



Teacher Training in Mathematics for Elementary School: a Comparative Study Between Brazil and Portugal¹

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ABSTRACT

This article aims to carry out a comparative study on the initial training of teachers for the first years of schooling, between Brazil and Portugal, with an analytical focus on professional knowledge for the teaching of mathematics. The first material of analysis was the current legislation of the two countries, having as an initial milestone, in Brazil, the LDB/1996 and, in Portugal, the Bologna Declaration/1999. Next, the Pedagogical Projects of the Pedagogy Course in 40 Brazilian public institutions and, in Portugal, the Study Plans of 1st Cycle Degrees and the respective Professional Masters from nine public institutions. In the analysis of this material, in addition to the course workload for mathematical training, the nomenclature of the subjects in this area and their menus were highlighted. For analysis of the menus, two *corpora textuais* (Brazilian and Portuguese context) were constituted, presenting, with *IraMuTeq* software, a hierarchical classification descending from the class distribution, having as reference a literature about professional knowledge to teach mathematics. The results show that the didactic load destined to the formation of knowledge necessary to teach Mathematics in the first years of schooling, in Portugal, is almost ten times higher than in Brazil. And what is taught in Brazil in relation to the specialized training of the future teacher with a degree in Pedagogy is not always focused on the teaching content of that level, and may be restricted only to numbers and operations, leaving aside: geometry and measurements, algebra and statistics and probability, for example.

KEYWORDS: Teacher education. Teachers who teach mathematics. Degree in pedagogy. Degree for elementary school. Comparative research.

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Formação Docente em Matemática Para os Primeiros Anos da Escolarização: Estudo Comparativo Brasil-Portugal

RESUMO

Este artigo objetiva realizar um estudo comparativo sobre a formação inicial de professores para os primeiros anos da escolarização, entre Brasil e Portugal, tendo como foco analítico os conhecimentos profissionais para o ensino de Matemática. Foram tomados como material de análise, primeiro, as legislações atuais dos dois países, tendo como marco inicial, no Brasil, a LDB/1996 e, em Portugal, a Declaração de Bolonha/1999. Em seguida, os Projetos Pedagógicos de Curso de Pedagogia em 40 instituições públicas brasileiras e, em Portugal, os Planos de Estudo de Licenciaturas do 1º ciclo e dos respectivos Mestrados Profissionalizantes de nove instituições públicas. Na análise desse material, destacou-se, além da carga horária do curso destinada à formação matemática, a nomenclatura das disciplinas dessa área e suas ementas. Para análise das ementas constituíram-se dois *corpora textuais* (contexto brasileiro e português), apresentando, com o software *IraMuTeq*, uma classificação hierárquica descendente da distribuição de classes, tendo como referência uma literatura sobre conhecimentos profissionais para ensinar Matemática. Os resultados mostram que a carga didática destinada à formação de conhecimentos necessários para ensinar Matemática nos primeiros anos da escolarização, em Portugal, é quase dez vezes superior à do Brasil. E o que se ensina, no Brasil, em relação à formação especializada do futuro professor com Licenciatura em Pedagogia nem sempre é focado nos conteúdos de ensino desse nível, podendo ficar restrito apenas aos números e operações, deixando de lado: geometria e medidas, álgebra e estatística e probabilidade, por exemplo.

PALAVRAS-CHAVE

Formação de professores. Professores que ensinam matemática. Licenciatura em pedagogia. Licenciatura 1º ciclo. Pesquisa comparativa.

Formación Docente en Matemáticas Para los Primeros Años de Escolaridade: un Estudio Comparativo Entre Brasil y Portugal

RESUMEN

Este artículo tiene como objetivo realizar un estudio comparativo sobre la formación inicial de docentes para la escuela primaria, entre Brasil y Portugal, teniendo como foco analítico el conocimiento profesional para la enseñanza de las Matemáticas. El primer material de análisis fue la legislación vigente en los dos países, teniendo como hito inicial, en el Brasil, el LDB/1996 y, en Portugal, la Declaración de Bolonia/1999. Luego, los Proyectos pedagógicos del Curso de pedagogía en 40 instituciones públicas brasileñas y, en Portugal, Planes de estudio para cursos de pregrado del 1er ciclo y respectivos Máster profesionales en nueve instituciones públicas. En el análisis de este material, además de la carga del curso para el entrenamiento matemático, se destacó la nomenclatura de las disciplinas en esta área y sus menús. Para el análisis de los menús, se crearon dos corpus textuales (contexto brasileño y portugués), presentando, con el software *IraMuTeq*, una clasificación jerárquica descendente de la distribución de clases, teniendo como referencia una literatura sobre conocimiento profesional para enseñar Matemáticas. Los resultados muestran que la carga didáctica destinada a la formación del conocimiento necesario para enseñar Matemáticas para la escuela primaria, en Portugal, es casi diez veces mayor que en Brasil. Y lo que se enseña, en Brasil, en relación con la formación especializada del futuro profesor en Pedagogia no siempre se centra en los contenidos de enseñanza de este nivel, y puede limitarse solo a números y operaciones, dejando de lado: geometría y medidas, álgebra y estadísticas y probabilidad, por ejemplo.

PALABRAS CLAVE: Formación del profesorado. Profesores que enseñan matemáticas. Licenciatura en pedagogía. Licenciatura do 1º ciclo. Investigación comparativa.

1 Introduction

The training of teachers who teach Mathematics in Basic Education (BE), particularly in the early years of schooling, has been a challenge for education throughout the world. At the end of the last century and beginning of this one, several countries have implemented curricular changes for the initial training of teachers, making this movement a privileged focus of study and research. Thus, this work aims to carry out a comparative study on initial teacher training for the first years of schooling, taking as a reference the curricular designs of this training in Brazil and Portugal, based on the emphasis given to knowledge for the teaching of Mathematics evidenced in number of subjects, workload and the privileged contents of the menus. We have chosen to use the expression first years of schooling to represent a period more or less common between the two countries which includes, in Brazil, Early Childhood Education and the Initial Years of Primary Education (1st to 5th) and, in Portugal, Pre-School Education (three years) and the 1st Cycle of Basic Education (1st to 4th). In this article, we seek to analyze and discuss the initial training in Mathematics Education that enables the future teacher to teach in these early years of schooling.

The option to take as an object of analysis the training of teachers who teach Mathematics in these two countries is justified by the curricular changes in higher education systems that have occurred in both countries since the year 2000.

Within these changes, Higher Education Institutions (HEIs) have assumed a prominent role in the curricular reformulations of courses that qualify teachers for teaching. The movement that has occurred in Brazil and Portugal has been effective since the definition of a public educational policy, although it happens at different times and in different contexts, but with the common goal of improving professional qualification.

The training of teachers has been a focus of study throughout the teaching experience of the authors of this work in higher education. The first author has been working with subjects focused on the pedagogical formation in Mathematics in the Degree in Pedagogy, aiming at the constitution and expansion of the repertoire of professional knowledge of future teachers. The second author has been developing formative activities in the Mathematics Degree, besides the formation of researchers in the area of Mathematics Education, focusing on the formation and professional development of the teacher in the area, who teaches at all levels of education.

