



CREATIVE LITTLE SCIENTISTS: Enabling Creativity through Science and Mathematics in Preschool and First Years of Primary Education

D3.2 Report on Mapping and Comparing Recorded Practices

ADDENDUM 8 of 13: National Report on Approaches in Portuguese Policy

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1. Aims of national report

This main aim of this National Report is to map existing approaches, as recorded in public policy documents and official statements of policy, to the teaching, learning, and assessment of science and mathematics in the early years and to teacher education in early years mathematics and science, in Portugal. This report has been prepared as part of Work Package 3.2 of the Creative Little Scientists project (D3.2 Report on Mapping and Comparing Recorded Practices) which aims to map and compare policy within and between European partner countries. The main research question for this phase of the project was: How is teaching, learning and assessment of science and mathematics conceptualised? What role does creativity play in these?

In order to analyse Portuguese policy documents, this report draws upon previous reports delivered in the Creative Little Scientists Project, the D2.2 Conceptual Framework and D3.1 List of Mapping and Comparison factors, which identified key dimensions pertinent to the role of creativity in early science and mathematics. As well as providing a structure for this report and facilitating comparison with other European policies, these frameworks help identify inconsistencies and tensions in the key policy messages within Portuguese policy.

1.2 Defining terms

Three terms often used in this report that would benefit from defining are: Policy, Curriculum, and Creativity.

1.2.1 Policy

The term policy is used in this report to refer to policy texts, which Ozga (2000, p.33) defines as any “*vehicle or medium for carrying and transmitting a policy message*”. However, in accordance with the aims of this report, policy will be examined according to messages in formal written documentation. This may include either statutory requirements or guidance.

1.2.2 Curriculum

The term curriculum is often used to refer to different aspects of educational policy. In a narrower sense it refers to the content and activities prescribed. In contrast, the term can be used to capture the wider aspects of educational policy. For example, Alexander (2010, p.250) refers to the curriculum as ‘what is intended to be taught and learned overall (the planned curriculum); what is taught (the curriculum as enacted); what is learned (the curriculum as experienced)’. In a similar way, Van den Akker (2007) describes three levels of curriculum policy: what is intended (the ideal and formally written), what is implemented (perceived and enacted by practitioners) and what is attained (experiences and outcomes of learners). In this light, policy texts are an element of the intended or planned curriculum: what is formally written.





1.2.3 Creativity

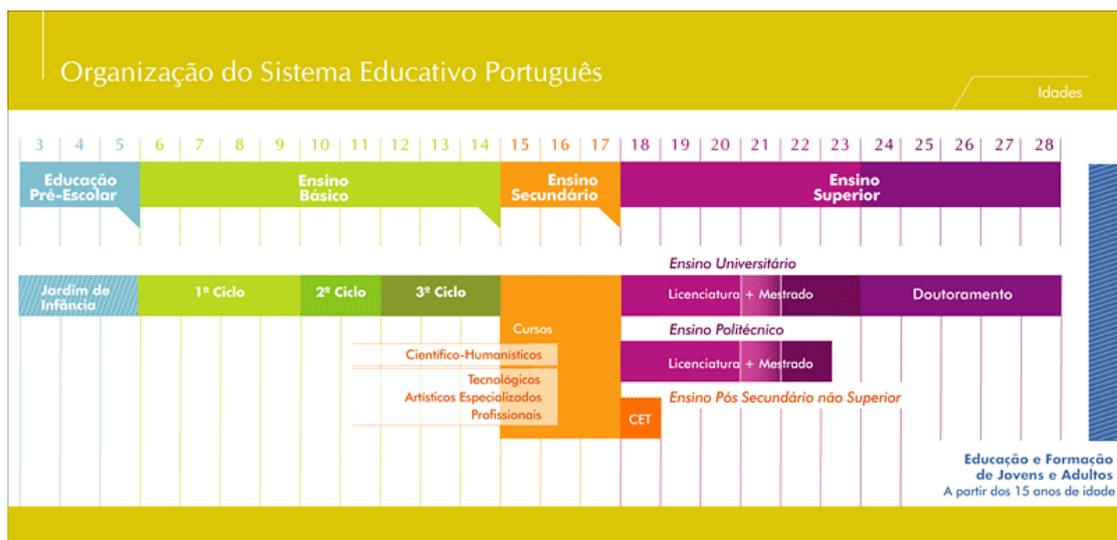
As reported in the *Conceptual Framework* (D2.2), the Creative Little Scientists project indicates a focus on little c, or personal, or everyday, creativity, i.e. ‘purposive imaginative activity generating outcomes that are original and valuable in relation to the learner’. In the Review of Science and Mathematics education in pre-school and early years of primary school (Task 2.2), an appendix to the *Conceptual Framework*, the following definition is used in relation to creativity in Science and Mathematics: ‘generate alternative ideas and strategies as an individual or community, and reason critically between these’.

2. Overview of National Early Years Education provision and policy

2.1 The Portuguese educational system - Some general information

The Portuguese education system, according to the basic law, is organized in pre-school education, school education and out-of-school education: a) the pre-school educational is complementary to the family action, b) school education includes Basic Education, secondary and higher education; c) the out-of-school adult education includes literacy activities and Basic Education, cultural and scientific improvement and updating, and initiation, retraining and professional improvement and takes place in an open framework of multiple initiatives, both formal and non formal (LBSE, artº 4).

Portuguese educational system 2011/2012



Source: GEPE - <http://www.gepe.min-edu.pt/np4/9.html>



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The national school network is composed mostly by public schools. In the last years there has been a reorganization and rationalization of the school network, which has been performed based on the closure of schools with few students and the reorganization of schools and groups, promoting the integration of all cycles teaching in the same educational project. These measures are promoting greater efficiency in the affectation of system resources, both in the administrative/ logistical support, and in terms of human resources¹.

Private schools in Portugal are regulated by a specific law and status subordinated to what is foreseen in the Education Act. In this sense, they are subject to administrative and financial inspections carried out by the competent authorities of the Ministry of Education. Central Government finances public and supports private schools/institutions which celebrate contracts of association with the Ministry of Education where there is shortage of places in public school provision. The amount of financial support depends on the number of pupils included in the association contract and it involves teaching staff, non-teaching staff and running costs.

Nevertheless, there are independent private schools which are not financed by the state and which can have or not pedagogical autonomy and parallelism. In the first case, pupils' assessment is carried out by the school itself, and in the second case pupils must be submitted to final examinations in a public school.

Table 1 - School population: Pre-school / 1st and 2nd cycles of Basic Education – 2008/09 school year

Education levels	Public schools	Publicly-funded private schools	Independent private schools
Pre-School	51.83 %	29.84 %	18.33 %
1 st and 2 nd cycles of Basic Education	88.08 %	3.19 %	8.73 %

Source: GEPE – Estatísticas da Educação 2008-2009.

The Ministry of Education sets the broad education policies. Five regional bodies (on the mainland) implement ministerial policies and provide guidelines, coordination and support to all non-higher education establishments. In the autonomous regions of Madeira and Azores, education administration is the responsibility of the respective regional governments, through secretariats of education.

¹ Education and Training 2020. National progress report - April 2011. Available in: http://ec.europa.eu/education/lifelong-learning-policy/doc/natreport11/portugal_pt.pdf





Since 1998, more autonomy has been devolved to schools or groups of schools management bodies. In 2007, contracts of autonomy and development were negotiated between the Ministry of Education, schools who applied for it and local partners, in order to consolidate the transfer of new responsibilities.

Inspection is the responsibility of the General Inspectorate of Education, which has regional delegations supervising all aspects of non-higher education.

2.1.1 Pre-school education

In Portugal, pre-school education is considered as the first step of the education system and is aimed at children aged 3 to 5 years. In 2009, the law no. 85/2009 of 27 August, established the universality of pre-school education for children who reach 5 years, nevertheless, attendance is never compulsory.

The pre-school network is provided by the state, private and cooperative bodies, private social solidarity institutions and non-profit institutions. The public network is fully financed by the state which also covers the costs of the educational component provided by the private social and non-profit networks. Fees are paid in independent private nursery schools.

Each class, per educator, should have a minimum attendance of 20 and a maximum of 25 children. Although in the case of a homogeneous group of children 3 years of age, cannot have more than 15 children assigned to each educator (Order no. 9 5106-A/2012, April 12).

General Objectives

The Law on Educational System Bases defines in article five, eight objectives for this level of education, which encompass health, wellness and cognitive development. These objectives are: (1) to stimulate the capabilities of each child, encouraging their training and the balanced development of all their potential, (2) to contribute to emotional stability and safety of the child, (3) to facilitate the observation and understanding of natural and human environment for better integration and participation of the child, (4) to develop the child's moral education and sense of the responsibility associated with freedom, (5) to promote the integration of children in different social groups, complementary of the family, in view of the development of social skills, (6) to develop the child's capacities of expression and communication, as well as their **creative imagination**, and encourage playful activity; (7) to promote hygiene habits that defend personal and public health; (8) to screen for inadequacies, disabilities or precocities, and to promote better orientation and guidance of the child.

