

Science teaching and continuing education of literacy teachers: recognizing the research field

ABSTRACT

Science teaching in the early years of elementary education presents an important research field regarding children's scientific literacy in this segment of education. First, for the typical curiosity of this age range, and later, for the need to build citizen profiles that are reflective and critic to their living environment. However, on the demands for reading and writing appropriation, little attention is given to the construction of Science knowledge, especially in the first three years of elementary education, period of transition between Pre-school and Elementary School. In the perspective of the appreciation of Science teaching during literacy, this study aimed to identify and analyze researches, theses, and dissertations that discuss the continuing education of literacy teachers as mediators of scientific knowledge in the Literacy Cycle. For the study, it was used the Catalog of Theses and Dissertations of the Higher Education Personnel Improvement Coordination (Capes), within the delimited period from 2007 to 2018. There have been retrieved 73 works, of which, 31 address the continuing education of teachers of elementary school, focused on Science education, demonstrating an increase in the number of researches that show this interest. But of those, only 03 Master's dissertations were dedicated to the continuing education of literacy teachers, indicating a need for research that may collaborate with new guidance for scientific literacy mediated by the teacher who lectures reading and writing.

KEYWORDS: Basic Literacy Cycle. Literacy. Continuing Education. Scientific Education.

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INTRODUCTION

Is very curious nature, inherent to the child, makes Science teaching necessary to, early in childhood, develop in students of all elementary school the reflective and critical profile on issues that integrate them, as well as their lived and experienced spaces (VIEIRA; TENREIRO-VIEIRA; MARTINS, 2014).

The introduction of Sciences in the early years of elementary school, as an attempt to provide possibilities of a better teaching, requires understanding of the contexts of educational conducts so that this improvement is associated with the initial training of teachers (FRACALANZA; AMARAL; GOUVEIA, 1986).

Typically, teachers of the early years of elementary school come from pedagogy curriculum, where the workload for the development of knowledge in the area of Natural Sciences is typically offered in just one semester. For example, in subjects such as Science Teaching Strategies, which ultimately grant a condition of polyvalent or generic teachers (SILVA, 2009; MEGID NETO; ROCHA, 2010; MAGALHÃES JÚNIOR; TOMANIK, 2013; AUGUSTO; AMARAL, 2015).

This is an important finding because there is a great concern of the teachers of elementary education with the literacy program, especially in the first three years of elementary school, making Science teaching an appendix without relevance, developed by obligation of the determined curriculum (CHASSOT, 2014).

Nonetheless, literacy is to promote students' ability to interpret their relationship with the world, identifying themselves in the spaces where they act, not reduced being to a mechanical and rigid process of handling letters and words (FREIRE, 1990).

In this regard, the literacy process of reading and writing appropriation should not be separated from scientific literacy, explaining that the later “[...] should be developed since the beginning of the school process, even before the child knows how to read and write” (LORENZETTI; DELIZOICOV, 2001, p. 13). In addition, even before that knowledge, children are already readers of the world, seeing it, feeling it, interacting with their context (FREIRE, 1989; FREIRE, 1990).

Lorenzetti and Delizoicov (2001) draw attention to the fact that from the teaching of Science, the child's literacy process can be leveraged by the construction of senses and meanings in the creation of speeches in reading and writing.

For these reasons, we bring the issue of the literacy teacher of elementary school as the mediator of scientific knowledge in the literacy cycle in an attempt to identify the field of study that deals with their continuing education, focused on the teaching of Science.

Thus, this study aimed to identify and analyze researches that discuss the continuing education of literacy teachers as scientific knowledge mediators in the first three years of Basic Education, from the following question: What is the current scenario of research on continuing education of literacy teachers, based on theses and dissertations focused on the teaching of Science in the Literacy Cycle?

The results are part of a larger research approved by the Ethics Committee of the State University of Campinas (Unicamp), Campinas-SP, Brazil, on April 1, 2018, under C.A.A.E. No. 79826017.8.0000.5404.

LITERACY AND SCIENCE EDUCATION

In the history of education, the process of appropriation of writing and reading, of the introduction of the human being in the world of letters, and of literacy became the object of political maneuvering for it is the initiation of the man in the world as a citizen. Also, establishing his right to read and write by setting his ability to decision-making, particularly as an active consumer of the modern, capitalist times (SAVIANI, 2008).

Therefore, to be an illiterate is to be on the margins of society, namely to experience marginality (SAVIANI, 2008; MARCILIO, 2016) and that “[...] to literate an individual at the right age is to make him a full member of the public environment, a citizen to the full” (MARCILIO, 2016, p. 15), as

Illiteracy not only threatens the economic order of a society, but also constitutes deep injustice. This injustice has serious consequences, such as the inability of illiterate people to make decisions for themselves, or to participate in the political process. Thus, illiteracy threatens the very character of democracy. It undermines the principles of democratic society (FREIRE, 1990, p. XI, own translation).