The studies and experience in the formation of Mathematics teachers were enhanced from the theoretical contributions of Ball *et al* (2008), by deepening the initial contributions of Shulman (1986) on the basic knowledge for teaching. Ball *et al* (2008) distinguish **two domains of Knowledge of Content for Teaching**: specific knowledge of the content of teaching and didactic-pedagogical knowledge of the content of teaching. Each of these domains is subdivided into three sub-domains. In the case of Mathematics, **the subdomains of Content Specific Knowledge are:**

- **Common knowledge of mathematics** is what everyone needs to know and learn to solve problems or use it socially in everyday activities;
- **The specialized knowledge of school mathematics** is the knowledge of the content necessary to teach mathematics and that is directly linked to the teaching context, being fundamental for the teacher to be able to explore it and mediate it didactically-pedagogically in the classroom;
- **The knowledge of mathematical content on the horizon** is a broader knowledge of the common knowledge of mathematics and of the specialized knowledge related to the level of teaching where the teacher acts, which implies a historical and epistemological knowledge of Mathematics as a field of knowledge and of the relationships and connections between the different sub-areas of this and its presence and function in other disciplines and other fields of knowledge.

Ball *et al.* (2008) still distinguish three subdomains of **didactic-pedagogical knowledge from teaching content**: knowledge of school mathematics and its relationship with students at their different levels of education; knowledge of school mathematics and its teaching; and knowledge of school mathematics from the perspective of the curriculum.

Taking the Brazilian context in relation to the contributions of Ball *et al.* (2008), we noticed that, considering the period of schooling, on average 12 years studying mathematical knowledge at school, most students who enter the Degree in Pedagogy present difficulties in relation to the common knowledge of Mathematics. We understand that this problem amplifies the challenge of initial teacher training in relation to this field, since, in addition to learning the specialist knowledge to teach Mathematics, the future teacher needs to learn the common knowledge that he or she could not learn during basic schooling.

On the other hand, much of the mathematical knowledge acquired by students during basic schooling should be the subject of reflection and problematization in initial formation. This is because many of the contents learned and that are part of the common knowledge can contain conceptual and procedural errors, mainly contents such as division, fractions, geometry and measures. In addition, we often find Pedagogy students with a history of failure in this discipline, some even have a traumatic relationship with mathematics, even aversive, and the trainer is responsible for a work of deconstruction of these stereotypes.

In this regard, Gatti and Nunes (2014) recommend that:

It is with this background of students that teachers in undergraduate programs must work; for this reason, it is important to have good curricular and didactic planning, with the creation of cultural stimuli and utilization of the motivation that these segments carry. For this, however, it is necessary not only an adequate pedagogical involvement with the graduates but also an institutional project for the reception and training of these students (GATTI and NUNES, 2014, p. 49).

This problem led to the following question: How have undergraduate courses for the first years of schooling faced the conceptual and procedural difficulties of students in relation to school content? What space and time have these courses been devoted to the specialized

training of the teacher who teaches Mathematics? What contents and knowledge of teaching in Mathematics have been privileged in these courses in Brazil? Does this also happen in other countries?

To answer these study questions, we have chosen to carry out a comparative study between the initial training of teachers in Brazil and in Portugal, in relation to the first years of schooling, taking as a reference the curricular designs of the undergraduate courses in these countries, with a focus on teaching knowledge related to the teaching and learning of Mathematics.

For this purpose, we present below a brief characterization of teacher training in Brazil and Portugal, the methodological path of the comparative study, highlighting the procedures for collecting and analyzing the information and, finally, the analysis and discussion of the results.

2 Initial Teacher Training in Brazil and Portugal

The reforms in higher education are driven by several factors, among which we highlight the reform of legislation that guides and regulates educational policy, the academic research that deals with teacher training and the social transformations that require the training of qualified professionals for the contemporary world. This process gained intensity at the end of the last century and, although it takes place in different contexts and with different actors, it involves the definition of a State policy for Higher Education.

2.1 Brazilian Context in Initial Teacher Training

The time frame of the Brazilian educational context that we considered for this study was the promulgation of the National Education Guidelines and Bases Law 9394/96 (LDB), as a teacher training policy (according to chapter VI: articles 61 to 67), as well as the approval of resolutions for teacher training. For its implementation, there was a need to design a new Higher Education curriculum, aiming at the training of Basic Education professionals capable of responding to social and cultural demands.

This scenario is also marked by academic reflection on the formation of teachers, based on studies and research on the teacher and his training and professional knowledge under new paradigms of the teacher as intellectual or professional reflective or, also, investigative of his practice (SHULMAN, 1986; NOVOA, 1995; GERALDI *et al*, 1998; COCHRAN-SMITH and LYTLE, 1999, among others).

In the bulge of this movement, the National Curricular Guidelines for the training of Basic Education teachers (NCGDP) were instituted in 2002 by means of Resolution CNE/CP No. 1/2002. These guidelines gave rise to the curricular guidelines for each specific degree course. In the case of the Degree in Pedagogy, its guidelines were instituted by means of Resolution CNE/CP No. 1 of 15 May 2006, without necessarily meeting all the requirements of the NCGDP, although they expand on some aspects.

DCNFP/2002 was repealed by means of Resolution CNE/CP no. 2/2015, which defined the National Curricular Guidelines for initial training at the higher level (undergraduate courses, pedagogical training courses for graduates and second-degree courses) and for continuing training (DCNFIC). This resolution contemplated the educational standards for initial and continuing training, recognizing as the responsibility of the educational system and educational institutions the definition of policies for the appreciation of the teaching profession. At the same time that higher education institutions are in the process of curriculum reforms to meet these training guidelines, we have the approval of the CNE/CP Opinion No. 22/2019 and, consequently, the repeal of the CNE/CP Resolution No. 2/2015, through Resolution CNE/CP No. 2 of December 20, 2019. This defines the National Curricular Guidelines for the Initial Training of Teachers for Basic Education and establishes the Common National Base for the Initial Training of Teachers for Basic Education (BNC-Training).

In this historical process of building the curricular matrix and defining the professional profile, the Degree in Pedagogy was submitted to several curricular changes, changing from a bachelor's course to a degree course, although the bachelor bias remains dominant. The Pedagogy course, according to Saviani (2007), was initially "defined as a bachelor's degree alongside all the other courses [...] a bachelor's degree would be obtained by means of the didactic course, lasting one year, added to the bachelor's course. This is the origin of the famous '3+1 scheme". (p. 117).

In relation to the National Curricular Guidelines for the Degree in Pedagogy (NCGDP), instituted in 2006, it should be noted that these reinforce the idea that the Degree in Pedagogy continues to be the main locus of teacher training for teaching functions "in Early Childhood Education and in the Initial Years of Elementary School, in the High School courses, in the Normal mode, Professional Education in the area of services and school support and in other areas in which pedagogical knowledge is provided" (BRAZIL, 2006, Art. 4).

Based on these NCGDP, each HEI started to formulate its proposal for the Pedagogical Course Project (PCP) of Pedagogy Degree. There was, thus, the intentionality of implementing a professional training project that met the legal provisions and, at the same time, provided the teacher with a solid theoretical-scientific basis of the knowledge needed for teaching in a multidisciplinary perspective, as well as the construction of his professional identity.

