.05	0.13	0.87	0.50	0.50
4.20	0.789	1.2668	236.12	0.89	0.45	0.50	0.001	0.39	0.25	0.36	0.00	0.00	1.00	0.51	0.49
62.12	1.167	0.8571	78.00	0.00	0.00	0.28	0.000	0.86	0.00	0.14	0.00	0.00	1.00	0.57	0.43
3.80	0.606	1.6513	203.44	1.58	1.20	0.76	0.000	0.43	0.19	0.38	0.00	0.00	1.00	0.58	0.42
51.93	1.757	0.5692	285.33	0.98	0.56	0.58	0.000	0.44	0.22	0.18	0.15	0.03	0.97	0.22	0.78
51.93	9.318	0.1073	516.31	0.95	0.11	0.12	0.001	0.54	0.23	0.15	0.07	0.00	1.00	0.42	0.58
51.93	4.097	0.2441	260.13	0.93	0.38	0.41	0.000	0.51	0.20	0.17	0.12	0.00	1.00	0.25	0.75
0.52	3.077	0.3250	241.86	0.12	0.05	0.44	0.000	0.61	0.14	0.18	0.08	0.01	0.99	0.31	0.69
51.93	2.500	0.4000	213.29	1.11	0.43	0.39	0.000	0.52	0.21	0.20	0.07	0.02	0.98	0.35	0.65
4.64	1.030	0.9711	121.19	0.96	1.06	1.10	0.002	0.45	0.25	0.28	0.01	0.06	0.94	0.55	0.45
4.58	1.327	0.7535	107.24	0.66	0.45	0.67	0.004	0.49	0.33	0.18	0.01	0.00	1.00	0.59	0.41
5.53	1.702	0.5876	248.30	0.99	0.69	0.70	0.002	0.41	0.51	0.05	0.04	0.05	0.95	0.46	0.54
5.61	1.382	0.7236	110.65	0.66	0.33	0.51	0.002	0.35	0.18	0.46	0.01	0.08	0.92	0.56	0.44
13.33	0.449	2.2291	189.34	0.81	0.53	0.65	0.002	0.02	0.96	0.00	0.02	0.19	0.81	0.36	0.64
4.13	0.371	2.6960	237.12	1.20	1.20	1.01	0.008	0.01	0.99	0.00	0.00	0.01	0.99	0.38	0.62
9.85	0.637	1.5698	191.49	1.72	1.76	1.02	0.005	0.10	0.88	0.00	0.01	0.01	0.99	0.42	0.58
10.89	1.115	0.8968	213.62	0.64	0.34	0.53	0.003	0.27	0.66	0.03	0.03	0.09	0.91	0.49	0.51
5.68	0.525	1.9048	242.00	0.74	0.49	0.66	0.000	0.35	0.59	0.06	0.00	0.08	0.92	0.38	0.62
5.62	1.571	0.6364	1508.00	0.94	0.92	0.98	0.000	0.73	0.24	0.03	0.00	0.03	0.97	0.15	0.85
4.40	3.743	0.2672	133.36	0.76	0.45	0.59	0.000	0.55	0.35	0.10	0.00	0.02	0.98	0.56	0.44
3.93	1.532	0.6529	295.88	0.56	0.05	0.08	0.000	0.45	0.38	0.12	0.05	0.05	0.95	0.18	0.82
5.09	1.519	0.6585	80.40	0.42	0.25	0.60	0.000	0.44	0.24	0.32	0.00	0.02	0.98	0.46	0.54
17.60	1.282	0.7801	125.07	0.96	0.70	0.73	0.001	0.43	0.25	0.25	0.08	0.14	0.86	0.45	0.55
93.03	1.101	0.9079	169.14	0.34	0.51	1.51	0.000	0.36	0.09	0.55	0.00	0.20	0.80	0.43	0.57
6.96	1.556	0.6429	226.00	0.66	0.53	0.81	0.000	0.32	0.13	0.55	0.00	0.02	0.98	0.45	0.55
3.89	0.887	1.1277	35.00	0.06	0.01	0.21	0.000	0.32	0.09	0.55	0.04	0.19	0.81	0.53	0.47
5.83	1.646	0.6076	197.09	0.32	0.16	0.50	0.001	0.49	0.26	0.24	0.01	0.02	0.98	0.41	0.59