Consistent with the objectives set forth in the Basic Law, the Framework Law of Pre-school Education establishes the general principle that pre-school education should encourage "the formation and the balanced development of the child, with a view to their full integration into society as an autonomous, free and fair human being". This principle underlies all the articles of the law and it affects the overall objectives set for teaching pre-





school education: a) To promote the personal and social development of the child based on life experiences in a perspective of democratic citizenship education, b) to promote the inclusion of children in different social groups, the respect for different cultures, favoring a progressive awareness as a member of the society, c) to contribute to equal opportunities in the access to school and to learning success; d) to encourage the global development of each child in the respect for their individual characteristics, instilling behaviors that promote meaningful and diverse learning's e) to develop the expression and communication across multiple languages as media for relation, information, aesthetic awareness and understanding of the world; f) to awaken curiosity and critical thinking; g) to provide opportunities for child welfare and safety, particularly in the context of individual and collective health; h) To identify the inadequacies, deficiencies or precocious behavior and promote a better orientation and guidance of the child; i) to encourage the participation of families in the educational process and to establish effective collaborative relationships with the community.

Curriculum

Curriculum Guidelines for pre-school education are a set of principles to support the teacher in decisions about their practice, i.e., to conduct the educational process to develop with the children. Curriculum Guidelines provide a common reference for all teachers of the National Preschool Education and are intended for the organization of the educational component.

It is not a program, since they adopt a perspective that is more focused on indications for the teacher than the prediction of learning to be undertaken by children. They differ from some conceptions of curriculum as they are more general and extensive, that is, they include the possibility to support various educational options and therefore various curriculums.

With support on these grounds, curriculum development is the responsibility of the educator and will take into account: (i) the general objectives – set out in Law Table of Preschool Education; (ii) organization of the educational environment – as support for curriculum and its intentionality.

2.1.2 Compulsory education

Since 2009 (Law no. 85/2009 of August 27), education is compulsory from 6 to 18 years of age - has a duration of 12 years. Pupils who have reached the age limit for compulsory education and who have not successfully completed the 12th grade may continue their education in different types of adult education.



Table 2 - Compulsory education – Basic Education and secondary education

Levels		Grades	Age
Basic Education (Ensino Básico)	First Cycle	1.º - 4.º	6-10 years old
	Second Cycle	5.º - 6.º	10-12 years old
	Third Cycle	7.º - 9.º	12-15 years old
Secondary Education		10.º - 12.º	15-18 years old

Source: GEPE - <http://www.gepe.min-edu.pt/np4/9.html>

Basic Education – 1st cycle (6-10 years old)

Admission to compulsory school is generally based on catchment areas. However parental choice is possible if there are places available in the school they prefer for their children.

Initial enrolment in the 1st year of Basic Education is compulsory for all children who have completed 6 years of age by 16th of September, or 31st of December at the request of parents and depending on the places available in schools (Order no. 14 026/2007 of July 3).

In the 1st cycle of Basic Education the working day consists of 5 compulsory teaching hours plus 3 more hours of optional curricular enrichment activities.

The main guidelines for organising the school year are the following ones:

- The school year is the period between 1st September and 31st August;
- The school year, fixed annually by legislation from the Minister of Education, lasts for 180 effective days of school activities in schools which minister compulsory education;
- Each term lasts for approximately 3 months, followed by a two weeks break of school activities;
- Breaks of school activities occur at Christmas, Carnival and Easter;
- School year begins in the first fortnight of September and ends between the end of April and the end of June.

The first cycle of Basic Education works with a single teacher, with the recourse to specialist teachers in certain areas.

Class size/student grouping

In the first cycle, the constitution of classes must meet, according to the order n.º 5106-A/2012, 12 April, the following conditions:

- a class who started school in a given year should be maintained throughout the entire cycle, i.e., during four years;
- a class cannot be constituted only by students that were retained;



- Whenever possible, the same teacher should accompany the class over the four years of schooling;
- Classes are comprised of 26 students, as long as they include only one year of schooling. If they include students from different school years and only one teacher, they must be composed by 18 students – if with more than one teacher may reach 22 students;
- Classes that have students with special educational needs of a prolonged character (cannot include more than 2 students in these conditions), consist of 20 students maximum.

Curricular control and content

The curriculum is determined at the national level. The Ministry of Education also defines the teaching methods' guidelines, which are adapted in each school by its teachers, in close relation with the school education project.

The current curriculum for the first cycle of Basic Education dates from 1998. It was updated in 2004, having then been introduced some changes resulting from the entry into force of some official documents. Until now, it keeps unchanged.

As to what concerns the first cycle of Basic Education, teaching is the responsibility of a generalist teacher who may be assisted by other teachers in specialist areas, namely: Music, Foreign Language and Physical Education.

With the implementation of full-time school, by extending the hours of operation for a minimum of eight hours per day schools promote activities to enrich the curriculum, including the compulsory teaching of English, study support for all students, physical fitness activities and sports, the teaching of music and other artistic expressions and other foreign languages.

General Objectives

According to the Basic Law of the educational system, the curriculum of the 1st cycle defines three main objectives for Basic Education:

- Creating the conditions for global development and harmonious development of personality, through the progressive discovery of interests, skills and capabilities that provide a personal training, in its dual individual and social dimension.
- Provide the acquisition and mastery of knowledge, tools, skills, attitudes and values essential to informed choice of future paths or professional school.
- Develop values, attitudes and practices that contribute to the formation of conscious and participatory citizens in a democratic society.

Directions of Policy

At this moment in Portugal, several changes and a reorientation of the educational policy are under way, with particular emphasis on the action and the educative organization of teachers of all grade levels.





An important curriculum document, "National Curriculum for Basic Education - Essential skills" was recently revoked by Order 17169/2011 of 23 December. This document contained the guidelines that served as reference for the official documents of the Ministry of Education, especially for programs, learning goals, national tests and examinations of Basic Education. The Ministry of Education, through the Secretary of State for Basic and Secondary Education, is preparing documents clarifying educational goals and priorities of the fundamental contents of the programs.

The "National Curriculum for Basic Education - Essential Skills" defined a set of general competencies to be achieved by students at the end of basic education. It contained also, general and specific instructions for its operation in each curriculum area and the actions and activities to be undertaken by the teacher. In the case of "Environmental Studies" the following learning experiences were suggested: problem solving, collaborative work, individual work, the use of ICT resources, investigative activities, a variety of situations for communication and action in the environment, projects, etc.

Competence, in this official document, related to the process of activating 'resources' (knowledge, skills, strategies) in various situations, including problem situations (ME 2001a: 9).

When the "National Curriculum for Basic Education - Essential Skills" was implemented, some changes were introduced to the Basic Education "Curricula and Programmes Organisation" (ME, 2004). According to Varela (2012), the most significant changes made by these official documents concern the schools' primary objectives and a renovated didactic approach to the several curricular areas consistent with those designs, including the Natural and Physical Science component of the Environmental Studies area:

- the valorisation of experimental learning in the different areas and disciplines of Basic Education, particularly and compulsorily in Science teaching;
- the adoption of a school curriculum for the development of student skills². In it, it is explained that reasoning, communication and attitudes are important domains for the development of specific skills to achieve scientific literacy by the end of Basic Education. Skills in these domains are developed simultaneously and transversally with the different forms of knowledge (ME, 2001a);
- the existence of comments in the curriculum that point to a greater appreciation of the social dimension in the construction of the students' learning:

"(...) students come to school with their own sets of ideas, preconceptions, representations, emotional and affective dispositions and ways to act. (...) These structures, when faced with other more objective ones, socially shared and emanating from the teaching process, get ruptured and the simplistic view of reality is undermined, (...), originating an increasingly accurate and scientific knowledge." "This progression stems from the subjective (that which is



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experienced) and aims for the objective (that which is socially shared)..." (ME, 2001a:75).

In another part of the text, there is also a suggestion to carry out:

"(...) learning activities that include the use of scientific language, (...) of discussion situations that allow for the development of skills in explanation of ideas, refutation and argument,(...) educational experiences which also contemplate cooperation in the sharing of information, presentation of results..." (ME, 2001a:133).

However, more than three decades of experience have shown that the introduction of Science themes and new approaches to knowledge construction in the Basic Education programmes has failed to produce any significant effects in the renovation of pedagogical practices and subsequent improvement of the quality of student learning. It has not been enough to include in the curriculum these scientific didactic innovations, whose aim is to break away from the teaching practices that have been engrained in our schools for years (Sá, 2002; Varela 2012).

It is also important to refer that in the scope of the 'Global Strategy for the National Curriculum Development' the Ministry of Education launched a project called *Metas de Aprendizagem* (Learning Goals). This project was designed with the aim to establish learning goals for each cycle (including pre-school level), as well as its development and progression by grade, subject and disciplinary area. Although these learning goals are not binding the Ministry of Education hopes that it will turn into an important tool to support the curriculum management, as a consequence from the recognition of its practical use by teachers, students and families (for more information please consult the following link – <http://www.metasdeaprendizagem.min-edu.pt/>).

Currently, the "Learning Goals" will also be subject to change and are expected to enter into a process of public discussion from July 27, 2012. At this moment it is only known that it will be called "Curriculum Goals."