The Brazilian Literacy is a process that concerns, for a long time, governments, nongovernmental organizations, school administrators, teachers, parents and guardians, each according to their needs and interests, mainly from national public education indexes obtained with external tests performed by the National Institute of Educational Studies Anísio Teixeira (INEP) (ALAVARSE; BRAVO; MACHADO, 2013; KUSIAK, 2012; BONAMINIO; SOUZA, 2012).

According to Marcílio (2016), between the years 2001 and 2007, 75% of the Brazilian population was composed of functional illiterates, and in 2009. This rate decreased to 68% of the population between 15 and 64 years, so that “[...] only 1 out of every 4 Brazilians could read and write fully and utilize these skills to develop his life” (MARCILIO, 2016, p. 15).

The latest data provided by the Brazilian Institute of Geography and Statistics (IBGE) in June 2019 (IBGE, 2019), show that 11.3 million Brazilians are illiterate, corresponding to a margin of 6.8% of illiteracy in people over 15 years of age. In this group, 7% are men and 6.6% are women, data that become more troubling when was identified that in any age group studied blacks and browns have higher illiteracy rate, reinforcing the need for a deeper look into this inequality.

Some policy measures stand out in this field of education, focused on the issue of appropriation of the “[...] functioning of the Alphabetical Reading System [...]” (LEAL, 2017, p. 95) and the “[...] mathematical literacy” (Fonseca, 2017, p. 170) in the attempt to elevate the quality of the teaching-learning process, since the 1990s, based on the indexes produced by the National System of Basic Education Assessment (SAEB), which evaluated every two years students enrolled in the 5th grade of elementary school, in the 9th grade of high school, and in the 3rd year of high school in Brazil (BONAMINIO; SOUZA, 2012).

Of these initiatives, among others, we highlight the approval of the Elementary Education of nine years, as from the Law No. 11.274/2006, which included, formally, six year old children in the literacy process (BRASIL, 2006); the Provinha Brasil, established by the Decree No. 10 of April 24th, 2007, is a diagnostic assessment, investigative of the skills developed by children enrolled in the 2nd year of elementary school (BRAZIL, 2007); and the National Pact for Literacy at the Right Age (PNAIC), established by the Decree No. 867 of July 4th, 2012, with the proposition to ensure that all children are literate until the age of eight, by the end of the 3rd year of elementary school (BRASIL, 2012).

It is worth noting that it relies on literacy teachers, in addition to reading and writing, to also promote to their students in primary education the “[...] understanding of the natural and social environment, political system, technology, arts and values on which the society is based on” (BRASIL, 1996). Thus, we identify ourselves with Leal (2017, p. 95, own translation) in his way to assume literacy:

[...] as a process that at the same time, children can learn how is the operation of the Alphabetical Writing System, in a articulated and simultaneous to the learning outcomes related to social uses of written and spoken language [...] as a process in which children learn to read, to write, to speak, to listen, but they appropriate, through reading, writing, speaking, listening, relevant knowledge for life.

To consider the school literacy process, valuing the social importance of the action of writing and reading, based on practices that contextualize the real issues of the student, it is also an invitation to a different view to their scientific literacy, because from early childhood education they are already sensitive to natural phenomena so that

Supporting children as they develop scientific thinking during the early childhood years can lead children to easily transfer their thinking skills to other academic domains which may support their academic achievement and their sense of self-efficacy (TRUNDLE, 2009, p. 01).

The appreciation of Science teaching during the literacy process is relevant as we must understand children at this stage of their development as active beings and as capable of interacting with natural phenomena that surround them, a characteristic that enhances their learning ability (TRUNDLE, 2010; SAÇKES; FLEVARES; TRUNDLE, 2010), in addition to the legal obligation of the Sciences discipline offer by schools (BRASIL, 1996).

There is however a social and political pressure on schools and teachers, which consequently leaves a moral and ethics pressure on children, when inserted in the early years of elementary education. Children are conditioned to the partitioning of time, thoughts and knowledge building, as if learning is, chronometrically, a moment inert to the phenomena experienced by them, disregarding their previous experiences and their social historical structures (GOULART, 2017).

Nowadays, with the recent implementation of the National Common Curriculum Base (*Base Nacional Curricular Comum*, BNCC), there are many discussions about the changes imposed on schools and teachers, amongst them, the end of the cycle of three years for children literacy, reducing this time for the 2nd year instead of the 3rd; the curriculum readjustment, vertically imposed by the Ministry of Education (MEC); and the reformulation of the demands for external

evaluations, which became effective, starting on 2019, in day care, pre-school, in addition to the 2nd year of the elementary school (INEP, 2019).

CONTINUING EDUCATION OF TEACHERS OF THE EARLY YEARS OF ELEMENTARY SCHOOL, LITERACY TEACHERS

The continuing education of teachers of the early years of elementary school goes far beyond what is simply to imagine which ways would be viable to provide them with teaching and learning moments that fulfill them in the aspects of a supposed techno-scientific gap, regarding for example, the contents of Natural Sciences, whose initial training in pedagogy courses did not allow them to have greater access.

For Nóvoa (1995), continuing education must value the innovative experiences and collectivity of the education systems, focusing on qualitative proposals of teaching activities and professional development, with no prospects for the introduction of control instruments, but innovative practices established in the knowledge built at the very school.