0.00	1.727	0.5789	41.67	0.18	0.17	0.93	0.000	0.61	0.32	0.08	0.00	0.00	1.00	0.42	0.58
4.59	3.235	0.3091	47.00	0.21	0.20	0.92	0.000	0.33	0.09	0.58	0.00	0.11	0.89	0.64	0.36
8.27	3.688	0.2712	89.43	0.23	0.22	0.95	0.000	0.48	0.19	0.32	0.00	0.02	0.98	0.47	0.53
5.62	1.630	0.6136	110.65	0.58	0.38	0.66	0.000	0.45	0.09	0.46	0.00	0.00	1.00	0.42	0.58
4.50	1.263	0.7921	180.06	0.41	0.20	0.49	0.001	0.50	0.21	0.29	0.00	0.02	0.98	0.42	0.58
5.10	1.488	0.6720	124.59	0.88	0.47	0.54	0.002	0.46	0.15	0.40	0.00	0.00	1.00	0.45	0.55
5.81	1.255	0.7968	237.29	0.55	0.18	0.33	0.003	0.54	0.20	0.26	0.00	0.05	0.95	0.46	0.54
1.90	1.206	0.8293	66.17	0.36	0.13	0.37	0.000	0.63	0.20	0.17	0.00	0.00	1.00	0.46	0.54
3.77	2.412	0.4146	147.30	0.64	0.29	0.45	0.000	0.56	0.12	0.32	0.00	0.00	1.00	0.39	0.61
3.39	1.756	0.5693	228.50	4.80	3.95	0.82	0.000	0.27	0.55	0.18	0.00	0.01	0.99	0.47	0.53
6.07	0.467	2.1429	200.50	0.06	0.25	3.89	0.000	0.24	0.67	0.10	0.00	0.05	0.95	0.33	0.67
11.74	2.136	0.4681	391.69	1.53	0.50	0.33	0.001	0.40	0.25	0.29	0.05	0.10	0.90	0.40	0.60
25.67	0.475	2.1053	879.00	0.68	0.38	0.55	0.000	0.42	0.13	0.45	0.00	0.00	1.00	0.32	0.68
5.06	1.533	0.6523	278.06	0.78	0.43	0.55	0.002	0.21	0.73	0.05	0.02	0.04	0.96	0.41	0.59
10.30	4.091	0.2444	97.50	0.30	0.05	0.17	0.000	0.40	0.13	0.47	0.00	0.00	1.00	0.31	0.69
4.47	1.457	0.6865	247.76	0.60	0.26	0.44	0.001	0.39	0.35	0.26	0.00	0.00	1.00	0.46	0.54
4.07	0.703	1.4222	70.17	0.27	0.08	0.28	0.000	0.60	0.24	0.16	0.00	0.04	0.96	0.24	0.76
3.32	0.207	4.8313	256.86	1.47	0.72	0.49	0.000	0.48	0.30	0.22	0.00	0.00	1.00	0.17	0.83
0.00	1.000	1.0000	60.50	0.14	0.12	0.85	0.000	0.45	0.27	0.27	0.00	0.23	0.77	0.68	0.32
334.00	0.336	2.9791	466.24	0.35	0.11	0.32	0.003	0.61	0.26	0.13	0.00	0.01	0.99	0.46	0.54
2.48	1.184	0.8446	135.33	0.41	0.20	0.48	0.001	0.45	0.45	0.11	0.00	0.01	0.99	0.60	0.40
3.00	1.005	0.9949	146.28	0.33	0.20	0.60	0.001	0.42	0.35	0.23	0.00	0.02	0.98	0.53	0.47
55.16	0.393	2.5455	108.00	0.00	0.38	0.00	0.000	0.27	0.64	0.09	0.00	0.00	1.00	0.36	0.64
4.50	0.324	3.0849	118.97	1.01	0.54	0.53	0.000	0.48	0.20	0.32	0.00	0.00	1.00	0.39	0.61
3.52	1.429	0.7000	1216.00	0.73	0.58	0.80	0.000	0.50	0.08	0.42	0.00	0.00	1.00	0.28	0.72
6.45	0.761	1.3144	289.56	0.51	0.15	0.29									