For the 1st cycle of basic education only the program with the contents of each curriculum area (Curriculum Organization and Programs of the 1st cycle of basic education, 2004) exist at this time. Here too, there have been changes, earlier this school year, with the introduction of the new programs in Mathematics and Portuguese Language. It is likely that the "Environmental Studies" program will also be subject to change in the coming times.





3. Methodology for mapping approaches

3.1 Research Question

The main research question for Work Package 3.2, adapted for this National Report is:

How is teaching, learning and assessment of science and mathematics in the early years conceptualised in policy in Portugal?

The sub questions identified within this overarching research question were:

- *What is the role of creativity in the way teaching, learning and assessment of science and mathematics in the early years are conceptualised in policy in Portugal?*
- *What are the main similarities and differences between mathematics and science in the way teaching, learning and assessment of these areas in the early years are conceptualised in policy in Portugal?*
- *What are the main similarities and differences between pre-school and school phases in the way teaching, learning and assessment of science and mathematics in the early years are conceptualised in policy in Portugal?*

In order to examine how teaching, learning and assessment are conceptualised across Portuguese policy, this report drew upon the framework of curriculum components ‘*the vulnerable spider web*’ (see van den Akker, 2007) that identifies the following key questions related to student learning:

- Rationale or vision: Why are children learning?
- Aims and objectives: Toward which goals are children learning?
- Content: What are children learning?
- Location: Where are children learning?
- Learning activities: How are children learning?
- Teacher role: How is the teacher facilitating learning?
- Materials and resources: With what are children learning?
- Grouping: With whom are children learning?
- Time: When are children learning?
- Assessment: How to measure how far children’s learning has progressed?

As well as factors relating to the curriculum, the *Conceptual framework* (D2.2) identified Teacher factors as a significant in teaching, learning and assessment approaches in the classroom. This is further indicated in the D3.1 *List of Mapping and Comparison factors* derived from the *Conceptual Framework*. Consequently, this project set out to examine Teacher factors addressed in policy, in particular the approaches documented in relation to both:





- Initial Teacher Education: What are the requirements for initial teacher education?
- Continuing Professional Development: What are the opportunities for Continuing Professional Development?

3.2 Method

This report addressed the research questions through an analysis of relevant policy documents in Portugal. One of the first challenges, therefore, was to identify what constituted relevant documents. The second challenge was to adopt an approach to analysis that could not only evaluate approaches across documents but could allow these to be compared to approaches in partner countries. This was addressed by use of a survey tool grounded upon prior work in the creativity Little Scientists project.

3.2.1 Data selection

Policy documents were chosen that captured the different aspects of curriculum according to the nine dimensions identified by Van den Akker (listed above) in relation to early science and mathematics. They cover curriculum and assessment requirements, guidance in relation to teaching approaches and regulations that relate to teacher education.

3.2.2 Survey tool

A survey tool was developed in order to quantify judgments about the extent to which particular approaches were emphasised in Portuguese policy documents. Whilst quantifying approaches is problematic, this was considered important in order to support comparisons between European partners, as well as provide an informative representation of approaches within Portuguese documents.

The survey tool comprised of two main sections: one relating to Teaching, Learning, and Assessment approaches. This was subdivided according to the dimensions of curriculum described previously, namely: *Rationale; Aims; Content; Location; Learning activities; Teacher role; Materials and resources; Grouping; Time*. The other section focused on Teacher Education, subdivided into Initial Teacher Education and Continuing Professional Development.

The sections were comprised of a series of questions about approaches advocated in national policy. In each section researchers in partner countries were asked to provide background information or evaluate the extent to which particular approaches were, or were not emphasised across policy documents, and also the extent to which the role of creativity is emphasised in these approaches. These approaches listed were carefully drawn from prior work in the Creative Little Scientists project, namely the D2.2 the *Conceptual Framework* and the D3.1 *List of Mapping and Comparison factors*, which drew attention to significant approaches characteristic of creativity in early years science and mathematics.





3.3 Selection of Documents

This review Focuses Largely on the existent curriculum documents for Pre-school and Basic Education - 1st cycle, the principal legislation of education policy for these levels of education and in addition, other documents, including Eurydice reports and some research articles about the curriculum reform in Portugal.

Table 3 - Key documents used in the review

Documents	
Ministry of Education - Law of the Education System - new consolidated version (Decree-Law No. 49/2005, of August 30th).	Policy document - Mandatory
Curriculum Organization and Basic Education programs - 1st Cycle. Mem Martins. Department of Education (2004). http://www.escolavirtual.pt/assets/conteudos/downloads/1c1cr/Cgenerico/p1ciclo.pdf?width=965&height=600	Report
Ministry of Education (2001). National Curriculum for Basic Education - Essential Skills. Lisbon. Department of Education.	Policy document - Mandatory
Ministry of Education (1997). Curriculum guidelines for pre-school education. Department of Basic Education: Lisbon. Available in: http://sitio.dgjdk.min-edu.pt/recursos/Lists/Repositrio%20Recursos2/Attachments/25/Orientacoes_curriculares.pdf	Policy document - Mandatory
Learning Goals. Directorate General for Innovation and Curriculum Development. http://www.metasdeaprendizagem.min-edu.pt/educacao-pre-escolar/apresentacao/	Policy document - Mandatory
Curricular reorganization of Basic Education : assessment of learning: the concepts to practice: Implementing Order 30/2001 of 19 July. Lisbon: Department of Basic Education	Policy document - Mandatory
Education and Training 2020. National progress report - April 2011. Available in: http://ec.europa.eu/education/lifelong-learning-policy/doc/natreport11/portugal_pt.pdf	Report
Normative Order no. No. 14/2011 of 18 December	
National system overviews on education systems in Europe and ongoing reforms. Eurydice: Portugal, March 2011	Website
Decree-Law No 43/2007 of 22 February. Defines the legal regime of professional qualification for teaching.	
Ministry of Education and Science. Directorate General for Education http://www.dgjdk.min-edu.pt/index.php?s=directorio&pid=3	Official Website
GEPE - Statistics and Education Planning Office: http://www.gepe.min-edu.pt/np4/9.html	Official Website





4. Approaches to Teaching, Learning and Assessment

4.1 Rationale or Vision

A. Purposes for Science Education

The curriculum for pre-school and 1st cycle of Basic Education in Portugal does not state specific purposes for science education. In these two levels of education, the sciences are grouped into content areas – “Knowledge of the World” in pre-school, and “Environmental Studies” in the 1st cycle. The objectives of these areas are formulated in close relation with the learning that children should acquire in each of those areas of the curriculum. Also the "Learning Goals", recently developed for Pre-schools and for all cycles of primary and secondary education, as the name suggests, refer only to learning (content - knowledge) that students should demonstrate at the end of each level of education.

However, a few ideas emerge from the analysis performed in the areas of "Knowledge of the World" (Pre-school) and “Environmental Studies” (1st cycle) : i) this area is seen as a sensitization for the science and integrates aspects of different fields of human knowledge: history, sociology, geography, physics, chemistry and biology ... that, although elementary and appropriate for children of these ages, should always correspond to a great scientific rigor; ii) it must promote understanding and interaction with the natural and social world that surrounds the child, to make sense of ideas that he builds; iii) encourage the natural curiosity and desire to know; iv) use and refine different means of expression and communication, to better understand the world and have the means to represent and give meaning; v) solve problems that lead children to reflect on how and why. Thus, for example, the different explanations of reality should be verified by observation and action, look for patterns, reasoning about data, solve problems and communicate results. In this sense the area of mathematics is directly related to the area of “Knowledge of the World” (ME- OCEPE, 1997, p. 78).

B. Role of Creativity in the purposes of Science Education

Creativity is not mentioned as a purpose in the curriculum of "Environmental Studies" of the 1st cycle of Basic Education or in the curriculum guidelines for pre-school education.

In this document, the curriculum guidelines for Pre-school Education, does not appear any reference to the term creativity or any other associated with it (ME-OCEP, 1997), nor in the current document that defines the learning goals that the children will reach at the end of Pre-school. This in spite of the Basic Law of the Portuguese Education System, in its Article 5, point 1.f, taking the promotion of creativity in children as one of the objectives for this level of education: “ to develop the child’s capacities of expression and communication, as well as their **creative imagination** ... ”

C. Main differences between preschool and primary school

There are no significant differences.





D. Differences between science and mathematics

There are no significant differences between science and mathematics

4.2 Aims and Objectives

A. Key summary points

In the curricula and other legal documents only the aims and Objectives for each level of general education are defined. In terms of learning science there is an additional difficulty, because they do not constitute an autonomous area, but are grouped with other scientific disciplines. However, the reading and analysis of curricula for preschool and 1st cycle shows that the knowledge and understanding of concepts has a dominant role among the various intended learning outcomes.

In the Curriculum Organization and Basic Education programs - 1st Cycle it is referred explicitly that students should have opportunities to "deepen their knowledge of nature and society, leaving teachers to give them the tools and techniques needed so they can build their own knowledge in a systematic way" (ME - OCP, 2004) ..