The planning of continuing education proposals for literacy teachers requires of us, researchers and trainers, while sponsoring and training institutions, to understand the universe to which the two main actors in the process of learning to read and write, the child and the teacher, are subjected (MORORÓ; BASSO, 2005; LEITE, 2010). This brings us to the following questions: how much do their stories and how these have been constituted are the material for finding better and better ways for the teaching-learning process of reading and writing in classroom, which are increasingly multiple in social, cultural, political and economic diversity? How does Science education play a role of integrating possibilities for a transforming education since early years of childhood?

Researchers such as Megid Neto and Rocha (2010), and Lima, Bello and Siqueira (2015), present data that highlight the need for research development directed to the initial and continuing education for teachers who teach Science in the elementary school.

Megid Neto and Rocha (2010) conducted a bibliographic survey between 2003 and 2008, aiming to identify works with alternative proposals for the initial and continuing training of Science teachers of elementary school, from five Brazilian and four international journals, as mentioned:

[...] *Ciência & Educação* [Science & Education]; *Investigação em Ensino de Ciências* [Research in Science Education]; *Caderno Brasileiro em Ensino de Física* [Brazilian Journal of Physics Education]; *Revista do Centro de Educação* [Journal of the Education Center]; *Revista Ensaio* [Ensaio Magazine]; *Journal of Science Teacher Education*; *Research in Science Education*; *Journal of Elementary Science Education*; *International Journal of Science Education* (MEGID NETO; ROCHA, 2010, p. 156).

The authors identified nine works related to studies of initial and continuing education practices, and of these, only four dealt with the initial training (TRUNDLE; ATWOOD; CHRISTOPHER, 2006; ZIMMERMANN; EVANGELISTA, 2007; LOGHINI, 2008; NILSSON, 2008); one had an analysis of both initial and continuing training (LOGHINI; HARTWING, 2007); and four analyzed exclusively the continuing

education of elementary school teachers (MONTEIRO; TEIXERIA, 2004; JARVIS; PELL, 2004; AKERSON, 2005; DIXON AND WILKE, 2007).

Lima Bello and Siqueira (2015) analyzed works of six journals that address Science education that were published between the years 2004 and 2013 (Table 1): Revista Ciência & Educação [Science & Education Journal] (C & E): volume 15 (2004) to volume 19 (2013); Revista Investigação em Ensino de ciências [Research in Science Education Journal] (IENCI): volume 14 (2004) to volume 18 (2013); Revista Brasileira de Pesquisa em Educação em Ciências [Brazilian Research in Science Education Journal] (RBPEC): volume 9 (2004) to volume 13 (2013); Revista Experiências em Ensino de Ciências [Experiences in Science Education Journal] (EENCI): volume 4 (2004) to volume 8 (2013); Revista Electrónica de Enseñanza de las Ciencias [Science Education Online Journal] (REEC): volume 7 (2004) to volume 12 (2013); Revista de Educação, *Ciência e Tecnologia* [Education, Science and Technology Journal] (Alexandria): volume 2 (2004) to volume 7 (2013).

Table 1 – Scientific production of analyzed journals between the years 2004 and 2013

Period/Journal	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
C & E	40	36	24	28	36	39	45	60	60	60	428
EENCI	-	-	18	18	18	24	36	36	21	32	203
IENCI	13	17	18	18	18	20	24	24	36	35	223
REEC	23	21	22	30	40	58	96	29	33	27	379
RBPEC	24	15	12	12	18	20	22	30	30	29	212
Alexandria	-	-	-	-	18	22	14	21	30	33	138
Total	100	89	94	106	148	183	237	200	210	216	1583

Source: Adapted from Lima, Bello and Siqueira (2015).

These authors found that of the total of 1,583 works analyzed, only in eleven of them teachers of the initial years of elementary school were the targeted audience of interest, characterizing the need for investigations that focus on continuing training of these teachers regarding Science education.

Even if the analysis sometimes cover less specific issues, few works were identified as dedicated to the scientific literacy in elementary school, as for the example of Fernandes's research (2015), which produced a discussion of Brazilian dissertations and theses that investigated pedagogical practices in this segment of education, of a total of five thousand works, only eighty-seven were developed between 1972 and 2012; and Viecheneski, Lorenzetti and Carletto (2015), who analyzed works presented at the National Research Meeting in Science Education (*Encontro Nacional de Pesquisa em Educação, ENPEC*), between the years 1997 and 2013 in nine editions of the event, only twenty-five contemplated discussions on Science education in elementary school.

From the mentioned conjecturing; the peculiarities that involve Science education in elementary school; and the importance of building new conceptions about the literacy process in childhood and its relation to Science education, it has been recognized the need to understand how the academic research that deal with continuing education of literacy teachers about Science education in the literacy

cycle are situated, using as research field the Higher Education Personnel Improvement Coordination (Capes) Theses and Dissertations Catalog.