APPENDIX G – Example of query from the Microsoft SQL Server 2014 Management Studio for importing Higher Education Census' Microdata, 2010-2015

To generate a table with the data from the Undergraduate Courses according to the OECD Main Areas:

```
drop table #tmp1
SELECT *
, case when CO_OCDE_AREA_GERAL like '1' then 1 else 0 end as CO_OCDE1_Edu
, case when CO_OCDE_AREA_GERAL like '2' then 1 else 0 end as CO_OCDE2_HumArt
, case when CO_OCDE_AREA_GERAL like '3' then 1 else 0 end as CO_OCDE3_CSocNegDir
, case when CO_OCDE_AREA_GERAL like '4' then 1 else 0 end as CO_OCDE4_CienMatComp
, case when CO_OCDE_AREA_GERAL like '5' then 1 else 0 end as CO_OCDE5_EngProdConst
, case when CO_OCDE_AREA_GERAL like '6' then 1 else 0 end as CO_OCDE6_AgricVet
, case when CO_OCDE_AREA_GERAL like '7' then 1 else 0 end as CO_OCDE7_Saude
, case when CO_OCDE_AREA_GERAL like '8' then 1 else 0 end as CO_OCDE8_Serv
, case when CO_OCDE_AREA_GERAL like '9' then 1 else 0 end as CO_OCDE9_Outros
, case when [CO_GRAU_ACADEMICO] like '1' then 1 else 0 end as CO_Bacharelado
, case when [CO_GRAU_ACADEMICO] like '2' then 1 else 0 end as CO_Licenciatura
, case when [CO_GRAU_ACADEMICO] like '3' then 1 else 0 end as CO_Tecnologo
, case when [CO_MODALIDADE_ENSINO] like '1' then 1 else 0 end as Mod_Presencial
, case when [CO_MODALIDADE_ENSINO] like '2' then 1 else 0 end as Mod_Elearning
, case when CO_OCDE_AREA_GERAL like '1' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE1
, case when CO_OCDE_AREA_GERAL like '2' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE2
, case when CO_OCDE_AREA_GERAL like '3' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE3
, case when CO_OCDE_AREA_GERAL like '4' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE4
, case when CO_OCDE_AREA_GERAL like '5' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE5
, case when CO_OCDE_AREA_GERAL like '6' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE6
, case when CO_OCDE_AREA_GERAL like '7' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPertino] else 0 end as
NVagas_OCDE7
, case when CO_OCDE_AREA_GERAL like '8' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRINCIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPertino]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT
```

```

_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPERTINO] else 0 end as
NVagas_OCDE8
, case when CO_OCDE_AREA_GERAL like '9' then
[QT_VAGAS_PRINCIPAL_EAD]+[QT_VAGAS_PRINCIPAL_INTEGRAL]+[QT_VAGAS_PRINCIPAL_MATUTINO]+[QT_VAGAS_PRIN
CIPAL_NOTURNO]+[QT_VAGAS_PRINCIPAL_VESPERTINO]+[QT_OUTRAS_VAGAS_EAD]+[QT_OUTRAS_VAGAS_INTEGRAL]+[QT
_OUTRAS_VAGAS_MATUTINO]+[QT_OUTRAS_VAGAS_NOTURNO]+[QT_OUTRAS_VAGAS_VESPERTINO] else 0 end as
NVagas_OCDE9
, case when CO_OCDE_AREA_GERAL like '1' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE1
, case when CO_OCDE_AREA_GERAL like '2' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE2
, case when CO_OCDE_AREA_GERAL like '3' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE3
, case when CO_OCDE_AREA_GERAL like '4' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE4
, case when CO_OCDE_AREA_GERAL like '5' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE5
, case when CO_OCDE_AREA_GERAL like '6' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE6
, case when CO_OCDE_AREA_GERAL like '7' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE7
, case when CO_OCDE_AREA_GERAL like '8' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE8
, case when CO_OCDE_AREA_GERAL like '9' then [QT_INGRESSO_CURSO] else 0 end as NIngressantes_OCDE9
, case when CO_OCDE_AREA_GERAL like '1' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE1
, case when CO_OCDE_AREA_GERAL like '2' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE2
, case when CO_OCDE_AREA_GERAL like '3' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE3
, case when CO_OCDE_AREA_GERAL like '4' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE4
, case when CO_OCDE_AREA_GERAL like '5' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE5
, case when CO_OCDE_AREA_GERAL like '6' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE6
, case when CO_OCDE_AREA_GERAL like '7' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE7
, case when CO_OCDE_AREA_GERAL like '8' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE8
, case when CO_OCDE_AREA_GERAL like '9' then [QT_MATRICULA_CURSO] else 0 end as NMatriculas_OCDE9
, case when CO_OCDE_AREA_GERAL like '1' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE1
, case when CO_OCDE_AREA_GERAL like '2' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE2
, case when CO_OCDE_AREA_GERAL like '3' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE3
, case when CO_OCDE_AREA_GERAL like '4' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE4
, case when CO_OCDE_AREA_GERAL like '5' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE5
, case when CO_OCDE_AREA_GERAL like '6' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE6
, case when CO_OCDE_AREA_GERAL like '7' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE7
, case when CO_OCDE_AREA_GERAL like '8' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE8
, case when CO_OCDE_AREA_GERAL like '9' then QT_CONCLUINTE_CURSO else 0 end as N_CONCLUINTE_OCDE9
into #tmp1
FROM dbo.DM_CURSO
where TP_ATRIBUTO_INGRESSO<>1 and CO_NIVEL_ACADEMICO<>2

--select * from #tmp1