These guidelines provide for the formation of a professional qualified to work in the teaching of all areas of the national common basis of the school curriculum in the early years of schooling. Thus, Resolution 01/2006, in Art. 7, defines 3,200 hours as minimum workload, with the following distribution:

I - 2,800 hours dedicated to training activities such as assistance to classes, holding seminars, (...) participation in cooperative study groups; II - 300 hours dedicated to the Supervised Internship in Early Childhood Education and in the initial years of Elementary School, (...) according to the institution's pedagogical project; III - 100 hours of theoretical and practical activities (...) of scientific initiation, extension and monitoring (BRAZIL, 2006, p.4).

This workload is distributed in three nuclei that compose the structure of the Pedagogy Course: basic studies nucleus; deepening and diversification studies nucleus and integrating studies nucleus (Art. 6). The formation focused on the school contents appears only in the basic studies nucleus, thus discriminated: "decoding and use of codes of different languages [...] didactic work with contents pertinent to the first years of schooling, relative to the Portuguese Language, Mathematics, Sciences, History and Geography, Arts, Physical Education" (BRAZIL, 2006, p.03). However, the Resolution does not specify the minimum workload for each of these areas of knowledge.

Although we intend, in this study, to verify how each PCP interprets and applies this resolution in practice, Saviani (2007) has already advanced a first observation regarding this problem:

[...] the new national curriculum guidelines for the Pedagogy Course are both extremely restricted and too extensive: very restricted in essence and rather excessive in accessory. They are restricted in what is essential, that is, what configures pedagogy as a theoretical-practical field endowed with an accumulation of knowledge and experiences resulting from centuries of history. But they are extensive in the accessory, that is, they expand into multiple and repetitive references to the language in evidence today, impregnated with expressions such as environmental-ecological knowledge; plurality of worldviews; interdisciplinarity, contextualization, democratization; ethics and affective and aesthetic sensibility; social, ethnic-racial, economic, cultural, religious, political exclusions; diversity; differences; genders; generational groups; sexual choices [...] (SAVIANI, 2007, p.127).

As for the performance of the professional of the Degree in Pedagogy, in this study, the focus was on the formation of the pedagogue for performance in the Kindergarten and pre-school (from 0 to 5 years) and Elementary School - Initial Years: 1st to 5th year (6 to 10 years), in accordance with what is provided by LDB 9394/94. This legislation gained a new wording from Law 12.796/2013, consolidating the free and compulsory Basic Education from 4 (four) to 17 (seventeen) years, organized into three levels: a) Pre-School; b) Elementary School; c) High School (BRAZIL, 2013).

2.2 Portuguese Context in Teacher Training

For this comparative study, we consider as a temporal delimitation the curricular reforms that have been driven by the implementation of higher education legislation in Portugal, through the Bologna Declaration¹. The process of construction of the European Higher Education Area (EHEA), aiming at "achieving greater compatibility and comparability between higher education systems" and the promotion of "mobility and employability of citizens" (BOLONHA, 1999) has been an important milestone of reflection since its implementation by several European countries.

¹ Joint Declaration of European Ministers of Education, signed in Bologna on 19/06/1999.

Sursock (2011) gives a good overview of this process in Europe:

European higher education has been affected by a number of changes over the past decade, including higher participation rates, internationalization, the growing importance of knowledge-based economies and increased global competition. These changes have resulted in two European policies - the Bologna Process and the Lisbon Strategy. The Lisbon Strategy aims to make Europe the most competitive knowledge-based economy in the world, with more emphasis on research and innovation and broad access to education and learning opportunities (SURSOCK, 2011, pp. 69-70).

In this context, objectives concerning the organization of the higher education system were defined through the adoption of "[...] a system with easy equivalence academic degrees, Diploma Supplement; [...] a system based on two main phases, pre-licentiate and post-licentiate; [...] creation of a credit system - ECTS²" (BOLONHA, 1999, p.01). Portugal, as a participant in the EHEA, follows the criteria established by the Bologna Declaration.

It is important to highlight, with the edition of the Law of Directives and Bases of the Educational System (LDES) No. 115/1997 of 19 September, amended by Law No. 49/2005 of 30 August, the proposal of change regarding the professional qualification of teachers. This occurred because kindergarten teachers and teachers of the 1st cycle of Basic Education (EB) were graduated in bachelor's degrees and, from this law on, have 'the degree of licentiate', according to Art. 31, item 1:

Early childhood educators and primary and secondary school teachers acquire professional qualification through higher education courses that confer the degree of licentiate, organized according to the needs of professional performance in their level of education and teaching (PORTUGAL, 2005b, p. 5123).

Thus, the training model now offers courses that are structured in three cycles in university education (bachelor's, master's and doctorate) and polytechnic education (bachelor's and master's), according to the new wording of LDES, through Law No. 49/2005 of August 30 (PORTUGAL, 2005b, p. 5129).

This structure presents a cycle of studies that includes, in the bachelor's degree, between six and eight semesters and, in the master's degree, between three and four semesters, this being considered the period to train the teacher in pre-school education and basic education of the 1st cycle, requiring "the academic degree of master in education justified as a way to offer opportunities [...] through qualified training" (NUNES and NUNES, 2013, p.205). In this context, master's studies, in university education, are of "an academic nature, with recourse to research, innovation or the deepening of professional skills", and, in polytechnic education, master's studies are of "a professional nature", with pre-school education courses and 1st and 2nd cycle EB courses being developed in Higher Education Schools (ESE) (PORTUGAL, 2012).

² European Credit Transfer System: Sistema Europeu de Transferência de Créditos (ECTS) que é baseado no princípio de créditos, correspondendo 1 crédito ECTS a 28 horas de trabalho do estudante. Informação disponível em: <http://www.dges.mctes.pt/DGES/pt/Estudantes/Processo+de+Bolonha/Objectivos/ECTS/Etcs.htm>. Acesso em: 12 jun.2016.

Based on the Bologna process and the new legislation of the Portuguese education system, a curricular design was elaborated to meet these norms and, especially, what is dealt with by Decree-Law 43/2007³, thus configuring the curricular structure of the Degree in EB (Art. 15) and the Master (Art. 16) with a workload of 180 credits, thus distributed:

The number of credits in the cycle of studies leading to the degree of Basic Education graduate is 180. The credits are distributed among the training components as follows: a) General educational training: 5 to 20 credits; b) Specific didactics: 15 to 20 credits; c) Initiation to professional practice: 15 to 20 credits; d) Teaching training: 120 to 135 credits (Art. 15)

The number of credits in study cycles leading to a master's degree is from 90 to 120 credits thus distributed with the respective minimum percentage: a) General educational training (5%); b) Specific didactics (20%); c) Supervised teaching practice (45%); d) Teaching training (25%) (Art. 16, PORTUGAL, 2007, p.1324).

We highlight that, in the Degree in EB, the credits for training in the area of teaching are from 120 to 135 credits, being at least distributed as follows: 30 credits in Portuguese; 30 in Mathematics; 30 in Environmental Studies (Nature Sciences, History and Geography of Portugal); 30 in Expressions (PORTUGAL, 2007, p. 1327).