METHODOLOGY

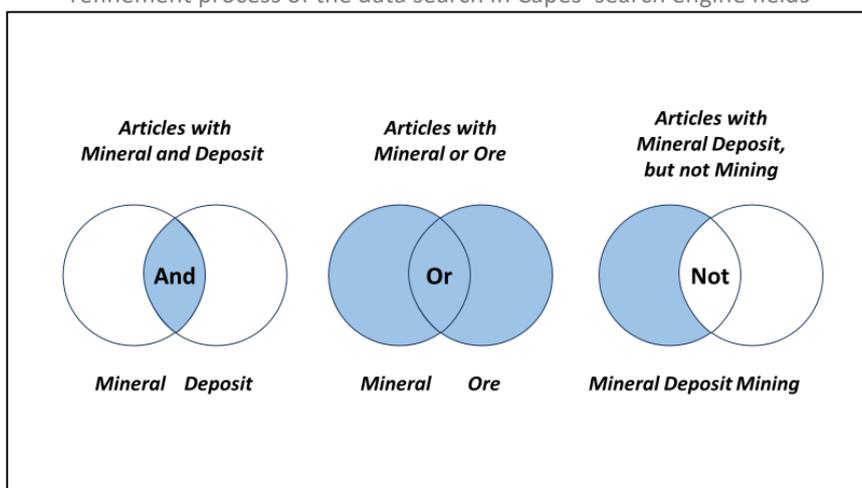
Capes Theses and Dissertation Catalog is a bibliographic research platform and it has the collection of theses and research dissertations conducted at recognized doctoral and master programs, with complete texts files, provided by postgraduate programs from 2010, and metadata of researches from before this period (CAPES - BOLETIM N. 37, 2018).

Electronic search engines in online platforms are more technologically advanced, providing results obtention with agility and a condition to refine the subject of search. However, it is necessary to have a planning to adequately direct the tracking of data so that

The methodology should contain a set of actions or tactics related to restrictions and/ or limits set by the user. The researcher should also translate his needs using, not only strategy, but some other specifications, such as the use of well-targeted keywords (PORTAL CAPES, BOLETIM N. 52, 2018).

In the surveys executed in Capes Theses and Dissertations Catalog, the definition of keywords can be enriched by Boolean operators: quotes (" ") in the search for exact phrases or the order in which the terms may appear, resulting in accurate amount of retrieved documents; AND, which allows combinations of terms that reflect the interest of the researcher; OR, which selects documents with at least one of the terms; and NOT that "[...] excludes terms so that each result does not contain any of the terms that follow it" (CAPES - BOLETIM N. 52, 2018) (Figure 1).

Figure 1 – Illustration of the use of Boolean operators as support tools for the refinement process of the data search in Capes' search engine fields



Source: Boletim Eletrônico Portal de Periódicos of CAPES, N. 52 (2018).

George Boole, a mathematician and British philosopher (1815-1864), was the one who developed this methodology, based on three basic operations (and, or and not), and "[...] used in computer data processing, automation of industrial

production, the theory applied to fluids and information science” (CAPES - BOLETIM N. 52, 2018).

Thus, for the suggested database search, the Capes Theses and Dissertations Catalog, the description terms determined for the search were teacher training, elementary school and Science education, using the Boolean quotes (“ ”) and, in accordance to the proposal: “continuing education of teachers” and “elementary” and “science education”.

To define these description terms, it was taken into consideration the interests of the research by the corresponding educational stage of the literacy Cycle, legally defined in 2006, which allows us to emphasize the term “elementary school” to characterize the period between the years 2007 and 2018 as the latest nomenclature, to the detriment of older terms of Brazilian education system, such as “primary” or “first segment”, culminating with possible studies related to the training of literacy teachers, as well as the implementation of the PNAIC, since 2012.

According to the purpose of this research, there have been selected the theses and dissertations that refer to continuing education of teachers of elementary school for Science education, and they have been organized according to: title; year of publication; type of research; defense year; program according to Capes specification; author; supervisor; and the associated institution. For the selection process it was taken into account the terms in the title of the research, the reading of the abstracts and, where necessary, the query to the research on its destination repository, being classified according to a code “T.x” and “D.y” where “T” is the doctoral thesis, “D” to the master's thesis, and “x” and “y” to its specific identification (T.1, T.2 ... T.9; D.1, D.2 ... D.21).

RESULTS AND DISCUSSION

Regarding the last query conducted in Capes Theses and Dissertations Catalog, since November 2018, there have been retrieved, on June 3rd, 2019 (06.03.2019), the total of 79 records, researches conducted between the years 2007 and 2018, which are distributed as: 15 doctoral theses; 33 academic master's dissertations; 25 professional master's dissertations; and 06 professional-level papers. For investigative analysis, we dismissed the professional-level papers, making the total of 73 works, including dissertations and theses.

The data collected showed that there was an increase in the interest of researchers referring to teacher training, focused in elementary school, since 2007, for master's research, and since 2009 for doctoral research, as shown in Figure 2:

Figure 2 - Quantity of dissertations and theses retrieved

Year of Defense	Type of Research		Total
	Master	Doctorate	
2007	01	-	01
2008	02	-	02
2009	-	01	01
2010	01	-	01
2011	-	-	-
2012	02	01	03
2013	-	01	01
2014	05	02	07
2015	09	03	12
2016	11	02	13
2017	17	02	19
2018	10	03	13
TOTAL	58	15	73

Source: Own compilation (2019).