However, it is also referred that for students to achieve "mastery of the concepts it is necessary for everyone to become active observers with the ability to discover, investigate, experiment and learn" (ME - OCP, 2004). For this some simple processes of knowledge of the surrounding reality are suggested (to observe, describe, formulate questions and problems, advance possible answers, test, verify), assuming an attitude of permanent research and experimentation. It should also be able to: select different sources of information (oral, written, observation ... etc..) And use various forms of collection and treatment of simple data (interviews, surveys, posters, graphs, tables) use different methods to communicate the information collected.

In the document on the "Learning Goals" these appear as verbs: describes, identifies, distinguishes, checks, systematize, structure, communicate and debate. For example, the target 21 states: "The student identifies and verifies properties of different materials, conditions and forms that appear to change its physical state, and handles small devices for specific purposes" (Website Learning goals). Within each goal, several objectives are operationalized. For the former goal, the student until the end of 4th grade - end of 1st cycle of Basic Education - must:

- a) organize materials based on diverse criteria for classification (eg natural or manufactured; mineral, vegetable or animal origin; physical status; attracted / not attracted by the magnet; b) identify factors (variables) that can influence the behavior (floating / sinking, dissolution) of different materials/objects in water or in other liquids, and the effect of variation of each one of them; c) identify the characteristics of an object' image in a plane, concave, convex or cylindrical mirror, checking the variation of the number of images of an object from two plane mirrors when they are associated in different ways; d) indicate characteristics of different soil samples (color, texture, smell, permeability),





recognizing some of its characteristics (color, texture, hardness ...) and applications in rock samples from his close the environment. e) describe the water cycle, identifying the state changes that occur, and participating in laboratory procedures for its verification. (...)

B. Role of creativity

Creativity is not mentioned explicitly among the aims and objectives of science education in the current curriculum. The references to creativity appear only in the fundamental laws governing the pre-school and 1st cycle of Basic Education:

- In Pre-school Education, the Framework, Decree-Law No. 5 / 97 of February 10, Article 10, defines the objectives of Pre-school. In these objectives, although there is no explicit reference to creativity, there are some expressions that may indicate, implicitly, that the child's creative action is associated with them: "d) To encourage the overall development of each child, respecting their individual characteristics, instilling behaviors that promote meaningful and diversified learning; f) to awaken curiosity and critical thinking".
- In the curriculum guidelines for pre-school education does not appear any reference to the term creativity or another associated with it (ME-OCEPE, 1997), nor in the current document that defines the learning goals that children will reach by the end of Pre-school, despite the Basic Law of the Portuguese education system, that states in its Article 5, that one of the objectives of preschool education is "to develop the child's capacities of expression and communication, as well as their **creative imagination**, and encourage **creative** play activities."
- In turn, for Basic Education there are only brief mentions. For example, article 7 (a) of the Basic Law of the Educational System – new version consolidated (Law n.º 49/2005, of 30 of August) – states that one of its aims is to "provide common training to all Portuguese that guarantees the discovery and the development of their interests and skills, reasoning ability, memory and critical thinking , **creativity** (...)".
- One of the three main objectives for the Primary School (see page 6 of this report) relating to the personal dimension of the training, refers more specifically for this level of education that it shall "encourage, while respecting the specific stages of development of students, a construction based on the values of personal initiative, creativity and persistence" (ME: OCP, 2004, p. 13).

C. What are the main differences between preschool and school?

There are no relevant differences

D. What are the differences, if any, between science and mathematics?

There are no significant differences between science and mathematics.



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4.3 Content

A. Key summary points

The curriculum organization of the 1st cycle of Basic Education has the following structure:

Curriculum areas of the 1st cycle of Basic Education	
Compulsory disciplinary areas of (a):	Portuguese; Mathematics; Environmental Studies; Expressions: artistic Physical and motor.
Areas not disciplinary (b):	Project area; Supported Study Education for citizenship
Total: 25 hours (a)	
Discipline of optional frequency (c)	Moral and Religious Education
Total: 1 hours	
Total: 26 hours	
Curricular enrichment activities (d)	

Each subject area of the curriculum includes the following components: a) the Guiding Principles b) General Objectives c) Learning Blocks. These latter correspond to sets of learning activities designated by a concept, an articulating theme or designation by a stage of development of curricular activity. Each block, while section or segment of a subject area, consists of four stages of activities corresponding to each of the four years of the 1st Cycle.

The Natural Sciences were included in the primary school program in 1975 (with the establishment of democracy), through the creation of the “Physical and Social Environmental Studies”. Some changes introduced by the curricular reform carried out in 1990 in Portugal are still in effect today: i) the change of the curricular area name from “Physical and Social Environmental Studies” to “Environmental Studies”; and ii) the extension and intensification of the Science component, with the inclusion of Physical Sciences into a block called “Discovering Materials and Objects”. Since its creation until today, the curricular area of Environmental Studies takes on a globalising nature, as it integrates contributions from several other scientific disciplines, such as History, Geography and Ethnography, among others (Varela, 2012).

The Environmental Studies program, which includes the component of the sciences (physical and natural), is organized in the following content blocks:



<i>Blocks</i>	<i>Content</i>
Block - Self-discovery:	<ol style="list-style-type: none"> 1. Your identification; 2. Your tastes and preferences; 3. Your body; 4. The health of your body; 5. The safety of your body.
Block - The discovery of your natural environment:	<ol style="list-style-type: none"> 1. The living beings in your environment; 2. The physical aspects of the local environment; 3. Identify colors, sounds and smells of nature; 4. Astronomical bodies.
Block - The discovery of materials and objects:	<ol style="list-style-type: none"> 1. Conducting experiments with some materials and objects of everyday Use; 2. Conducting experiments with water; 3. Conducting experiments with the sound; 4. Handling objects in concrete situations; 5. Conducting experiments with the air; 6. Conducting experiments with light; 7. Conducting experiments with magnets; 8. Conducting experiments in mechanics; 9. Conducting experiments with electricity.

The mathematics program of the 1st cycle of Basic Education, recently readjusted (2012) consists of two main components: mathematical themes and transversal capabilities common to all the learning of mathematics.

The program is structured around four main themes of mathematics, by cycles of learning and not by years of schooling: Numbers and operations, Algebra, Geometry, and Data organization and treatment. However, in the 1st cycle of Basic Education does not appear the subject of Algebra - although there are objectives in other subjects of this cycle that have an algebraic character – and, in this cycle, Geometry is associated with Measurement. But transversal capabilities are offered for problem solving, mathematical reasoning and mathematical communication. These capabilities should receive continued attention in all cycles of Basic Education.



In Pre-school Education there is no formal curriculum but a set of guidelines that help the educators to structure their educational activity (Curriculum Guidelines for Preschool Education - OCEPE, 1997). The document is structured into two main parts: General Principles and Educational Intervention. In the first part are emphasized the scope of application and the specific objectives of this level of education. In the second part, the educational intervention incorporates three dimensions: organization of the educational environment, the content areas and educational continuity.

In relation to the content areas, these are defined as "areas of knowledge, with their own structure and socio-cultural relevance, which include different types of learning, not only knowledge but also attitudes and know-how" (OCEPE, 1997 p. 47).

The area of the "Knowledge of the World" in Pre-school education is rooted in the child's natural curiosity and this desire to know and to understand why. Curiosity is encouraged and extended in pre-school through opportunities for contact with new situations that are both instances of discovery and exploration of the world.

The organization of the content areas covers domains and sub-domains that have a correspondence with the program areas of the 1st cycle of Basic Education.

Table 1 – Correspondence of content areas between the Pre-school and 1st cycle of Basic Education.

Content areas in the curriculum guidelines of the pre-school	Compulsory curriculum areas of the 1st cycle of Basic Education
Area of Personal and Social Formation	Education for citizenship
Area of Expression and Communication: – <i>Domain motor expressions, dramatic, artistic and musical;</i> – <i>Field of Oral Language and Approach to Writing;</i> – <i>Domain of mathematics.</i>	Expressions: Artistic, Physical and motor Portuguese Language (Oral and written communication) Mathematics
Knowledge of the World Area	Environmental Studies;

The area of the "Knowledge of the World" includes the widening of basic knowledge necessary for social life, for example: learn to name and use different equipment and utensils, to use objects to build new shapes, to recognize and name different colors, sensations and feelings, to know his full name, address and location, to know how to say his age and to realize that he is growing; to know some aspects of the natural and social environment. But this area also involves the discussion of scientific information on biology, knowledge of body organs, of animals, their habitats and habits, of plants, etc... And also experiences of physics and chemistry (light, air, water, etc..) that can be performed by children of pre-school age. Playing with water, to fill and to empty containers may be, for





example, one way to understand that the air takes up space, to experience the principle of communicating vessels, to question why do some objects float while others sink. There are also ways to explore the effects of light and shadow, either using natural resources (sunlight) or technical ones (lamps, overhead projector, slide projector, etc.), that allow, for example, to explore the tilt and size of shadows at various times of the day, projecting the shadow of one's body and hands, and to play with shapes, colors, materials and textures. The observation of the weather and some knowledge about meteorology (wind, rain, etc.) are also referred.

B. Role of creativity emphasised?

Creativity is not referred in the content for science. In the curriculum of pre-school it is only referred that some aspects of the area "Knowledge of the World" can "help to develop aesthetic sensitivity, imagination and language" in children.