We identified as a differential in relation to the Brazilian reality the recognition, in terms of legislation, of the valorisation of school contents in teacher training. For example, for training in the area of Mathematics, Portuguese legislation requires compliance with 30 credits, or at least 840h of study involving Mathematics and its teaching, excluding, from that total, the workload for teaching in that area.

In this scenario of legal determinations, driven by a global educational agenda, teacher training in Portugal is defined as "a generalist professional training achieved through a degree in basic education. This will necessarily continue in a master's degree course in teaching, academic or vocational" (NUNES; NUNES, 2013, p. 204).

As for the fields of action of the teacher in the Portuguese educational system, according to LDSE 49/2005, they comprise the following organization:

1. pre-school education: intended for children aged between 3 and 6 years up to 15 September;
2. Basic education: children aged 6 years between 16 September and 31 December. Basic education comprises three sequential cycles, the 1st of four years, the 2nd of two years and the 3rd of three years;
3. The secondary education courses last three years (PORTUGAL, 2005b, p. 5126) (emphasis added).

For the present study, only the curricular designs aimed at the initial formation of teachers in the degree courses of EB, with or without integrated master's degree, related to the fields of operation in pre-school education (three years) and 1st cycle of basic education (four years) in the Portuguese context will be analyzed. We exclude, in this work, the information related to the 2nd cycle (corresponding to the 5th and 6th years in Brazil).

³ <http://www.dges.mctes.pt/NR/rdonlyres/40A12447-6D29-49BD-B6B4-E32CBC29A04C/1139/DL432007.pdf>

3 Methodological Paths of This Study

In view of the purpose of this work - to carry out a comparative study on teacher training for the first years of schooling based on the curricular designs of undergraduate courses in Brazil and Portugal, with emphasis on knowledge related to the teaching of Mathematics - we opted for the methodological perspective of comparative education.

Noah and Ecksteisn (1969) argue that studies in comparative education are necessary to establish important relationships between the phenomena studied in a scientific way. In this sense, they point out some fundamental phases in comparative research: (1) identification of the problem; (2) formulation of hypotheses; (3) definition of concepts and indicators; (4) selection of cases (or educational systems to be studied); (5) data collection; (6) data processing; (7) interpretation of results (NOAH; ECKSTEISN, 1969). Thus, in the development of this work, these phases were indicative.

The task of knowing and comparing what higher education systems bring in their curricular designs, in undergraduate courses, allows us to understand the knowledge that is privileged to qualify the education professionals who work in these different systems.

Our interest in comparing the teaching system in Brazil and Portugal aims at problematizing the mathematical formation of the teacher who teaches the first years of schooling in Brazil, in order to carry out a dialogue between different ways of thinking and to promote the formation of teachers for this type of teaching in the Brazilian and Portuguese context. In Portugal, there is an academic community that develops important studies in the area of Mathematics Education and Teacher Training that teach Mathematics, which contributed to the 2008 curricular reform process. Thus, the comparison between these two contexts can elucidate our differences and similarities and better situate our problems in relation to the professional training of teachers. The insights derived from this comparative study may bring other perspectives and possibilities in teacher training for the early years of schooling.

To develop this study, we have formulated the following investigative question: *What specific knowledge for the teaching of Mathematics is privileged in the curricular designs of teacher training for the first years of schooling, in the Brazilian context and in the Portuguese context?*

Anchored in this question and having the purpose of studying the curricular designs for the first years of schooling regarding mathematics education, we formulate the following specific objectives of the study: *To map the teaching contents in the area of Mathematics, Mathematics Education and correlated, through the curriculum menus, identifying the theoretical and methodological contributions privileged for the formation of the teacher who teaches Mathematics in the first years of schooling; To compare the mathematics formation of the teacher for the first years of schooling, in Brazil and in Portugal, as a way of identifying and problematizing similarities and differences.*

In view of these objectives, we carry out a time cut and the higher education institutions that offer initial teacher training for the first years of schooling. In terms of time clipping, we have established as a milestone, in Brazil, the educational legislation, more specifically, LDB/1996. In Portugal, the milestone was the Bologna Declaration/1999. Regarding the definition of institutions, we selected the public ones, although the Portuguese institutions, being in the public subsystem category, require the collection of a fee⁴ paid by students. Thus, the universe contemplated in the study was constituted by institutions of reference in the states/districts in the formation of teachers, with offer in the modality in person, independent of the working shift and that they make available in the sites the data analyzed in this study. Moreover, in Brazil, the number of Pedagogy courses counted, in 2016, around 1,200 courses, however, the data, analyzed here, represent only 3.3% (40 courses) of this total. In relation to Portugal, of the 52 (28 Polytechnic Institutes and 24 Universities) existing 1st cycle degree courses, in 2016, the data analyzed here represent 17% (09 courses) of this total. Table 1 below shows the number of institutions included in the study.

Table 1. Criteria and number of courses selected for study

BRAZIL	PORTUGAL
Licn1 - Degree in Pedagogy - professional training for Early Childhood Education and Initial Years of Elementary School	Licn2 - Basic Education Degree (LEB); Master in: Pre-School Education (MEPE) and Pre-School and Primary Education (MEPEEB)
IES: 30 (thirty) Federal and 10 (ten) State - located in the capitals of the federation (preferably)	IESP: 04 (four) Universities and 05 (five) Polytechnic Institutes (IP) through the ESE - located in the districts (preferably)

Source: Survey of data on websites, 2016

The comparative study had as an empirical source the documents made available on the websites of Brazilian and Portuguese institutions. In Brazil, we consulted the following documents: LDB 9394/96 and DCNPed; Pedagogical Course Project (PPC) of the Degree in Pedagogy. In Portugal, the following documents: Bologna Declaration of 1999, Referential European Dimension of Education of March 2016, LDB (Resolutions and Opinions of the Educational Area); Study Plans (PE) of the Degree in Basic Education and of the Master.

In possession of the curricular designs of the PPC and PE, we identify the compulsory (Dob) and optional (Dop) subjects (name, period, menu, workload) focused on mathematical education. Besides this information, we also include: name of the course, professional profile, total workload of the course. For data collection in each PPC and PE, we used the following keywords: mathematics, teaching, didactics, methodology and education.

⁴ In accordance with LDSE No 49/1995, Article 16 [...], subsection 2 - The tuition fee shall be fixed in accordance with the nature of the courses and their quality, with a minimum value corresponding to 1.3 of the national minimum wage (EUR 530.0 - 2016) in force and a maximum value which may not exceed the value set out in Article 16(2). Article 1(2) of the table annexed to Decree-Law No. 31 658 of November 21, 1941, updated, for the previous calendar year, through the application of the Consumer Price Index of the National Statistics Institute (PORTUGAL, 1995, p. 5124).

For the comparative analysis of the data, two textual corpora were organized. The first corpus, consisting of 69 menus (Dob), corresponds to 40 Licn1 courses in Brazil. The second corpus, consisting of 72 menus (Dob and Dop⁵), corresponds to nine courses of Licn2 (LEB) and nine courses of MEPE and/or MEPEEB in Portugal (see Table 1).