Drew attention the interval of time between the years 2014 and 2017 where the master's investigations showed considerable increase of interest to researchers for elementary school and the 42 dissertations retrieved during this period, being 03 of them concentrated in the field of knowledge "Education"; 03 in the field of knowledge "Teaching"; and the other 36 classified as belonging to the field of knowledge "Science and Mathematics Teaching", and of those, 22 dissertations were produced in academic master's programs and 20 in professional master's programs.

These numbers are accompanied by higher incidences of doctoral research between the years 2014 and 2018, that of the total of 15 retrieved theses, 12 are concentrated in this time interval and classified according to their area of expertise as follows: 01 thesis in the field of Biophysics; 02 theses in the field of Education; 03 theses in the field of Teaching; and 06 in the field of Science and Mathematics Teaching.

It was noticed that the field of Science and Mathematics Teaching has been demonstrating a significant contribution to the field of continuing education for elementary school teachers, a data found by Nardi (2015, p. 07), which draws our attention by "[...] significant contribution of research in Science and Mathematics Teaching for the education in Brazil [...] with the creation of the field (46) Science and Mathematics Teaching of CAPES, in September 2000".

It was highlighted that of the 73 retrieved academic productions in this survey, 09 theses were dedicated to the teaching of Science, and 06 were direct to teaching of Mathematics; while of the 58 master's dissertations, 22 had their objective focused on Science teaching; 33 on Mathematics education; 01 on Religious Education; 01 on English teaching; and 01 on Environmental Education. Through the proposed research, there were selected for analysis theses and dissertations that had focus on the teaching of Science, which are organized in Figure 3 and 4.

Figure 3: Doctoral theses that refer to continuing education of elementary school teachers, focused on the teaching of Science

Search Code	
T.1	I. Astronomy in the early years of Elementary School: rethinking teachers' education; II. 2009; III. Academic Doctorate; IV. Science Education (33004056079p0); V. Rodolfo Langhi; VI. Roberto Nardi; VII. Unesp
T.2	I. The challenges and possibilities of Science education in early years of elementary education: an investigation with teachers; II. 2014; III. Academic Doctorate; IV. Science Education (33004056079p0); V. Fabricio Vieira de Moraes; VI. Renato Eugenio da Silva Diniz; VII. Unesp – Bauru.
T.3	I. The Science teaching in the early years of Elementary Education and the continuous education for teachers: implantation and evaluation of the formative program of a Science center; II. 2014; III. Academic Doctorate; IV. Biological Sciences (Biophysics) (31001017012p6); V. Grazielle Rodrigues Pereira; VI. Robson Coutinho Silva; VII. UFRJ.
T.4	I. The contributions of a teacher continuous training course that act in the early years of the designs about epistemological and your relationship with educational practice; II. 2015; III. Academic Doctorate; IV. Science Education: Life and Health Chemistry (Ufsm - Furg) (42001013098p9); V. Viviane Maciel Machado Maurente; VI. Lisiane de Oliveira Porciuncula; VII. UFSM – FURG.
T.5	I. The collective construction of classes for the teaching of Science: a proposal for Continuing Education with teachers of the initial years of Primary Education; II. 2016; III. Academic Doctorate; IV. Science Education (33004056079p0); V. Aline Juliana Oja; VI. Fernando Bastos; VII. Unesp – Bauru.
T.6	I. Continuing Education for Science Teaching in the Science, Technology and Society Perspective: Contributions to Early Years of Elementary School Teachers; II. 2017; III. Academic Doctorate; IV. Science and Technology Teaching (40006018028p7); V. Fabiane Fabri; VI. Rosemari Monteiro Castilho Foggiatto Silveira; VII. UTFPR.
T.7	Continuing education for teachers in the nature of Science and technology with focus on scientific skills; 2017; Academic Doctorate; Science Teaching (33078017009p8); Sonia Aparecida Cabral; Sonia Aparecida Cabral; Univ. Cruzeiro Do Sul
T.8	I. A study on the professional development of teachers of the initial years of fundamental education, embased in the insertion of physics content in the education of sciences and in the academic production of the area, as innovative elements, under the advisory of a university; II. 2018; III. Academic Doctorate; IV. Science Education (33004056079p0); V. Sorandra Correa de Lima; VI. Roberto Nardi; VII. Unesp – Bauru.
T.9	I. Continuing Education for teacher of early years of Elementary School: contributions for the re-elaboration of pedagogical practices in the teaching of Natural Sciences; II. 2018; III. Academic Doctorate; IV. Education (21001014001p6); V. Maria Oneide Lino da Silva; VI. Jose Augusto de Carvalho Mendes Sobrinho; VII. UFPI.