```

To generate a table with the data from the Higher Education Institutions according to their Undergraduate Courses:

```

Select CO_IES,
count (CO_CURSO) as NCurso,
sum(CO_OCDE1_Edu) as NCO_OCDE1_Edu,
sum(CO_OCDE2_HumArt) as NCO_OCDE2_HumArt,
sum(CO_OCDE3_CSocNegDir) as NCO_OCDE3_CSocNegDir,
sum(CO_OCDE4_CienMatComp) as NCO_OCDE4_CienMatComp,
sum(CO_OCDE5_EngProdConst) as NCO_OCDE5_EngProdConst,
sum(CO_OCDE6_AgricVet) as NCO_OCDE6_AgricVet,
sum(CO_OCDE7_Saude) as NCO_OCDE7_Saude,
sum(CO_OCDE8_Serv) as NCO_OCDE8_Serv,
sum(CO_OCDE9_Outros) as NCO_OCDE9_Outros,
sum(CO_Bacharelado) as NCursosBacharelado,
sum(CO_Licenciatura) as NCursosLicenciatura,
sum(CO_Tecnologo) as NCursosTecnologo,
sum(Mod_Presencial) as NCursosPresencial,
sum(Mod_Elearning) as NCursosElearning,

```

```

sum(NVagas_OCDE1)+sum(NVagas_OCDE2)+sum(NVagas_OCDE3)+sum(NVagas_OCDE4)+sum(NVagas_OCDE5)+sum(NVagas_OCDE6)+sum(NVagas_OCDE7)+sum(NVagas_OCDE8)+sum(NVagas_OCDE9) as numtotalvagas,
sum(NVagas_OCDE1) as NVagas_OCDE1,
sum(NVagas_OCDE2) as NVagas_OCDE2,
sum(NVagas_OCDE3) as NVagas_OCDE3,
sum(NVagas_OCDE4) as NVagas_OCDE4,
sum(NVagas_OCDE5) as NVagas_OCDE5,
sum(NVagas_OCDE6) as NVagas_OCDE6,
sum(NVagas_OCDE7) as NVagas_OCDE7,
sum(NVagas_OCDE8) as NVagas_OCDE8,
sum(NVagas_OCDE9) as NVagas_OCDE9,
Sum(NIngressantes_OCDE1) as NIngressantes_OCDE1,
Sum(NIngressantes_OCDE2) as NIngressantes_OCDE2,
Sum(NIngressantes_OCDE3) as NIngressantes_OCDE3,
Sum(NIngressantes_OCDE4) as NIngressantes_OCDE4,
Sum(NIngressantes_OCDE5) as NIngressantes_OCDE5,
Sum(NIngressantes_OCDE6) as NIngressantes_OCDE6,
Sum(NIngressantes_OCDE7) as NIngressantes_OCDE7,
Sum(NIngressantes_OCDE8) as NIngressantes_OCDE8,
Sum(NIngressantes_OCDE9) as NIngressantes_OCDE9,
sum(NMatriculas_OCDE1)(Collins, #3616) as NMatriculas_OCDE1,
sum(NMatriculas_OCDE2) as NMatriculas_OCDE2,
sum(NMatriculas_OCDE3) as NMatriculas_OCDE3,
sum(NMatriculas_OCDE4) as NMatriculas_OCDE4,
sum(NMatriculas_OCDE5) as NMatriculas_OCDE5,
sum(NMatriculas_OCDE6) as NMatriculas_OCDE6,
sum(NMatriculas_OCDE7) as NMatriculas_OCDE7,
sum(NMatriculas_OCDE8) as NMatriculas_OCDE8,
sum(NMatriculas_OCDE9) as NMatriculas_OCDE9,
sum(N_CONCLUINTE_OCDE1) as Nconcluintes_OCDE1,
sum(N_CONCLUINTE_OCDE2) as Nconcluintes_OCDE2,
sum(N_CONCLUINTE_OCDE3) as Nconcluintes_OCDE3,
sum(N_CONCLUINTE_OCDE4) as Nconcluintes_OCDE4,
sum(N_CONCLUINTE_OCDE5) as Nconcluintes_OCDE5,
sum(N_CONCLUINTE_OCDE6) as Nconcluintes_OCDE6,
sum(N_CONCLUINTE_OCDE7) as Nconcluintes_OCDE7,
sum(N_CONCLUINTE_OCDE8) as Nconcluintes_OCDE8,
sum(N_CONCLUINTE_OCDE9) as Nconcluintes_OCDE9
into IES_cursos
from #tmp1
Group by CO_IES
Order by CO_IES