Each menu was considered an Initial Context Unit (ICU), submitted to basic lexicographical analysis (calculation of the frequency of words present in the analyzed menus) and to multivariate analysis (Descending Hierarchical Classification (CHD)⁶). The software searches for the cooccurrences of the words and organizes the information considered significant in Classes, having as purpose the comparative analysis and the relations among them. After this data treatment, the software generates a report identifying the Classes and presents, from the textual clippings representative of each one of them, a list of the most significant words, as well as the CHD graphics.

In addition to this comparative analysis of the formative studies in the area of Mathematics, we also analyze the percentage of these studies in the ratio of the total workload of the course to the total workload of the subjects in this area. Another aspect of analysis was the profile and professional qualification prescribed in the legislation and curricula of the courses in the Brazilian and Portuguese contexts.

4 Analyses and Results

The teacher training courses in Brazil and Portugal, highlighted for this study, bring important elements to a comparative analysis and present differences, similarities and distinct emphases in relation to the professional training of teachers for the first years of schooling

4.1 Comparative Analysis of Professional Profile and Workload for Mathematical Training

The analysis of the professional profile, expressed by the PPC of the 40 Brazilian courses selected for this study, shows the following composition: 20 courses aim at teaching in EI/AI and Educational Management (GE); 10 courses focus only on teaching in EI/AI; 04 courses aim at teaching in EI/AI, Youth and Adult Education and GE; 04 courses are aimed at teaching in EI/AI and Normal modality courses and GE; and 02 courses aim at teaching in EI/AI, Special Education and GE. We observe that all the courses aim at teaching formation, being the majority aggregated to another modality of professional performance. It should be noted that the Brazilian resolution does not specify the minimum teaching load required for the formation of each of these profiles, nor the teaching load foreseen for each school content to be taken as an object of formation, being at the discretion of each PCC the definition of the workload for each of the fields of school education.

⁵ Optional subjects: according to the PE of the courses, each area of knowledge has 2 to 3 subjects, the student must choose an optional subject in each area.

⁶Software IRaMuTeq 0.7 alpha2, licensed under the GNU GPL (v2) (CAMARGO & JUSTO, 2016)

In order to check the teacher's mathematical training, we search, together with the CCP, for the workload allocated to this field of study. Table 1 shows the percentage of the total workload of the Dobs for mathematical training that appears in the curriculum designs and the respective number of courses, as well as the average workload allocated to this area, in order to train the teacher who works in the first years of schooling.

Table 1. Schedule of compulsory and optional subjects related to Mathematics in the PPCs of the Degree in Pedagogy in Brazil.

Percentage of CH of the Course	Frequency (fi) - in Number of Courses	Average CH per Course
1,0 à 4,0 %	22	107,3
4,0 à 7,0 %	15	176,3
7,0 à 10,0 %	2	264
10,0 à 13,0 %	1	420
Total - Weighted average:	40	144,9

Source: PPCs of Pedagogy Degree in Brazil.

The data reveal that 55% of the courses only devote 1% to 3.9% of their workload to mathematical training for teaching at the highlighted levels of education. This represents an average of 107 hours, i.e. 3.3% of the total course workload for theoretical and practical studies in Mathematics and its teaching⁷. This figure can show a slight increase in the percentage if we take the weighted average (144.9 hours) per course for all 40 courses analyzed in this study, which corresponds to a total of 4.5% devoted to mathematical training, out of a course of 3,200 hours.

This result confirms the results obtained by Gatti and Nunes (2009, p.26), which indicate that the knowledge relating to specific professional training that make up the curriculum structure of the Degree in Pedagogy in Brazil is equivalent to only 28.9% of the workload of the Dob, being distributed as follows: contents of the curriculum of the children's and fundamental EB (7.5%); specific didactics, teaching methodologies and practices (20.7%); and knowledge related to technology (0.7%).

Thus, taking as a reference the data presented by the authors with regard to the workload for studies in the areas of knowledge (Portuguese Language, Mathematics, Sciences, History, Geography, Arts and Physical Education), we have an average percentage of 4% for each area of school knowledge relating to the level of the first years of schooling in Basic Education.

In Portugal, on the other hand, teacher training is aligned with a paradigm that defends that "professional qualification for teaching in a given field is an indispensable condition for the performance of teaching activity in the curricular areas or subjects covered by it" (PORTUGAL, 2007, p.1322). This training policy has, as a requirement for teaching, an integrated study system, of Licentiate's Degree followed by a Professional Master's Degree.

⁷In Brazil most courses divide the workload into T - Theoretical; P - Practical; E - Internship.

The results of our analysis of the nine integrated Degree and Vocational Master Courses in Portugal are summarized below in Tables 2 and 3.

Table 2. Schedule of compulsory and optional subjects of Mathematics included in the Plan of Studies (PE) of the 1st cycle of Basic Education in Portugal.

Percentage of CH of Course (LEB)	Frequency (fi) - number of Courses	Average CH per Course
15 a 18 %	3	770,7
18 a 21 %	4	926,8
21 a 24 %	2	1052,5
Total - Weighted average:	9	902,7

Source: PE of 1st cycle undergraduate education

Table 3. Hourly load of compulsory subjects of Mathematics in the Masters in Education and Pre-School (MEPE) and in Teaching in the 1st Cycle of Basic Education (MEPEEB) in Portugal.

Percentage of CH of Course (MP)	Frequency (fi) - number of Courses	Average CH per Course
3 a 7 %	4	116,8
7 a 11 %	4	271,8
11 a 15 %	1	300
Total - Weighted average:	9	206

Source: PE of MEPE and MEPEEB in Portugal.

These results reveal that the curricular designs of teacher training courses in Portugal aim at an important workload for conceptual and didactic-pedagogical training in Mathematics, for the future teacher who will teach Mathematics in the Early Years or Pre-School. In Table 2, the data show that 44% of the Lic2 courses allocate an average of 926.8 hours to theoretical-practical studies and tutorial guidance⁸ in the range of 18% to 20.9% of the course credits. In table 3, the data show that 44% of the Master's courses allocate an average of 271.8 hours, in the range of 7% to 11.9% of the credits.

Based on these results, we can state that the teacher, in Portugal, to be able to teach Mathematics in the first years of schooling must have an average of more than 1,000 hours of training activities in the field of Mathematics Education. However, it should be noted here that this significant teaching load aimed at the mathematical training of teachers working in the 1st cycle and Pre-School, in Portugal, is directly linked to Portuguese legislation (Decree-Law 43/2007), which requires a minimum of 30 credits in the undergraduate course, i.e. a minimum of 840 hours of student work dedicated to this specific training. This legislation expresses, thus, "the valorization of knowledge in the teaching field, assuming that the performance of the profession requires the mastery of the scientific, humanistic, technological or artistic content of the disciplines in the teaching curriculum area" (PORTUGAL, 2007, p.1321).

⁸ In Portugal, courses are organized in terms of ECTS (European Credit Transfer System) credits related to students' working time (hours) according to the following typology: T - Theoretical; TP - Theoretical-practical; PL - Laboratorial practice; S - Seminar; OT - Tutorial guidance; TC - Field work; E - Internship; O* - Other works.