C. Main differences between pre-school and school

The contents of science in pre-school education are treated in a more rudimental way, but as can be seen in the table above there is a tendency for continuity and deepening of the same themes in the 1st cycle.

D. Differences, if any, between science and mathematics

Unlike the sciences which constitute a component of Pre-school and 1st cycle of Basic Education integrated in a curriculum area, "Knowledge of the World", and "Environmental Studies", respectively, mathematics is treated as a cross-curriculum domain as well as a separate curriculum area.

4.4 Learning Activities

A. Key summary points

With the revocation of the 'National Curriculum for Basic Education - Essential Skills - Basic Education', there is little information on the learning activities. However, in the document containing the program (Organization Curriculum and programs of the 1st cycle), you can read in the guiding principles for the management of "Environmental Studies", that it will be "through different situations of learning that include direct contact with the environment, performing small research and actual experiences in school and community as well as through the use of information from more distant sources that students will be tackling and integrating progressively the meaning of the concepts. [In this process,] students will be helped to learn to organize information and to structure it so that it would constitute knowledge, facilitating then the teacher, its communication and sharing "(p. 102).

In block 3 and 5, more specifically oriented to science teaching ("Discovering the natural environment" and "The discovery of materials and objects", respectively) - are proposed activities to develop in students an experimental attitude (observation, introduction of





changes, assessing the effects and results, conclusions) that encourage students to raise questions and seek answers to them through experiments and simple searches. The activities will be based on direct observation, using all the senses, the collection of samples, without harming the environment, as well as experimentation. Activities involving the manipulation of objects and instruments, the care in their use and conservation, and the valorization of handwork, are declared important. The exploration of materials in current use is mainly based on observation of their properties and on elementary experiences that highlight them. The recording of experimental data, should be age-appropriate for the students, limited and oriented to the communication of their discoveries.

The work to be undertaken by students in all blocks, but mainly in blocks 3 and 5, must include mandatory, experimental activities and inquiry activities, involving: a) asking questions, b) the child's curiosity, c) use of instruments of observation and measurement, d) analysis and participation in the discussion of problems of general interest.

In pre-school education, the content areas assume activities which have as a principle the idea that children learn from exploring the world around them.

The area of "Knowledge of the World" includes the widening of basic knowledge necessary for social life.

But this area also involves the approach of the scientific aspects which go beyond the direct experience of the child and his immediate experiences. There is for example, content related to biology, knowledge of body organs, of animals, their habitats and habits, of plants, etc., and also experiences of physics and chemistry (light, air, water, etc..) that can be performed by children of pre-school age. Playing with water, to fill and to empty containers may be, for example, one way to understand that the air takes up space, to experience the principle of communicating vessels, to question why do some objects float while others sink. There are also ways to explore the effects of light and shadow, either using natural resources (sunlight) or technical ones (lamps, overhead projector, slide projector, etc.), that allow, for example, to explore the tilt and size of shadows at various times of the day, projecting the shadow of one's body and hands, and to play with shapes, colors, materials and textures. These are aspects of the "Knowledge of the World" which also contribute to developing aesthetic sensibility, imagination and language. If the observation of the weather is part of many contexts of pre-school education, the knowledge of meteorology (wind, rain, etc..) relates to issues of concern to children that may be treated in more depth. This is also the case of geography that may extend beyond the immediate environment, or deepen and diversify from it (rivers, seas, orography, etc..) and geology (comparing rocks, collection of stones, observation of their properties).

B. Role of creativity emphasised?

There are no references to creativity in learning activities.





C. Main differences between preschool and school

There are not very significant differences in terms of the activities suggested, because the approach of the sciences in Pre-school Education has a logic of continuity in first cycle of Basic Education.

D. Differences, if any, between science and mathematics

There are no significant differences between science and mathematics

4.5 Teacher Role / Location

A. Key summary points

Decree-Law no. 241/2001 of 30 August, which approved the specific profiles of professional performance of the kindergarten teacher and teacher of the 1st cycle of Basic Education, defines a set of roles that these teachers should play in each one of the curriculum areas.

In the context of the “Environmental Studies” area, the teacher of the first Cycle:

- a) Develops a scientific attitude in students, by mobilizing the processes by which knowledge is constructed;
- b) Uses strategies leading to the development of the following formative dimensions of science learning: (i) Curiosity, the enjoyment of knowing and a rigorous and informed knowledge of the social and natural reality; (ii) Ability to question and to recognize the value and the limits of the evolution of science; (iii) Ability to articulate the realities of the social and natural world with school learning; (iv) Understanding of the connections science-technology-development, resorting namely to the construction of simple objects, to the use of models and problem solving;
- c) Promotes integrated learning of content and processes of social and natural sciences;
- d) Involves students in experimental activities and activities that systematize their knowledge of natural reality, especially concerning the nature of matter, the solar system, the aspects of the physical environment, the living beings, and functioning, health and safety of the human body ;
- e) Develop learning in science, leading to the construction of a responsible citizenship, particularly in the context of health education, environment, consumption, respect for difference and democratic coexistence.

The analysis of curricula shows, also in agreement with what was written in the previous section (4.4.), that they suggest the promotion of an experimental and constructivist teaching of science. In block “Discovering Materials and Objects” there is great emphasis towards developing a “permanent experimental attitude” in the approach to its contents, such as: “conducting experiments with some materials and objects, experiments with water, sound, air, light, magnets, mechanics, etc.” In block 3, “Discovering the Natural





Environment”, we find expressions such as “raising questions, the search for answers through experiments, simple research, direct observation, sample collection, handling observation and measurement instruments like the thermometer, compass, magnifying glass, binoculars”... (ME, 2004:114).

The guiding principles of the curriculum confer to the teacher the power to direct the whole process of teaching and learning in which students must become active observers with the ability to discover, investigate, experiment and learn (ME-OCP, 2004:112). However, in the curriculum guidelines for pre-school and curriculum (program) of the 1st cycle of Basic Education there are few concrete indications on how the educator (pre-school) and teacher (1st cycle) should conduct science activities with children. There are only a few references to: (i) the promotion of group work, (ii) physical exploration of materials, (iii) using outdoor Learning Activities, (iv) Integrating Science with Other curricular areas, (v) Building on children's prior Experiences (vi) Encouraging different ways of recording and expressing, (vii) Encouraging problem finding.

B. Role of creativity emphasised

The role of creativity is not emphasized in the preschool nor in the 1st cycle of basic education.

C. Main differences between preschool and school

There are no significant differences between preschool Education and Basic Education (1st Cycle).

D. Differences, if any, between science and mathematics

There are no significant differences between science and mathematics

4.6 Materials and Resources

A. Key summary points

The guiding principles of the program of the 1st cycle of Basic Education suggest to the teacher the use of various materials and resources, aiming at a diversity of learnings, without specifying them.

The more specific references to instructional materials come only in "Block 5 - The Discovery of materials and objects". Here are listed various materials, tools and equipment for hands-on exploration in the classroom or for hands-on exploration outside the classroom (e.g. salt, sugar, milk, wood, clay, cork, sand, paper, wax, scissors, hammer, saw, hoe, typewriter, camera, recorder, magnifying glass, stapler, paper punch, balloons, syringes, lenses, prisms, mirrors, magnets, nails, pins, lamps, wires, batteries, levers, pulleys, pipettes, dropper, microscope, overhead projector, slide projector, thermometer, compass, magnifying glass, binoculars ...)

In the Curriculum Guidelines for Pre-school two types of materials are referred: some are reference materials such as books, newspapers, videos, slides, computer; others are





materials for conducting experiments. Among these are very simple materials from everyday life or the natural environment that can be used, and there are also specific materials such as magnets, magnifying glasses, binoculars, microscopes...

B. Role of creativity emphasised

In the content area "World Knowledge" in Pre-school Education it is explicitly stated that the variety of materials and objects used are "ways to extend experience, develop imagination and the possibilities of expression" (ME: OCEPE, p. 63).

C. Main differences between preschool and school

There are no significant differences between preschool Education and Basic Education (1st Cycle).

D. Differences, if any, between science and mathematics

There are no significant differences between science and mathematics

4.7 Groupings

A. Key summary points

Group work is mentioned a number of times across all documents analysed for both science and mathematics in the Pre-school Education and 1st Cycle of Basic Education curricula.

B. Role of creativity emphasised

In the Curriculum and Programs in Organization of Basic Education - 1st cycle creativity is referred to only once: "the Participation in personal or group projects will allow the child to develop, personally, their expressive and creative abilities" (OCP-EB, 2004, p. 67).

C. Main differences between preschool and school

In Pre-school Education there is a greater emphasis on group work. This emphasis is immediately expressed in the principles that underlie "Curricular Organizations: "the requirement to respond to all children-which presupposes a differentiated pedagogy, based on cooperation, in which each child benefits from the educational process developed with the group" (OCEPE, 1977, p.14). There is a greater tendency to enhance the social dimension of learning. Work in pairs, in small groups and, fundamentally, in a large group, are mentioned several times...

"The planning of the educational environment allows children to explore and to use space, materials and tools available to them, providing them diverse interactions with the whole group, in small groups and with a peer, and also the possibility to interact with other adults "(OCEPE, 1977, p 26).