```

To generate a table to characterize the Higher Education Institutions:

```

drop table #tmp
SELECT CO_IES, SUM (cast(QT_MATRICULA_CURSO as integer)) as TotalAlunos into #tmp
FROM DM_CURSO
where TP_ATRIBUTO_INGRESSO<>1 and CO_NIVEL_ACADEMICO<>2
GROUP BY CO_IES

SELECT TA.[CO_IES]
,[NO_IES]
,[QT_TEC_TOTAL]
,cast ([QT_TEC_TOTAL]as decimal)/TotalAlunos as QuantPropTec
,[VL_RECEITA_PROPRIA]
,[VL_TRANSFERENCIA]
,[VL_OUTRA_RECEITA]
,[VL_DES_PESSOAL_REM_DOCENTE]

```

```
, [VL_DES_PESSOAL_REM_TECNICO]
, [VL_DES_PESSOAL_ENCARGO]
, [VL_DES_CUSTEIO]
, [VL_DES_INVESTIMENTO]
, [VL_DES_PESQUISA]
, [VL_DES_OUTRAS]
, #tmp.TotalAlunos
into IES_Receitas
FROM [dbo].[DM_IES] as TA, dbo.#tmp
WHERE TA.CO_IES = #tmp.CO_IES
```

To generate a table to characterize the Higher Education Institutions according to their students:

```
drop table #tmp2
Select *
, case when [CO_OCDE_AREA_GERAL] like '1' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE1
, case when [CO_OCDE_AREA_GERAL] like '2' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE2
, case when [CO_OCDE_AREA_GERAL] like '3' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE3
, case when [CO_OCDE_AREA_GERAL] like '4' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE4
, case when [CO_OCDE_AREA_GERAL] like '5' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE5
, case when [CO_OCDE_AREA_GERAL] like '6' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE6
, case when [CO_OCDE_AREA_GERAL] like '7' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE7
, case when [CO_OCDE_AREA_GERAL] like '8' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE8
, case when [CO_OCDE_AREA_GERAL] like '9' then cast(IN_FINANC_ESTUDANTIL as int) else 0 end as
NALunosFinancEst_OCDE9
, case when [CO_OCDE_AREA_GERAL] like '1' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE1
, case when [CO_OCDE_AREA_GERAL] like '2' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE2
, case when [CO_OCDE_AREA_GERAL] like '3' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE3
, case when [CO_OCDE_AREA_GERAL] like '4' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE4
, case when [CO_OCDE_AREA_GERAL] like '5' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE5
, case when [CO_OCDE_AREA_GERAL] like '6' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE6
, case when [CO_OCDE_AREA_GERAL] like '7' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE7
, case when [CO_OCDE_AREA_GERAL] like '8' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE8
, case when [CO_OCDE_AREA_GERAL] like '9' then cast(IN_SEXO_ALUNO as int) else -1 end as
SexoAlunos_OCDE9
, case when [CO_OCDE_AREA_GERAL] like '1' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE1
, case when [CO_OCDE_AREA_GERAL] like '2' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE2
, case when [CO_OCDE_AREA_GERAL] like '3' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE3
, case when [CO_OCDE_AREA_GERAL] like '4' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE4
```

```
, case when [CO_OCDE_AREA_GERAL] like '5' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE5
, case when [CO_OCDE_AREA_GERAL] like '6' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE6
, case when [CO_OCDE_AREA_GERAL] like '7' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE7
, case when [CO_OCDE_AREA_GERAL] like '8' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE8