In this comparative study, it is worth mentioning that, although in the Degree in Basic Education (LEB), future teachers in Portugal already have an initiation into teaching practice, with internship activities at school, it is in the scope of the Professional Master's that they effectively obtain their professionalization. This is because, in addition to establishing contact with teaching practices at school again, through supervised internship during the MP, they are challenged to take these practices as an object of study and investigation, which may result, from this process, in the development of Master's dissertation projects.

As Lurdes Serrazina - one of the main Portuguese researchers in the field of training teachers who teach Mathematics in the Early Years - justifies, the future teacher needs to know in depth the mathematical knowledge he will teach, his concepts and procedures, "not separating him from his didactic and curricular knowledge, where the teaching practices are simultaneously starting and ending point". Mastery of this knowledge is fundamental, since "it develops the self-confidence of teachers both in their ability to learn mathematics and in teaching it to their students" (SERRAZINA, 2014, 1067).

In summary, comparing the workload of the degree courses of both countries, we see that in practice there is a significant difference in mathematical training. In Brazil, the courses have a low index (average of 144.9 hours per course), while the courses in Portugal show an appreciation attributed to the mastery of this teaching content, destining to this training an average of 902.7 hours in each course at undergraduate level. However, if we consider the compulsory title of master in order to teach in Portugal, the teacher who teaches Mathematics in the first years of schooling has, on average, a total of 1,108.7 hours of conceptual and didactic-pedagogical training in Mathematics. This represents a teaching load 7.6 times greater than that practiced in Brazil.

4.2 Comparative Analysis of the Contents on the Menus

Before we analyses the menus, it is necessary to analyses the nomenclatures of the subjects related to Mathematics that make up the degrees of the two countries. In the Brazilian case, Licn1 disciplines emphasize conceptual/procedural and didactic-pedagogical general aspects of Mathematics teaching. On the other hand, the subjects offered in the Licn2 and Professional Master courses, in Portugal, present a nomenclature based on the mathematical knowledge considered fundamental to the first years of schooling.

The analysis of the teaching contents privileged by the Mathematics area menus for teacher training in the first years of schooling was based on the relationships and correlations between each country's menus. This was done based on the analysis of the relationship between the linguistic context and the textual units of meaning, which are the environments of words, using the software IRaMuTeq 7.0 as an analytical resource. This analysis was made based on the categories of Ball *et al* (2008). We did, initially, a mapping through the word cloud that compose each of the corpus consisting of the menus of the disciplines related to Mathematics, of each country, according to Figure 1.

Figure 1. Word cloud of the corpora of the Mathematics subjects' menus of the undergraduate courses of Brazil (Licn1) and Portugal (Licn2).

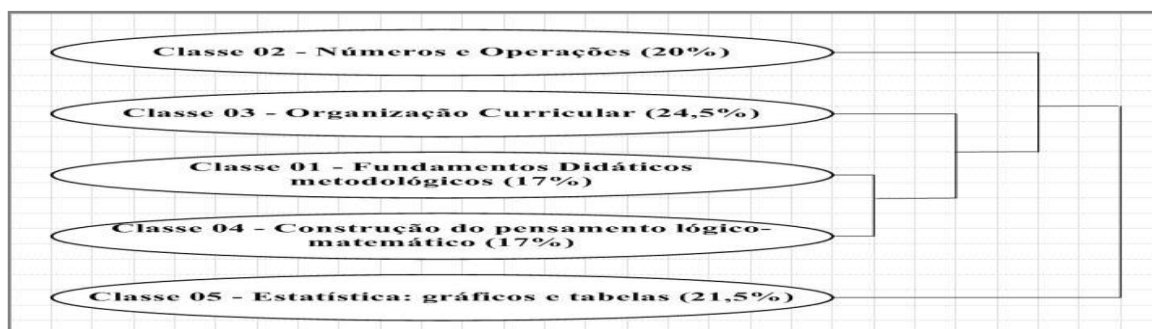


Source: Report produced from the application of IraMuTeq

A first interpretative reading of the word cloud of the Brazilian case (Licn1) reveals that the subjects emphasize general conceptual/procedural and didactic-pedagogical aspects of mathematics teaching, without, however, emphasizing the specific topics or contents to be studied, in view of their importance for teaching in the early school years. On the other hand, the word cloud of the Portuguese case reveals that the subjects offered in the Licn2 and Professional Master courses prioritize the specific topics of the contents to be taught in the first years of schooling, such as: numbers, rational number, operations, geometry, measures, probability, statistics.

The first text corpus, related to Licn1 in the Brazilian context, contains 69 menus or initial context units (ICU), separated by 113 sense nuclei, grouped into five categories of knowledge for teacher's mathematical training. We present figure 2 that illustrates the Descending Hierarchical Classification (DHC), showing the relationship and distribution among the Classes (categories).

Descending Hierarchical Classification - Corpus 1 (Licn 1, Brazil)



Source: Report produced from the application of IRaMuTeq

Class 1 presents a statement related to the didactic-methodological foundations with 17% of discourse analyzed, with the word methodological foundations as the most significant, grouping the following words: methodology; evaluation; pedagogical; didactic and teaching; content, research and resource; objective and activity; practical. We note that this discourse deals with the theorization of 'how' and 'why teach', with predominance of

methodological aspects, from the organization and didactic-pedagogical planning without necessarily establishing deepening and conceptual and procedural problematization of topics or mathematical knowledge that are the object of teaching and learning in the early years of school life. Class 1, therefore, has some approximation to the subdomain "knowledge of school mathematics and its teaching", of Ball *et al.*'s model (2008).

Class 2, which groups 20% of the analyzed discourse, reveals the most significant word, - number, with the following related words: operation; system, natural, decimal and rational; geometry and magnitude; integer and property. These words express that Class 2 has as a central focus of study the mathematical contents or topics that are the object of teaching and learning of the future teacher and, therefore, contemplate the subdomain of specialized knowledge of school mathematics (Numbers and Operations; Geometry), according to Ball *et al.* (2008), this subdomain is considered relevant and fundamental for the professional training of the teacher who teaches Mathematics at the levels in question. This relevance seems to be little valued by the PPCs of the Pedagogy Degree courses in Brazil, since only 1/5 of the teaching load in the area of Mathematics Education is destined to the study of this specialized knowledge for the teaching of this subject in the first years of schooling.

Class 3, according to the analysis pointed out by the software, is the largest of all, since it corresponds to 24.5% of all the didactic load destined to the mathematical formation of the teacher and has as a keyword of greater meaning, in the speech, the curricular organization. The other words that make up this discourse and are in second place are: content; education; conception and theory; youth and adult education and elementary education; teaching; process; mathematics; early childhood education and years; pedagogical. These words are significant for the statements of menus of subjects intended for training in educational legislation and curriculum. Class 3, assuming the classification of Ball *et al.* (2008), is linked to the subdomain knowledge of the content to be taught and the curriculum.