Source: Own compilation (2019) – Textual code: I. Title; II. Year; III. Type Of Work; IV. Program; V. Author; VI. Supervisor; VII. Institution

Figure 4: Master's theses that refer to continuing education of early years teachers, focused on the teaching of Science

Search Code	
D.1	I. Ethnographic study of the contributions of sociolinguistics to the introduction of science literacy in early schooling; II. 2007; III. Academic Master Education; IV. Education. V. Salete Flores Castanheira; VI. Stell Maris Bortoni-Ricardo; VII. UnB.
D.2	I. Continuing education for Science teachers for astronomy education in the early years of elementary education; II. 2012; III. Academic Master Education; IV. Education; V. Rosimere da Silva Dantas; VI. André Ferrer P. Martins; VII. UFRN.
D.3	I. The usage of blog associated to Science education for teacher formative process in early years of elementary education; II. 2014; III. Academic Master; IV. Teaching of Science and Technology (40006018006p3); V. Caroline Elizabel Blascko; VI. Marcia Regina Carletto; VII. UTFPR.
D.4	I. Sciences teaching in the perspective of scientific literacy: teaching pedagogic practices in the literacy cycle; II. 2015; III. Academic Master; IV. Education (42003016014p2); V. Igor Daniel Martins Pereira; VI. Marta Nornberg; VII. UFPel.
D.5	I. Continuing education for teachers and the methodology of teaching by investigation in early years of elementary school in Paraúna-GO; II. 2015; III. Professional Master; IV. Sciences and Mathematics Education (52005011002p5); V. Marcelo Bueno Moura; VI. Paulo Henrique de Souza; VII. IFG.
D.6	I. Scientific investigation practices as a pedagogical approach for science teaching in the early years of basic education; II. 2015; III. Professional Master; IV. Scientific, Educational and Technological Training (40006018019p8); V. Jose Augusto Real Limeira; VI. Arandi Ginane Bezerra Junior; VII. UTFPR
D.7	I. Analysis of an interdisciplinary science teaching proposal in the historical-critical perspective using WebQuest; II. 2016; III. Professional Master; IV. Teaching of Human, Social and Natural Sciences (40006018027p0); V. Giselle Palermo Schurch; VI. Zenaide de Fatima Dante Correia Rocha; VII. UTFPR.
D.8	I. Science education in the early years of elementary school: teaching practices of teachers of the municipal public schools in Uruaçu-AM; II. 2016; III. Professional Master; IV. Teaching of Science (52012018007p0); V. Orlandina Aparecida Borges Mendes; VI. Cleide Sandra Tavares; VII. UEG.
D.9	I. Continuing teacher education: implications of pedagogical practices developed in science classes; II. 2016; III. Professional Master; IV. Teaching of Science and Mathematics (11001011007p6); V. Dilair do Vale; VI. Aline Andreia Nicolli; VII. UFAC.
D.10	I. A proposal on continuing teacher education: elaboration of a program with investigative experimental activity for Science teaching in early years of elementary school; II. 2016; III. Professional Master; IV. Teaching of Science (51001012022p8); V. Alessandra Ferreira Beker Daher; VI. Vera de Mattos Machado; VII. UFMS.
D.11	I. The interdisciplinary approach for math and science in textbooks from 4th and 5th year of Elementary School; II. 2016; III. Academic Master; IV. Education (33006016005p7); V. Diego da Silva Gallet; VI. Maria Auxiliadora Bueno Andrade Megid; VII. PUC – Campinas.
D.12	I. Continuing teacher education of basic education: contributions of a formative intervention in Natural Sciences; II. 2016; III. Academic Master; IV. Scientific Education and Teacher Training (28006011010p6); V. Floraci Souza Caroso; VI. Ana Cristina Santos Duarte; VII. UESB.
D.13	I. Science teacher education of early years of elementary school: a proposal of a problematizing program on burnings; II. 2017; III. Professional Master; IV. Teaching of Sciences (51001012022p8); V. Catia Fabiane Reis Castro; VI. Vera de Mattos Machado; VII. UFMS.

Figure 4 – (Cont.)