D. Differences, if any, between science and mathematics

There are no significant differences between science and mathematics





4.8 Time

This is not discussed for either science or mathematics, in particular.

A. Key summary points

The curriculum guidelines for pre-school and 1st cycle of Basic Education do not mention the time that teachers should dedicate to approach the various curricular topics. The educational time dedicated to each of the areas of the curriculum is the responsibility of the educator or teacher, who may manage the curriculum flexibly, according to the educational needs of children. However, the daily or weekly educative routine is intentionally organized and planned.

Thus, the sequence of each day has a certain pattern in terms of approach of each curriculum area. Children know this routine that provides for succession and they know what they can do at various times, having the freedom to propose modifications. Not all days are equal, the proposals of the educator / teacher or children can modify the usual rhythm of work devoted to each area of the curriculum. The preschool curriculum explicitly states that it is for the teacher to organize the time devoted to each content area, although this organization matches "moments that are repeated at regular intervals" (OCEPE, 1997, p.40). The curricular structure of the 1st cycle of Basic Education refers only to the weekly time that should be devoted to the teaching of Compulsory disciplinary and not disciplinary areas (25 hours) and to the frequency of optional disciplines (one hour).

4.9 Assessment

A. key summary points

In Portugal do not exist purposes of assessment, specifically defined for science teaching. There are common purposes for all areas of the curriculum and for all cycles of Basic Education.

Basic Education – 1st Cycle

In the beginning of the school year, the pedagogical council, in agreement with guidelines laid down in the national curriculum, defines the assessment criteria for each cycle and year of schooling, as proposed by the teachers council in the 1st cycle of the Basic Education (Legislative Order No 1/2005 of January 5). The assessment criteria mentioned in the preceding paragraph are common references in school or group, and operationalized by the professor in class, in the case of the 1st cycle (unique and generalist teacher).

The assessment for Basic Education is regulated by Decree-Law (Decree-Law 6/2001de January 18 and Legislative Order No 1/2005) and assumes an integral and regulatory nature of educational practice, allowing the systematic collection of information to support appropriate decision-making to promote: the quality of learning. According to the Legislative Order No 1/2005 of 5 January, the assessment has, for all the cycle of Basic Education, the following purposes:





a) Supporting the educational process, in order to sustain the success of all students...; b) Certify the various learning and skills acquired by students at the end of each cycle and the output of basic education, through internal and external summative assessment; c) Contribute to improving the quality of the education system, enabling the decision-making for the improvement, and promoting greater social confidence in its operation.

Assessment in the Basic Education (all cycles) covers the following forms:

- Diagnostic evaluation – leading to the adoption of pedagogic differentiation strategies, to overcome any difficulties encountered by students, facilitating their integration into school and supporting career guidance and counseling. It can occur at any time during the school year when combined with formative assessment.
- Formative assessment – is the primary mode of evaluation of basic education, assumes a continuous and systematic nature and aims to regulate the teaching and learning, using a variety of tools to collect information, according to the nature of learning and to the contexts in which they occur.
- Summative assessment is carried out at the end of each term of each school year, and at the end of each cycle. It is reflected in the formulation of a judgment on the globalizing learning achieved by students. In the 1st cycle, the information resulting from the summative evaluation is descriptive in all curricular areas.

At the end of each cycle of Basic Education (4th, 6th and 9th year of schooling), students are also subjected to an external evaluation process.

This evaluation is made up of national exams in the basic and secondary education prepared by the Ministry of Education through the Office of Educational Evaluation. In Basic Education (Web site: <http://www.gave.min-edu.pt>), students take exams at the end of each cycle, corresponding to the end of 4th, 6th and 9th grades on Portuguese Language and Mathematics. In the 4th grade, the final year of the 1st cycle of Basic Education, pupils undergo gauged tests that aim to monitor and evaluate the education system, with a view to improve the quality of learning. In the next school year, the national exams will have also the aim of pupils assessment and will count 30% for the final classification in the 1st cycle.

In the first year of school no student repeats, except if the number of unjustified absences has been exceeded. In the following three years, students progress if they achieve the “Learning Goals” foreseen in the National Curriculum of Basic Education.

Pre-School Education

The Pre-School Education has specificities to which do not fit all shapes and evaluative practices traditionally used in other levels of education. In this sense, the evaluation in Preschool Education assumes a formative nature, being seen as monitoring of the processes of learning made by the children:

- The assessment, while integral element and regulator of the educational practice, allows a systematic collection of information that once analyzed and interpreted, supports the adoption of appropriate decisions and promotes the quality of



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learning. The reflection on the possible effects enables to establish the progression of learning to develop in each child, individually and in groups, taking into account its evolution.

- According to the Curriculum Guidelines for Preschool Education, "to evaluate the process and effects implies becoming aware of the action to adapt the educational process to the needs of children and its development. The assessment carried out with the children is an educational activity, and is also a valuation basis for the teacher. Their reflection from the effects they observe, allows them to establish the progression of learning to develop each child. In this sense, evaluation is support of planning "(see p 27).
- In the Specific Performance Professional Profile of the Educator it is referred that this "evaluates, in a formative perspective, their intervention, the environment and education processes adopted, as well as the development and learning of each child and of the group" (Annex no. 1, e), section 3, Chapter II).
- Moreover, the concept of Learning Goals as an instrument to support management of the curriculum, allowing to identify the skills and performance expected of children by providing a common reference that will be useful to educators to plan processes, strategies and modes of progression so that all children may have engaged learning in each content area before joining the 1st cycle of basic education.

In Pre-school Education, according to his conceptions and teaching options, the educator must employ diverse techniques and instruments for observing and recording, such as: a) Observation; b) Interview; c) Narrative approaches; d) Photographs, e) Audio and video recordings; f) Records of self-evaluation; g) Portfolios constructed with the children; h) Questionnaires for children, parents or other educational partners; i) other. In the 1st cycle of Basic Education, despite the assessment assuming also, in legal terms, a nature that is predominantly regulatory of the teaching and learning, written tests and student registration sheets are very frequently used.

What issues / tensions / policy criticisms exist?

One of the criticisms levelled at external evaluation at the end of the 1st cycle of Basic Education is the absence, since 2001, of an examination of the curriculum area of "Environmental Studies", which includes the component sciences (Varela, 2012).

B. Role of creativity emphasised

Having been recently repealed, as already mentioned, the national curriculum of Basic Education- Essential Skills, no guidelines exist currently for skills assessment. The assessment in this period of political uncertainty is limited, in this level of education, to the learning content - while the new curriculum guidelines are not approved. Thus, the assessment has focused essentially in learning the content defined in the national curriculum for the various areas and disciplines of each cycle.

For example, the "Learning Goals", recently approved for each cycle of education, including pre-school, and for each curriculum area, are formulated in terms of content that children





should learn during each cycle of education. Even the new mathematics curriculum for the first and second cycles of basic education, despite providing a set of transversal skills to be developed in children (problem solving, mathematical reasoning and mathematical communication), does not mention how to evaluate these skills..

C. Main differences between preschool and school

In pre-school, assessment is essentially formative, while in the 1st cycle of Basic Education it is also of diagnostic and summative nature.

D. Differences, if any, between science and mathematics

There are no differences in terms of processes, methods and evaluation purposes. This is defined and regulated in an identical manner for all curricular areas, either in the 1st cycle of Basic Education or in pre-school education.





5. Approaches to Teacher Education

In accordance with the Basic Law of Educational System, teachers (apart for higher education) are given initial and specialised education, and continuous professional development.

5.1 Initial teacher education

As previously mentioned, in Portugal the pre-school education is provided pursuant to point 2 of Article 30 of the Law of the Education for early childhood educators, while in the 1st cycle of basic education, as his character globalization is in accordance with Article 8. of the referred Act, the responsibility of a single teacher, which can be assisted in specialized areas. The training of these professionals is carried out in Universities and Higher Schools of Education of the public and private sector.

In Portugal, there since 2007 (Decree-Law No. 369/2007 of 5 November), the Agency for Assessment and Accreditation of Higher Education (A3ES). This agency's mission is to ensure the quality of higher education in Portugal, through evaluation and accreditation of higher education institutions and their courses of study and performance of the functions inherent in the integration of Portugal in the European system of quality assurance higher education.

A. Entry requirements

In order to apply for access to higher education via the national system, students must fulfill the following requirements: they must have passed an upper-secondary education course or legally equivalent qualification; they must have taken the necessary entrance exams for the course that wish to attend with a minimum mark of 95 points in 200 points; they must have satisfied the necessary pre-requisites (if applicable) of the course they are applying to. Entrance to each higher education institution is subjected to numerus clausus.