Class 4, which groups 16.9% of the discourse analyzed, brings together the fundamentals of teaching and learning. The word construction is the predominant in relation to the other words: knowledge; logical; thought; learning; conceptual; teaching; development and concept; mathematics; reasoning and application; epistemological. This class groups a discourse aligned with cognitive psychology, with the emphasis on constructivism, because it emphasizes theoretical and methodological studies for the construction of logical-mathematical thinking in the process of teaching and learning. This allows us to associate Class 4 to the subdomain characterized by Ball *et al.* (2008) as "knowledge of school mathematics and its relationship with students".

Class 5 can be linked to the "subdomain knowledge of mathematical content on the horizon" (BALL *et al.*, 2008), occupying 21.5% of the didactic load of the area, because its discourse has Statistics as the most important keyword, being accompanied by other words such as: graphs and tables; central measurement; educational; frequency and distribution; dispersion; data and reading; sample and instrument. This discourse reveals the importance of

the area of Statistics and its relationship with Mathematics. It is worth mentioning that of the 40 courses studied, only eight offer Statistics as mandatory and five offer it as optional. The words highlighted in this class are linked to the use of Statistics as a language of analysis, understanding and explanation of data investigated, contemplating, for example, studies of educational reality.

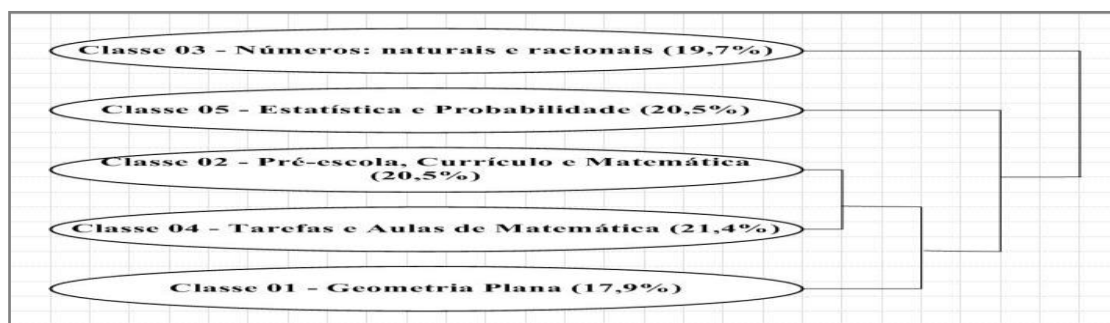
When analyzing the set of these five classes, we can distinguish two categories of emphasis on mathematical and didactic-pedagogical formation of the future teacher of the first years of schooling. One is more focused on the study of concepts and procedures of school mathematics (classes 2 and 5) and the other (classes 1, 3 and 4) is more focused on aspects and trends of a methodological, curricular and psycho-cognitive nature of teaching and learning mathematics.

Classes 1, 3 and 4, which total 58.4% of the discourse that makes up the statements on the menus, prioritize knowledge aimed at theoretical studies without a direct relationship with mathematical knowledge or other knowledge specific to teaching in the early school years. This emphasis, although relevant and necessary from the point of view of teacher training, is predominant in the training of teachers who teach Mathematics at the levels highlighted here and seems to meet what Gatti and Nunes (2009) observed when analyzing the menus of the courses of Pedagogy focused on teaching: "(...) A large number of menus register generic phrases that do not allow identifying specific content. There are institutions that propose the study of teaching content associated with the methodologies, but still in a panoramic and not very in-depth way" (p.22).

On the other hand, **Classes 2 and 5**, which total a smaller percentage (41.5%), seem to refer directly to the contents, that is, to the specific topics of mathematical knowledge required by the teaching and learning of Mathematics in the first years of schooling, such as: Numbers and Operations; Geometry and Measures; Statistics. However, if we consider the subdomains of the specific knowledge of mathematics that the teacher needs to know in order to teach Mathematics in this stage of school education, according to Ball *et al* (2008), we will see that these menus contemplate, only in part, the specialized knowledge of school mathematics and the knowledge of mathematical content on the horizon. This is because these menus do not make reference to basic contents that could bring greater meaning and understanding of numbers and operations, geometry and statistics, in view of their teaching, such as: algebra and algebraic thinking; functional thinking; probabilistic thinking; rational numbers, etc.

The second textual corpus of analysis comprises the Licn2 and Masters Vocational Menus of the Portuguese context, containing 72 menus or UCI. The analysis, using the IRaMuTeq software, allowed us to identify 199 sense nuclei that were grouped in five classes, as shown in figure 3.

Figure 3. Descending Hierarchical Classification - Corpus 2 (Licn 2 and MP), Portugal



Source: Report produced from the application of IraMuTeq

Classes 1 and 3 are linked to the sub-domain of specialist knowledge of school mathematics present in curriculum designs. **Class 1**, with 17.9%, presents, in the discourse analyzed, the words geometry and plan as the most significant, which appear strictly related to the following words: transformations; grandeur, volume and solid; space; ruler and figure; symmetry and estimation; area and similarity; measures. These statements make up a class that we can call **Geometry and Measures**, whose specific knowledge is not neglected in the training of teachers in the early years of schooling in Portugal.

Class 3 includes 19.7% of the discourse analyzed, revealing as the most significant words: number and rational/natural. The other words are focused on the mathematical content dealing with **Numbers and Operations**, namely: value; positional; system and operation; base; algorithm; set; natural; integer; rational; decimal; fractions; real, property; algebra; and function. We emphasize that this knowledge is usually worked in the first subjects offered in Licn2 of the Mathematics area, composing the subdomains of the specific knowledge of mathematics that the teacher needs to know to teach **numbers and operations**, according to Ball *et al* (2008).

Class 5 is linked, in part, to the subdomain knowledge of mathematical content on the horizon and, in part, to the subdomain specialized knowledge (to teach elements of statistics and probability) of school mathematics, reaching 20.5% of the total teaching load in the area of Mathematics Education. The most relevant words in the discourse analyzed are: **statistics and probability**. It appears in the center of the discourse with the following most significant words: random; data; dispersion; sample and table; graph; regression, distribution and event; correlation and variables. This discourse reveals that the area of statistics, which is an area related to mathematics, has an important place in teacher training. It is worth noting that all nine courses studied at Licn2 offer Statistics as a compulsory subject, but a large part of their studies are aimed at supporting research in the educational area and the analysis of problems in the educational field.

Classes 1, 3 and 5 total 58.1% of the discourse in the mathematics course menus. This data reveals the prioritization of studies related to specialized knowledge of mathematics to teach Mathematics and Statistics during the period of schooling under analysis in this study and aims to provide a solid base of professional knowledge for the teacher who works in it.

Classes 2 and 4 refer to the discourse related to the professional knowledge of the teacher who teaches Mathematics in the early years of schooling and which broadly contemplates the subdomains of **didactic-pedagogical knowledge of the teaching content** proposed by Ball *et al.* (2008): knowledge of school mathematics and its teaching; knowledge of school mathematics and its relationship with students at this level of schooling; and knowledge of school mathematics from the perspective of the curriculum.