D.14	I. Continuing teacher education on solid waste management: a proposal for scientific literacy in early years of elementary school; II. 2017; III. Professional Master; IV. Teaching of Natural Sciences and Mathematic (41006011010p3); V. Idione Da Silva; VI. Arleide Rosa da Silva; VII. FURB.
D.15	I. Experimental practices in physics: an approach for early years of elementary education; II. 2017; III. Professional Master; IV. Sciences and Technology in Education (42033012002p0); V. Carmem Regina Pereira da Silva Diehl; VII. Marcos Andre Betemps Vaz da Silva; VII. IFSUL.
D.16	I. Science education through investigation: a challenge to teacher education of early years of schooling; II. 2017; III. Professional Master; IV. Sciences and Mathematics Education Program (15001016078p1); V. Gilma Favacho Amoras Soares; VI. Terezinha Valim Oliver Goncalves; VII. UFPA.
D.17	I. Continuing education of early years of elementary education teachers' policies in Mato Grosso for the pedagogical usage of digital technology in Science Teaching; II. 2017; Academic; III. Master; IV. Teaching of Science and Mathematics (50002015101p9); V. Juciley Benedita da Silva; VI. Daise Lago Pereira Souto; VII. UNEMAT.
D.18	I. Municipal Meeting for astronomy educators of Anapolis (EMEAA): contributions for Science education in early years of elementary education; II. 2018; III. Professional Master; IV. Teaching of Science (52012018007p0); V. Lidia Carla do Nascimento; VI. Cleide Sandra Tavares; VII. UEG.
D.19	I. Thematic approach and the usage of the three pedagogical moments for continuing Science teacher education of early years of elementary school: contributions; II. 2018; III. Professional Master; IV. Science and Mathematics Education (30004012002p7); V. Jose de Amorim Theodorio; VI. Maria das Graças Ferreira Lobino; VII. IFES.
D.20	I. Continuing education for teachers of early years of elementary education: a proposal based on sequences of learning by investigation; II. 2018; III. Professional Master; IV. Science and Mathematics Education (52005011002p5); V. Helainy Waniessy Kenya Rodrigues Silva; VI. Paulo Henrique de Souza; VII. IFG.
D.21	I. Construction of skills and continuous training of teachers of Fundamental education in Ilhéus, Bahia from teaching Sciences by inquiry; II. 2018; III. Academic Master; IV. Science Education (28007018018p3); V. Sueli Fagundes Moreira; VI. Viviane Briccia do Nascimento; VII. UESC.
D.22	I. The formation of the Teacher / Pedagogue that teaches Natural Sciences in the early years of the Elementary School: pedagogic strategies with focus on microorganisms' approach; II. 2018; III. Professional Master; IV. Teaching of Science (52012018007p0); V. Wilker Rodrigues de Oliveira; VI. Solange Xavier dos Santos; VII. UEG.

Source: Own compilation (2019) – Textual code: I. Title; II. Year; III. Type Of Work; IV. Program; V. Author; VI. Supervisor; VII. Institution.

After the analysis of the total of 31 selected works, it was found that 15 dissertations correspond to researches made in professional master's programs (D.3; D.5; D.6; D.7; D.8; D.9; D.10; D.13; D.14; D.15; D.16; D.18; D.19; D.20; and D.22) and 07 theses to researches conducted in academic master's programs (D.1; D.2; D.4; D.11; D.12; D.17; and D.21); while all of the 09 theses identified are from doctoral academic programs. This is a fact that draws attention, demonstrating that the professional master's degrees, more specifically postgraduate programs in Science and Mathematics Teaching, is a field of considerable interest for the continuing education of teachers of early years of elementary school and the teaching of Science.

For the identification of works focused on the continuing training of literacy teachers, only 03 theses (D.1; D.4; and D.15) have shown interest in this segment with its research on scientific literacy in the Literacy Cycle.

The Castanheira (2007) (D.1) work has developed an ethnographic research, a case study, which aimed to understand how science teaching can be a facilitator of the literacy process in the first three years of elementary education from

[...] elements of Interactional Sociolinguistics, the Zone of Proximal Development, Vigotsky, and the actions of scaffolding proposed by Bruner and Cadzen, also complementing the notion of ways of contextualization provided by John Gumperz within a built environment with the proposal of the Culturally Sensitive Pedagogy (CASTANHEIRA, 2007, Abstract).

In its investigation, Castanheira (2007) demonstrated the possibility of Science teaching by integrating the learning of reading and writing of children 6-8 years old of a class of the 2nd year of elementary school, with actions planned with the regent teacher, from the proposed curriculum, developing the subjects: the elements of nature, air, water, heat and earth; infectious diseases, focusing on municipal health plan in tuberculosis; and live animals and vegetable beings, studying the metamorphosis of butterflies. The researcher characterized the Science, Technology and Society (STS) movement as the feasible development proposal of these subjects, with the perspective of a reflective and critic practice of those involved in the teaching-learning process by setting the classroom as an interactive environment.

As the methodology for data collection, the author used semi-structured interviews, audiovisual recordings on VHS and notes of their findings on the spot, during the moments of observation. She performed the analysis by triangulation of data, positively identifying the association of the interactional Sociolinguistics foundations with Vigotskyana's Learning Theory and Cadzan's Theory of scaffolding, from a diverse pedagogical practice with development of knowledge in natural sciences during the literacy process.

The second work is Pereira's theses (2015) (D.4), aimed to understand how the science teaching practices, organized by literacy teachers, could improve their students in scientific literacy process being research subjects, three teachers of Literacy Cycle, each of a different year, directly participating in the research activities.

The researcher used observation and filming of teaching practices of participant teachers in the survey during the development of their classes, and from the analysis by case study process, identifying the need for greater encouragement of contact of children in the literacy cycle with such knowledge, as well as the offer of programs of continuing education for those professionals.

In the third identified work, Diehl (2017) (D.15), the researcher developed a qualitative research, a case study, which examined how the physics content from PNAIC suggestions are added to students of the literacy cycle by literacy teachers.