B. The main Standards/competencies to be achieved

In Portugal, the specific profiles of competence of Educators and teachers first cycle of Basic Education are defined by Decree-Law No. 241/2001 of 30 August. The profile of competences of these professionals is organized into two main areas: a) skills development and curriculum development - the educator and teacher of the 1st cycle design and develop the curriculum, through the planning, organization and evaluation of the educational environment and learning performed by students; b) skills curriculum integration - the educator and teacher of the 1st cycle mobilizes the knowledge and skills needed to develop an integrated curriculum within curriculum areas (see Link: <http://ebookbrowse.com/dec-lei-241-2001-pdf-d305375481>)

C. Curriculum content

The initial training of Educator and Teacher Primary School comprises two separate training courses (two cycles of study) that usually have the following structure:





A-A first cycle of studies - Degree - which focuses on the scientific area or areas specific to each domain of competence for teaching in order to ensure mastery of the scientific content, humanistic and technological disciplines to teach. In the case of Early Childhood Educators and teachers of the 1st cycle of Primary School corresponds to the degree in Elementary Education;

B-A second cycle of studies - Master - which gives professional qualification for teaching and is organized in accordance with Decree-Law 43/2007 - new Legal Professional Qualification for Teaching, the following training components:

- a) General education - Covers the knowledge, skills, attitudes and skills in education relevant to the performance of all teachers in the classroom, kindergarten or school, in community relations and participation in analysis and policy development education and teaching methodologies;
- b) Specific Didactics - covers the knowledge, skills, attitudes and skills related to teaching in curriculum areas or subjects and cycles or levels of education of their area of qualification for teaching;
- c) Introduction to professional practice;
- d) Training cultural, social and ethical;
- e) Training in educational research methodologies;
- f) Training in the area of teaching.

Professional qualification conferred by a polytechnic or a university - In Portugal the ownership of the professional qualification for teaching general, in pre-school and on the 1st and 2nd cycles of Basic Education is given to those who have a degree in Elementary Education and a Masters in Education.

D. Level of training

The professional qualification for teaching is the Master's degree. This is the minimum academic qualification for the teaching profession, according to the changes introduced within the Bologna Process.

To enter the profession it is necessary to possess a professional qualification conferred by a polytechnic or a university for the cycle or recruitment group one is applying to, and pass the knowledge and competencies test (designed to evaluate scientific readiness) as well as obtain, at least, the mark of Good in the performance assessment of the probationary period (to assess pedagogic and didactic competencies).

Access to the teaching employment in the public sector is done via national application, based on academic qualification and professional experience. Teachers working in the public sector are civil servants.





E. Length of training

The length of training is 5 years - 3 years (degree) + 2 years (Master).

F. Institutions authorised to provide training

Initial teacher education is carried out in higher education institutions – polytechnic and universities – with the Master's degree being the minimum academic qualification for the teaching profession, according to the changes introduced within the Bologna Process.

5.2 Continuing professional development

The training of educators and teachers is recognized as a right that is enshrined in the Basic Law of the Portuguese Educational System. In this Law, it is stated that the training "is provided predominantly by the respective training institutions, in cooperation with the institutions where educators and teachers work" (Art. 38, 3). The Legal System of Training Educators and Teachers of Primary and Secondary Education reinforced the idea of lifelong learning and stated it as a duty and a right inseparable from the initial training (Decree-Law 207/96 of 2 November). Also the publication of the Teaching Career Statute expresses this understanding of training, considering it as a prerequisite for career development (Art. 43.) With this encouragement to continuing education has been recognized that the initial training alone is not sufficient for the teaching career, this was pointed out in the Basic Law when it stated that continuous training "complements and updates the initial training in a perspective of lifelong learning" (Article 33, 1.b).

As a consequence of some of the earlier legislative measures. was found in the period 1993 to 2005, a massified and mandatory training, given the demands of career teachers. During this period, there were thousands of actions of training on several topics. From 2005 there was a set of policy guidelines that led to the formation becomes more scarce and controlled.

In the period 2005 to 2011 are privileged actions didactic training on the specific relevance to the application in the classroom, which should represent at least 50% of the shares to be attended by teachers (Order 794/2005 of August 3). Later, established that at least two thirds (66%) would be in the scientific-teaching the teacher teaches (Decree-Law No. 15/2007 of 19 January). Thus, since 2005, the training of teachers came to be targeted to priority areas defined by the Ministry of Education, from a diversity and freedom (1003-2005) subject to the opposite situation (2005-2011) (Silva, 2011).

To ensure the training of teachers were created Centers of Associations of Schools (CFAEs), entities currently responsible for the largest percentage of the number of training courses.

For the accreditation of these centers, the training and trainers to ensure that, was created the Coordinating Council for Further Education of Teachers, which existed until 1994, when it was replaced by the Scientific Council for Further Education Teaching (CCPFC), organ of ministerial appointment. The financing of continuing training was provided January 1994 to





December 1999 by FOCUS (under the Community Support Framework II, the PRODEP II, Measure 2/Ação 2.1) and from there by PRODEP III, Measure 5 / Action 5.1.

In addition to the training centers for associations of school, the training of teachers is also offered by institutions of higher education universities and colleges responsible for initial teacher training.

There is, in Portugal, a Scientific and Pedagogical Council for Continuous Training, who is responsible for the accreditation of training providers and continuing training of teachers, monitor the system evaluation process of training, as well as the accreditation of specialized training courses (Decree-Law 155/99 of May 10).

In relation to continuing training of teachers in mathematics and science, the Ministry of Education, in collaboration with institutions of higher education responsible for teacher training and schools or groups of schools, has developed two major national projects of continuing training of teachers in mathematics and science. These projects, oriented at teachers of the 1st and 2nd cycle of Basic Education, had as main objectives to improve levels of student success in mathematics and science and the enhancement of skills of teachers in these curricular areas:

- The national program of teacher training in mathematics was developed successively between the years 2005 and 2010 (Joint Order no. 812/2005 and Order no. No 8783/2010). This program aimed at improving the students' learning of mathematics in the 1st and 2nd cycles of Basic Education and also at developing a positive attitude towards this curricular area. To this end, it intended: a) to enhance the mathematical knowledge, teaching and curriculum of the teachers involved, b) to implement experiences in mathematics curriculum development, c) to develop positive attitudes of teachers in relation to Mathematics; d) to create dynamic collaborative work between teachers and e) to promote networking between schools and groups.

The program has been addressed to the teachers of the 1st and 2nd cycles that are to teach Mathematics and lasted for one academic year. During training, teachers had joint training sessions and follow-up sessions in the classroom.

- The Training Program in Experimental Science Teaching for Teachers of the 1st cycle of Basic Education has developed over four academic years between 2006 and 2010 (Order no. No 2143/2007 of 9 February and Decree no. No. 701 / 2009 of 9 January), with the central purpose of increasing the level of scientific literacy of Portuguese students through the development of professional skills of teachers of the 1st cycle of Basic Education, in this curricular area.





6. Summary

The most important aspect that conditioned this report is the fact that at this time in Portugal changes and revisions of the curriculum are under way. The revocation of the "National Curriculum for Basic Education - Essential Skills", limited the information available to answer to some of the items in the questionnaire that was the basis for this report. This fact may have distorted the image here transmitted of the Portuguese educational reality expressed in official documents. However, the reality presented in the curricula does not reflect the reality of the educational practice that occurs in the classrooms of most schools.



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Various legislation



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Appendix A: Survey Ratings

Key: E= Pre-school, P=Early primary

Analysis of Approaches to Teaching and Learning

Rationale or Vision

Ai. What are the purposes of Science Education? (Adapted from T survey Q23)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. To provide a foundational education for future scientists and engineers	E		P	
b. To develop socially and environmentally aware and responsible citizens				EP
c. To enrich the understanding and interaction with phenomena in nature and technology		E		
d. To develop more innovative thinkers				EP
e. To develop positive attitudes to science	P	E		
f. To develop important attitudes and dispositions as a foundation for future learning	E			P
g. Other	E			

Aii. What is the emphasis, if any, on the role of Creativity in the purposes of Science Education? (Adapted from T survey Q23)

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. To provide a foundational education for future scientists and engineers		EP		
b. To develop socially and environmentally aware and responsible citizens		EP		
c. To enrich the understanding and interaction with phenomena in nature and technology		EP		
d. To develop more innovative thinkers		EP	P	
e. To develop positive attitudes to science		EP		
f. To develop important attitudes and dispositions as a foundation for future learning		EP		





Aims and Objectives

Ai. What views are indicated about the importance of the following Science learning outcomes? (Adapted from T survey Q24)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. To know and understand the important scientific ideas (facts, concepts, laws and theories).			P	
b. To understand that scientists describe the investigations in ways that enable others to repeat the investigations.		P		
c. To be able to ask a question about objects, organisms, and events in the environment.			P	
d. To be able to employ simple equipment and tools, such as magnifiers, thermometers, and rulers, to gather data and extend to the senses.			P	
e. To know and understand the important scientific processes.		P		
f. To be able to communicate investigations and explanations.		P		
g. To understand that scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.	P			
h. To have positive attitudes to science learning.	P			
i. To be interested in science.	P			
j. To be able to plan and conduct a simple investigation.		P		
k. To have positive attitudes to learning.		P		
l. To understand that scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge).	P			
m. To be able to collaborate with other children			P	
n. Other				

*In the curricula and other legal documents only the aims and Objectives for each level of general education are defined. In terms of learning science there is an additional difficulty, because they do not constitute an autonomous area



Aii. What is the emphasis, if any, on the role of Creativity in the following Science learning outcomes?