Class 2, with discourse related to the sub-domain knowledge of school mathematics from the perspective of the curriculum, reaches up to 20.5% of the total didactic load of the area, grouping the following words with more meaning in its discourse: **pre-school and mathematics/curricular**. These words relate to others, such as: guidelines; education; curriculum; themes, national and basic education; mathematics; program; cycle; teaching; science and purpose. It is important to emphasize that these words are contained in the menus of subjects focused on mathematics training, although they do not express mathematical content, the focus is articulated with the curricular organization of the teaching of mathematics, especially in the disciplines of the master's degree that make up the complementary training needed for action at the **preschool level**.

Class 4, with discourses related to the subdomains of school mathematics knowledge and its relationship with teaching and students, reaching 21.4% of the area's teaching load. The discourse related to this class has as its most significant words: **math, task and class**. This class also includes other words such as: class; math; activity; student; practice; learning; reflection; pedagogical; project; oral and written; communication; exploration; research. We find, therefore, that the most significant words in this class confirm its emphasis on the didactic-pedagogical aspects of the teaching action, in the development and management of the class.

Classes 2 and 4 total 41.9% of the discourse that composes the statements of the menus and contemplate knowledge aimed at theoretical and practical studies of mathematical knowledge directly related to the practice of teaching and learning mathematics in the early years of schooling. In addition, the menus indicate formative elements of the teaching related to the reflexive and investigative dimensions, fundamental for the constitution of the professional identity of the teacher. This teaching formation aims at interconnecting the mathematical content, the didactic content and the teaching practice, according to Fiorentini and Oliveira (2013) and Serrazina (2014), to what the researches in the area of Mathematical Education point out that recognize, in this interconnection, a good way to work the knowledge of the area in the initial formation courses of teachers, mainly in the first years of school.

It is important to point out that in this article the semantic meaning of the words on the menus used in the two formative contexts was not analyzed. The results presented here reveal aspects of mathematical training, contrasting the Brazilian and Portuguese contexts in terms of teacher training for the early years of schooling. To this end, in the following section we present a short discussion and synthesis of the results of this analysis.

5 Conclusions and Final Remarks

The first difference observed between the two programs concerns the profile of the professional to be trained. In Brazil, teaching training is the professional profile common to all Degree courses in Pedagogy, at the same time 75% of the courses added to this profile training in other dimensions related to school education that have a direct relationship with school content, such as: Youth and Adult Education; Education in Normal Mode courses; Special Education, as well as training in educational management. That is, in Brazil, it is expected that the Pedagogy course should train both the teacher in the first years of schooling as well as the pedagogue or educational scientist and the educational manager, thus no longer providing specialized training for the teacher who works in the first years of schooling. In Portugal, the degree courses in Basic Education and Masters, offered in an integrated system, propose to qualify the future teacher only for teaching, which may explain the high value of professional training in the study of school knowledge, especially of a disciplinary nature.

The second aspect that we highlight in the analysis is the difference in workload required in each context. In both contexts, since the end of the 1990s, the training of the teacher who works in the initial years of schooling takes place at a higher level, but with different emphases. In Brazil, the degree course in Pedagogy (Licn1), with a minimum workload of 3,200 hours, has, on average, as the results of this study indicate, 144.9 hours devoted to mathematical training, which is equivalent to a teaching load of only 4.5% of the total course. While in Portugal, in addition to graduating (Licn2 or LEB), the future teacher needs to complement his or her training with a Vocational Master's degree, making up a total of at least 6,500 hours of studies aimed at teaching in the early school years. Thus, an average of 1,109 hours of training in Mathematics is allocated, which corresponds to about 17% of the total teaching load of the initial training course.

This allows us to conclude that, in Portugal, the training of the teacher who teaches Mathematics in the highlighted levels of education receives a specialized training in Mathematics almost four times higher than that received in Brazil. If we consider nominally the number of hours of study of the future teacher, this difference practically doubles to almost ten times more in Portugal than in Brazil.

A third aspect to be highlighted is the analysis of the nomenclature of subjects focused on the formation of the teacher who teaches Mathematics in the first years of schooling. The curriculum designs analyzed in Brazil show a variability of names for these subjects (Mathematics Education; Theoretical and Methodological Foundations of Mathematics Teaching; Mathematics School and Culture; Mathematics Literacy; Mathematics Teaching Content and Methodology, etc.), while in Portugal, the names of the subjects appear, for the most part, with the same nomenclature of the fundamental fields of school mathematics (Numbers and Operations; Geometry, Quantities and Measures; Elementary Mathematics and Materials; Algebra and Functions; Statistics and Probability; Didactics of Mathematics; Mathematics in Early Childhood Education). What can this reveal us?

If, on one hand, the Brazilian curriculum prioritizes a more inter, pluri or transdisciplinary approach to mathematical contents, how can this be achieved without mastering the knowledge historically produced in the field of Mathematics or without carrying out a more in-depth study of the contents that are the object of teaching in the early school years? On the other hand, although the Portuguese curriculum seeks to provide a solid disciplinary training in Mathematics, even if from a non-formal perspective, it seems to open little space for a more interdisciplinary school culture or project development, in order to interrelate the fundamental school knowledge in early childhood education.

On the other hand, it is important to emphasize that the absence, in the Brazilian curriculum of Pedagogy courses, of certain contents fundamental to the initial formation of the teacher who teaches Mathematics does not mean absence, at this time, of research and studies on these contents in Brazil. We can cite, in the period studied, the work of Lopes (2008), who defended, since the years of 2003, the study of probability along with that of statistics in Early Childhood Education and in the Initial Years of Elementary School. Regarding the study and development of algebraic and functional thinking since the early years of schooling, we highlight the studies of Fiorentini *et al.* (1993) and Ribeiro and Cury (2015). About the teaching of Geometry and Measurements in Pre-School and Early Years, we cite the studies of Moura and Lorenzato (2001) and Nacarato and Steps (2003).

The fourth aspect concerns the contents of the menus of the subjects that are part of the two formative contexts. Both contemplate the two domains of the model of Ball *et al.* (2008): Specific Knowledge of Mathematics for teaching and Pedagogical Knowledge of Mathematics to be taught. However, when we analyze the sub-domains present in the menus dedicated to the mathematical training needed to teach in the first years of schooling, we observe a significant difference, since in Brazil we have an average of 41.5% of the 144.9 hours dedicated to the mathematical training of the teacher, while in Portugal 58% of the 1,109 hours are dedicated to this training. This, in a way, confirms what had already been pointed out by Gatti and Nunes (2009, p. 24) in relation to Brazil: "the specific contents of the subjects to be taught in the classroom are not the object of the teacher's initial training courses".

In summary, in relation to the comparative analysis of the professional profile of the egress and the workload for mathematical training, this study shows differences in the paradigm of teacher training between Brazil and Portugal. In Brazil, the initial training follows what is stated in Resolution no. 1/2006 and confirms, in practice, based on the analyzed menus, what already denounced Saviani (2007) in relation to the fact that the Degree in Pedagogy presents curricular designs extremely restricted in relation to the contents of the teaching and *too extensive* in the accessory, relative to the multiple aspects of the educational field. In Portugal, the Degree in Basic Education, linked to the Professional Master's Degree, shows an opposite trend to the Brazilian one, since it presents curricular designs strongly focused on teaching, emphasizing the domain of specific knowledge and necessary for professional performance, as required by Law no. 49/2005 (MEC).

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