Four literacy teachers of a public school were subject of this research, and through questionnaires and interviews they shared information of their initial and continuing education, used as subsidies for the planning of a training program of 20 hours, which took place in two meetings. In the course they developed

knowledge on: Space: sun, stars, planets, natural satellites, artificial satellites; and planet Earth: air, water, fire, animals and plants; state of matter, heat, temperature, thermal energy, force, friction force, pressure, atmospheric pressure, density, buoyancy, body weight, body mass. At the end of their research, they developed an experimental guidance book which would help literacy teachers in Science classes.

In her conclusions, Diehl (2017) identified the need for encouragement of experimental practices in literacy cycle; the offer of courses that value the knowledge of physics in Pedagogy programs, providing opportunities for the experiences of knowledge and experimental practices; and of a program for continuing education that address long-term continuing education for literacy teachers in the field of natural Sciences.

As stated, the studies of Castanheira (2007), Pereira (2015) and Diehl (2017) reflect significant interest of continuing education for literacy teachers as mediators of science knowledge in the teaching and learning of reading and writing in the first three years of elementary school. Researchers explore the pedagogical practice and teaching knowledge established by these teachers, valuing their contexts and their formative experiences, constituent of the teacher professional profile (NÓVOA, 1995; TARDIF, 2014).

Many are the decision-making dilemmas on the most appropriate program that should be adopted in the practices for the continuing training of basic education teachers, mostly when we analyze the deterministic issues of an inherited positivist posture of the very classic form with which Science was always conceived (ROSA, 2004). But this is a field that has been expanding its views on collaborative, reflective and critical process about the pedagogical practice of teachers, based on instituted knowledge teaching and its own pedagogical commonplace (MIZUKAMI, et al., 2010; FRANCO; LISITA, 2012; PEPPER, 2012; TARDIF, 2014), being a complex process that must be constantly in epistemological redefinition, in the appreciation of the theory/ practice relation, breaking the hegemonic principle of the academic teacher training (COMPIANI, 2015).

CONSIDERATIONS

The teaching of Science in childhood should be considered as an essential element in the formation of citizens with reflective and critical profiles, given the typical conditions of human curiosity in kindergarten and in the early years of the elementary education, especially for the reading and writing appropriation process.

However, still few works are developed with an interest in scientific literacy in the early years of elementary school in Brazil, especially on initial and continuing training of polyvalent teachers, as shown by the latest surveys developed on the state of knowledge of this field of research.

The results obtained in this study, from the Capes Thesis and Dissertations Catalog, between the years 2007 and 2018, call attention to the increase and concentration at national level of master's research between 2014 and 2017, and doctorate, between 2014 and 2018, with emphasis on Postgraduate programs on Science and Mathematics Teaching, mainly of professional master's programs.

On the current situation of Brazilian research on the continuing education of literacy teachers as mediators of scientific knowledge, pointed out in this article, the results state that of the total of 31 studies analyzed that spoke about the continuing education of teachers of the early years of elementary school, focused on Science education, both theses and dissertations, only 03 dissertations were devoted to this subject. These researches presented diverse investigative interest, being directed to the pedagogical practices of Sciences and how development of scientific knowledge can leverage the literacy process; with the supply of experimental training programs in specific areas of Nature Sciences, such as physics education.

We consider that the data obtained in this survey contributes significantly to the awareness of the importance of opening new fronts of research that address the subject of the initial and continuing training of literacy teachers.

O ensino de ciências e a formação continuada de professores alfabetizadores: reconhecendo o campo de pesquisa

RESUMO

O ensino de Ciências nos anos iniciais da Educação Básica apresenta campo de pesquisa importante no que tange à alfabetização científica para crianças nesse segmento do ensino. Primeiro, pela curiosidade típica da faixa etária, e, depois, pela necessidade da construção de perfis de cidadãos reflexivos e críticos dos seus contextos vividos. Porém, pelas exigências quanto à apropriação da leitura e da escrita, dentre outros fatores, pouco se dá a devida atenção à construção de conhecimentos sobre ciência, principalmente, nos três primeiros anos do Ensino Fundamental (EF), período de transição entre a Educação Infantil e o EF. Na perspectiva de valorização do ensino de Ciências durante a alfabetização, este trabalho objetivou identificar e analisar pesquisas, teses e dissertações, que discutem a educação continuada de professores alfabetizadores como mediadores do conhecimento científico no Ciclo de Alfabetização. Para o levantamento, foi utilizado o Catálogo de Teses e Dissertações da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes), delimitado o período de 2007 a 2018. Foram recuperados 73 trabalhos, dos quais, 31 tratavam da formação continuada de professores dos anos iniciais, focada no ensino de Ciências, demonstrando aumento do número de pesquisas que apresentam esse interesse. Porém, desse total, foram identificadas apenas 03 dissertações de mestrado que se dedicaram à formação continuada de professores alfabetizadores, indicando a necessidade da realização de pesquisas que possam colaborar com novos direcionamentos da alfabetização científica mediada pelo professor que ensina a ler e escrever.

PALAVRAS-CHAVE: Ciclo básico de alfabetização. Alfabetização. Educação continuada. Educação científica.

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