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. To know and understand the important scientific ideas (facts, concepts, laws and theories).		EP		
b. To understand that scientists describe the investigations in ways that enable others to repeat the investigations.		EP		
c. To be able to ask a question about objects, organisms, and events in the environment.		EP		
d. To be able to employ simple equipment and tools, such as magnifiers, thermometers, and rulers, to gather data and extend to the senses.		EP		
e. To know and understand the important scientific processes.		EP		
f. To be able to communicate investigations and explanations.		EP		
g. To understand that scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.		EP		
h. To have positive attitudes to science learning.		EP		
i. To be interested in science.		EP		
j. To be able to plan and conduct a simple investigation.		EP		
k. To have positive attitudes to learning.		EP		
l. To understand that scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge).		EP		
m. To be able to collaborate with other children		EP		
n. Other				

Content

A. How are Science and Mathematics presented as learning domains?

	As its own learning area	Encompassed within other social sciences (e.g. geography)	Encompassed within more general understanding
Science		EP	
Mathematics	P	E*	

* In pre-school mathematics is included in the area of Expression and Communication, along with the motor expressions, dramatic, musical and artistic and Approach to Oral Language and Writing;



Learning Activities

Ai. What activities are encouraged? (Adapted from T survey Q29)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Observe natural phenomena such as the weather or a plant growing and describe what they see.	E		P	
b. Ask questions about objects, organisms, and events in the environment.	E		P	
c. Design or plan simple investigations or projects.	E		P	
d. Conduct simple investigations or projects	E			P
e. Employ simple equipment and tools to gather data and extend to the senses.	E		P	
f. Use data to construct reasonable explanations.	E		P	
g. Communicate the results of their investigations and explanations.	E	P		
h. Other				

Aii. What is the emphasis, if any, on the role of Creativity in the following activities?
(Adapted from T survey Q30)

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. Observe natural phenomena such as the weather or a plant growing and describe what they see.		EP		
b. Ask questions about objects, organisms, and events in the environment.		EP		
c. Design or plan simple investigations or projects.		EP		
d. Conduct simple investigations or projects		EP		
e. Employ simple equipment and tools to gather data and extend to the senses.		EP		
f. Use data to construct reasonable explanations.		EP		
g. Communicate the results of their investigations and explanations.		EP		
h. Other				





Teacher Role / Location

Ai. What learning/teaching contexts and approaches are mentioned? (Adapted from T survey Q25)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Open/unstructured play	EP			
b. Role/Pretend play	EP			
c. Drama	EP			
d. Teaching science from stories	EP			
e. Using history to teach science (e.g. transport, the work of scientists)	EP			
f. Working in small groups			EP	
g. Physical exploration of materials			EP	
h. Using outdoor learning activities		P	E	
i. Taking children on field trips and/or visits to science museums and industry	P			
j. Integrating science with other curricular areas			E	P
k. Building on children's prior experiences			E P	
l. Fostering collaboration		E	P	
m. Encouraging different ways of recording and expressing ideas – oral, visual, digital, practical			EP	
n. Encouraging problem finding – e.g. children asking questions			EP	
o. Encouraging problem solving – e.g. children solving practical tasks		P	E	
p. Encouraging children to try out their own ideas in investigations	P		E	
q. Fostering classroom discussion and evaluation of alternative ideas	EP			
r. Fostering imagination	P	E		
s. Relating science to everyday life	EP	E		
t. Using questioning as a tool in science teaching	EP			
u. Using digital technologies with children for science teaching and learning		E	P	
v. Fostering autonomous learning	E	P		
w. Other	E			





Aii. What is the emphasis, if any, on the role of Creativity in the following learning/teaching contexts and approaches? (Adapted from T survey Q26/27)

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. Open/unstructured play		EP		
b. Role/Pretend play		EP		
c. Drama		EP		
d. Teaching science from stories		EP		
e. Using history to teach science (e.g. transport, the work of scientists)		EP		
f. Working in small groups		EP		
g. Physical exploration of materials		EP		
h. Using outdoor learning activities		EP		
i. Taking children on field trips and/or visits to science museums and industry		EP		
j. Integrating science with other curricular areas		EP		
k. Building on children's prior experiences		EP		
l. Fostering collaboration		EP		
m. Encouraging different ways of recording and expressing ideas – oral, visual, digital, practical		EP		
n. Encouraging problem finding – e.g. children asking questions		EP		
o. Encouraging problem solving – e.g. children solving practical tasks		EP		
p. Encouraging children to try out their own ideas in investigations		EP		
q. Fostering classroom discussion and evaluation of alternative ideas		EP		
r. Fostering imagination		EP		
s. Relating science to everyday life		EP		
t. Using questioning as a tool in science teaching		EP		
u. Using digital technologies with children for science teaching and learning		EP		
v. Fostering autonomous learning		EP		
w. Other		EP		

* The role of creativity is not emphasized in the preschool nor in the 1st cycle of basic education.



C. What, if any, Inquiry Approaches are discussed? (Adapted from T survey Q31)

	A (Open)	B (Guided)	C (Structured)	N/A
a. QUESTION: Children investigate scientifically oriented question				
b. EVIDENCE: Children give priority to evidence				
c. ANALYSE: Children analyse evidence				
d. EXPLAIN: Children formulate explanations based on evidence				
e. CONNECT: Children connect explanations to scientific knowledge				
f. COMMUNICATE: Children communicate and justify explanation				
g. REFLECT: Children reflect on the inquiry process and their learning				
h. Other				

* Do not are Inquiry approaches discussed.

Materials and Resources

A. What materials are suggested? (Adapted from T survey Q38)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Instructional materials (e.g. textbooks)	E		P	
b. Audio-visual resources	E		P	
c. Relevant library materials (e.g. story books)			E	
d. Equipment and materials for hands-on exploration in the classroom (e.g. magnets, building blocks)			EP	
e. Equipment and materials for hands-on exploration outside the classroom	P		E	
f. Computers		E	P	
g. ICT resources (e.g. computer applications)			EP	
h. Other digital technologies (e.g. interactive whiteboard, camera)	P			
i. Budget for supplies (e.g. paper, drawing materials)	P		E	
j. Teaching support personnel (e.g. classroom assistant)	P		E	
k. Other support personnel (e.g. technical support)	P			
l. Other				



Groupings

A. What groupings, if any, are suggested for teaching Mathematics and Science?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
Individual work	P	E		
Pair work	P			E
Small group work			P	E
Whole class activities			P	E

In Pre-school Education there is a greater emphasis on group work. This emphasis is immediately expressed in the principles that underlie Organizations Curriculum, "the requirement to respond to all children-which presupposes a differentiated pedagogy, based on cooperation, in which each child benefits from the educational process developed with the group" (OCEPE, 1977, p. 14).

"The planning of the educational environment allows children to explore and use space, materials and tools available to them, providing them diverse interactions with the whole group, small group and peer, and also the possibility to interact with other adults "(OCEPE , 1977, p 26).

Assessment

A. What purposes of assessment are included? ((Adapted from T Survey Q36)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. To identify areas for improvement in your science teaching	EP			
b. To identify aspects of the science curriculum that could be improved	EP			
c. To identify ways to improve child science learning	EP			
d. To monitor regularly individual children's or cohorts of children's progress towards a set of desirable science learning outcomes			EP	
e. To inform parents of their child's progress in science			EP	
f. To help group children for science instruction purposes				
g. To monitor year-to-year child progress in science				
h. To provide feedback to children about their progress in science			EP	
i. To set targets with children for their own development in science				
j. Other				



B. What importance is given to of the following priorities for children’s assessment in Science? (Adapted from T Survey Q33)

To assess the development of children’s:

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Knowledge and understanding of scientific ideas (facts, concepts, laws and theories)			EP	
b. Knowledge and understanding of scientific processes	EP			
c. Competencies necessary to carry out scientific inquiry	EP			
d. Understandings about scientific inquiry (e.g. how science and scientists work)	EP			
e. Positive attitudes and increase of interest in science	EP			
f. Positive attitudes and increase of interest in learning science	EP			
g. Other	E			

*** There is not a specific assessment for the area of science and mathematics. The assessment, goals, methods, etc.. is defined in decree-law for all areas of the curriculum. The priorities and assessment instruments used depend on conceptions of teaching of each teacher.**

C. What ways of assessing are advocated? (Adapted from T Survey Q34)

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Using checklists to record observations of children	EP			
b. During classroom interaction	EP			
c. Evaluating children’s pictures, graphs etc which show their scientific reasoning	EP			
d. Evaluating children’s relevant gestures or physical activity	EP			
e. Marking their homework	EP			
f. Using authentic problem-based tasks	EP			
g. Asking each child to reflect on their own learning and progress	EP			
h. Using closed question tests	EP			
i. Using open question tests	EP			
j. Using questions in context	EP			
k. Using portfolios (collection of evidence of children’s work and progress)	EP			
l. Children correcting each other’s work and giving each other feedback	EP			
m. Other	EP			



*** this information was in the "National Curriculum for Basic Education - Essential Skills" - Repealed**

D. What Creative attributes are addressed in assessment?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
Sense of initiative	EP			
Motivation	EP			
Ability to come up with something new	EP			
Ability to connect what they have learnt during your lessons with topics in other subjects	EP			
Imagination	EP			
Curiosity	EP			
Ability to work together	EP			
Thinking skills	EP			
Other	N			