, case when [CO_OCDE_AREA_GERAL] like '9' then cast(NU_IDADE_ALUNO as int) else 0 end as
IdadeAlunos_OCDE9
into #tmp2
from DM_ALUNO
where [IN_MATRICULA]<>0 and CO_NIVEL_ACADEMICO<>2 and CO_ALUNO_SITUACAO in (2,6)
```

```
Select cast(co_ies as int)as IES
, sum(NAlunosFinancEst_OCDE1) as NAlunosFinancEst_OCDE1
, sum(NAlunosFinancEst_OCDE2) as NAlunosFinancEst_OCDE2
, sum(NAlunosFinancEst_OCDE3) as NAlunosFinancEst_OCDE3
, sum(NAlunosFinancEst_OCDE4) as NAlunosFinancEst_OCDE4
, sum(NAlunosFinancEst_OCDE5) as NAlunosFinancEst_OCDE5
, sum(NAlunosFinancEst_OCDE6) as NAlunosFinancEst_OCDE6
, sum(NAlunosFinancEst_OCDE7) as NAlunosFinancEst_OCDE7
, sum(NAlunosFinancEst_OCDE8) as NAlunosFinancEst_OCDE8
, sum(NAlunosFinancEst_OCDE9) as NAlunosFinancEst_OCDE9
, sum(CASE WHEN SexoAlunos_OCDE1 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE1
, sum(CASE WHEN SexoAlunos_OCDE1 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE1
, sum(CASE WHEN SexoAlunos_OCDE2 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE2
, sum(CASE WHEN SexoAlunos_OCDE2 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE2
, sum(CASE WHEN SexoAlunos_OCDE3 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE3
, sum(CASE WHEN SexoAlunos_OCDE3 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE3
, sum(CASE WHEN SexoAlunos_OCDE4 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE4
, sum(CASE WHEN SexoAlunos_OCDE4 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE4
, sum(CASE WHEN SexoAlunos_OCDE5 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE5
, sum(CASE WHEN SexoAlunos_OCDE5 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE5
, sum(CASE WHEN SexoAlunos_OCDE6 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE6
, sum(CASE WHEN SexoAlunos_OCDE6 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE6
, sum(CASE WHEN SexoAlunos_OCDE7 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE7
, sum(CASE WHEN SexoAlunos_OCDE7 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE7
, sum(CASE WHEN SexoAlunos_OCDE8 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE8
, sum(CASE WHEN SexoAlunos_OCDE8 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE8
, sum(CASE WHEN SexoAlunos_OCDE9 = 1 THEN 1 ELSE NULL END) as SexoFAlunos_OCDE9
, sum(CASE WHEN SexoAlunos_OCDE9 = 0 THEN 1 ELSE NULL END) as SexoMAlunos_OCDE9
, AVG (CASE WHEN IdadeAlunos_OCDE1 <> 0 THEN IdadeAlunos_OCDE1 ELSE NULL END) as
MediaIdadeAlunos_OCDE1
, AVG (CASE WHEN IdadeAlunos_OCDE2 <> 0 THEN IdadeAlunos_OCDE2 ELSE NULL END) as
MediaIdadeAlunos_OCDE2
, AVG (CASE WHEN IdadeAlunos_OCDE3 <> 0 THEN IdadeAlunos_OCDE3 ELSE NULL END) as
MediaIdadeAlunos_OCDE3
, AVG (CASE WHEN IdadeAlunos_OCDE4 <> 0 THEN IdadeAlunos_OCDE4 ELSE NULL END) as
MediaIdadeAlunos_OCDE4
, AVG (CASE WHEN IdadeAlunos_OCDE5 <> 0 THEN IdadeAlunos_OCDE5 ELSE NULL END) as
MediaIdadeAlunos_OCDE5
, AVG (CASE WHEN IdadeAlunos_OCDE6 <> 0 THEN IdadeAlunos_OCDE6 ELSE NULL END) as
MediaIdadeAlunos_OCDE6
, AVG (CASE WHEN IdadeAlunos_OCDE7 <> 0 THEN IdadeAlunos_OCDE7 ELSE NULL END) as
MediaIdadeAlunos_OCDE7
, AVG (CASE WHEN IdadeAlunos_OCDE8 <> 0 THEN IdadeAlunos_OCDE8 ELSE NULL END) as
MediaIdadeAlunos_OCDE8
```

```
, AVG (CASE WHEN IdadeAlunos_OCDE9 <> 0 THEN IdadeAlunos_OCDE9 ELSE NULL END) as
MediaIdadeAlunos_OCDE9
--into IES_alunos
from #tmp2
group by CO_IES
order by IES
```

To generate a table to characterize the Higher Education Institutions according to their professors:

```
drop table #tmp3
Select *
, case when [CO_ESCOLARIDADE_DOCENTE] like '1' then 1 else 0 end as Escolaridade1
, case when [CO_ESCOLARIDADE_DOCENTE] like '2' then 1 else 0 end as Escolaridade2
, case when [CO_ESCOLARIDADE_DOCENTE] like '3' then 1 else 0 end as Escolaridade3
, case when [CO_ESCOLARIDADE_DOCENTE] like '4' then 1 else 0 end as Escolaridade4
, case when [CO_ESCOLARIDADE_DOCENTE] like '5' then 1 else 0 end as Escolaridade5
, case when [IN_SEXO_DOCENTE] like '0' then 1 else 0 end as DocenteMasculino
, case when [IN_SEXO_DOCENTE] like '1' then 1 else 0 end as DocenteFeminino
, case when [CO_SITUACAO_DOCENTE] like '1' then 1 else 0 end as DocenteExercicio
, case when [CO_SITUACAO_DOCENTE] like '2' then 1 else 0 end as DocenteAfastQualif
, case when [CO_SITUACAO_DOCENTE] like '3' then 1 else 0 end as DocenteAfastActExternas
, case when [CO_SITUACAO_DOCENTE] like '4' then 1 else 0 end as DocenteAfastOutros
, case when [CO_SITUACAO_DOCENTE] like '5' then 1 else 0 end as DocenteAfastSaude
into #tmp3
from DM_DOCENTE
```

```
Select cast(co_ies as int) as IES
, count(co_docente) as numDocentes
, sum(Escolaridade1) as NumDocEscolaridade1
, sum(Escolaridade2) as NumDocEscolaridade2
, sum(Escolaridade3) as NumDocEscolaridade3
, sum(Escolaridade4) as NumDocEscolaridade4
, sum(Escolaridade5) as NumDocEscolaridade5
, sum(DocenteMasculino) as NumDocMasculino
, sum(DocenteFeminino) as NumDocFeminino
, sum(DocenteExercicio) as NumDocExercicio
, sum(DocenteAfastQualif) as NumDocAfastQualif
, sum(DocenteAfastActExternas) as NumDocAfastActExternas
, sum(DocenteAfastOutros) as NumDocAfastOutros
, sum(DocenteAfastSaude) as NumDocAfastSaude
--into IES_docentes
from #tmp3
group by CO_IES
order by IES
```

To generate a table to join all the Higher Education Institutions above data:

```
Select * from IES_Receitas, IES_cursos, IES_docentes
where IES_Receitas.CO_IES=IES_cursos.CO_IES and IES_Receitas.CO_IES=IES_docentes.ies
order by IES_Receitas.CO_IES
```

APPENDIX H – HEIs which obtained a 5-scored in the IGC Index, 2010-2015

Code	HEI	Federal State
2969	Instituto Superior de Educação Ocidente (OCIDEMNTE)	BA
2	Universidade de Brasília (UNB)	DF
1326	Faculdade Capixaba da Serra (MULTIVIX SERRA)	ES
2397	Faculdade Fucape (FUCAPE)	ES
890	Escola de Governo Professor Paulo Neves de Carvalho (EG)	MG
849	Faculdade Jesuíta de Filosofia e Teologia (FAJE)	MG
598	Universidade Federal de Itajubá (UNIFEI)	MG
592	Universidade Federal de Lavras (UFLA)	MG
575	Universidade Federal de Minas Gerais (UFMG)	MG
8	Universidade Federal de Viçosa (UFV)	MG
597	Universidade Federal do Triângulo Mineiro (UFTM)	MG
779	Faculdade de Ponta Porã (FAP)	MS
15001	Universidade Federal da Integração Latino-Americana (UNILA)	PR
1851	Escola Brasileira de Administração Pública e de Empresas (EBAPE)	RJ
2591	Escola Brasileira de Economia e Finanças (EBEF)	RJ
3614	Escola de Ciências Sociais	RJ
1030	Faculdade de Economia e Finanças IBMEC (Faculdades IBMEC)	RJ
633	Instituto Militar de Engenharia (IME)	RJ
586	Universidade Federal do Rio de Janeiro (UFRJ)	RJ
1382	Faculdades Est (EST)	RS
717	Fundação Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA)	RS
581	Universidade Federal do Rio Grande do Sul (UFRGS)	RS
4756	Centro Universitário Municipal de São José (USJ)	SC
585	Universidade Federal de Santa Catarina (UFSC)	SC
151	Escola de Administração de Empresas de São Paulo (FGV-EAESP)	SP
2128	Escola de Direito de São Paulo (FGV DIREITO SP)	SP
2129	Escola de Economia de São Paulo (EESP)	SP
4943	Escola Superior de Administração e Gestão Strong da Baixada Santista	SP
1438	Faculdade de Administração de Empresas (FACAMP)	SP
149	Faculdade de Medicina de São José do Rio Preto (FAMERP)	SP
4024	Faculdade de Tecnologia de Mococa (FATEC)	SP
1874	Faculdade de Tecnologia de Ourinhos (FATEC)	SP
1520	Faculdade FIA de Administração e Negócios (FFIA)	SP
15401	Faculdade Fipecafi (FIPECAFI)	SP
1946	Faculdade Legale (FALEG)	SP
2368	Faculdade São Leopoldo Mandic	SP
4925	Fundação Universidade Federal do ABC (UFABC)	SP
1161	Inspere Instituto de Ensino e Pesquisa (INSPER)	SP
602	Instituto Tecnológico de Aeronáutica (ITA)	SP
54	Universidade Estadual de Campinas (UNICAMP)	SP

56	Universidade Estadual Paulista Júlio de Mesquita Filho (UNESP)	SP
7	Universidade Federal de São Carlos (UFSCAR)	SP
591	Universidade Federal de São Paulo (UNIFESP)	SP

APPENDIX I – HEIs focused in a specific area which obtained a 5-score in IGC Index, 2010-2015

Code	HEIs	Federal State
2969	Instituto Superior de Educação Ocidente (OCIDEMNTE)	BA
2397	Faculdade Fucape (FUCAPE)	ES
890	Escola de Governo Professor Paulo Neves de Carvalho (EG)	MG
1851	Escola Brasileira de Administração Pública e de Empresas (EBAPE)	RJ
2591	Escola Brasileira de Economia e Finanças (EBEF)	RJ
1030	Faculdade de Economia e Finanças IBMEC (Faculdades IBMEC)	RJ
633	Instituto Militar de Engenharia (IME)	RJ
151	Escola de Administração de Empresas de São Paulo (FGV-EAESP)	SP
2128	Escola de Direito de São Paulo (FGV DIREITO SP)	SP
2129	Escola de Economia de São Paulo (EESP)	SP
4943	Escola Superior de Administração e Gestão Strong da Baixada Santista	SP
149	Faculdade de Medicina de São José do Rio Preto (FAMERP)	SP
1520	Faculdade FIA de Administração e Negócios (FFIA)	SP
1946	Faculdade Legale (FALEG)	SP
2368	Faculdade São Leopoldo Mandic	SP
1161	Inspere Instituto de Ensino e Pesquisa (INSPER)	SP
602	Instituto Tecnológico de Aeronáutica (ITA)	SP

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PhD

