

Article

Sustainable Development in Basic Education Sciences in Portugal—Perspective of Official Curriculum Documents

Patrícia João ^{1,2,*} , Patrícia Sá ¹, Maria Helena Henriques ²  and Ana V. Rodrigues ¹

¹ Research Centre on Didactics and Technology in the Education of Trainers, University of Aveiro, 3810-193 Aveiro, Portugal; patriciasa@ua.pt (P.S.); arodrigues@ua.pt (A.V.R.)

² Geosciences Center, University of Coimbra, 3030-790 Coimbra, Portugal; hhenriq@dct.uc.pt

* Correspondence: pat.joao@ua.pt

Abstract: This study aims to identify and characterize the understanding of the concept of Sustainable Development in the official scientific educational documents of basic education in Portugal. Methodologically, it is a qualitative study that fits into the interpretive paradigm; its implementation is based on an interpretative-descriptive strategy of exploratory nature. The study involved the organization of the analysis corpus and the subsequent content analysis of the selected documents. The documents included in this corpus are the official educational documents on the teaching and learning of Natural Sciences in Basic Education (1st to 9th grade—ages 6 to 15): the Essential Learning and two transversal documents (the Student Profile on Leaving Compulsory Schooling and the Environmental Education Framework for Sustainability). The obtained results show that these documents frame and guide the implementation of Education for Sustainable Development, in all its dimensions, throughout basic education. However, this does not happen in an equitable way, neither in all documents nor in all years of schooling.

Keywords: sustainable development; basic education sciences; Portuguese Curricular Guidelines



Citation: João, P.; Sá, P.; Henriques, M.H.; Rodrigues, A.V. Sustainable Development in Basic Education Sciences in Portugal—Perspective of Official Curriculum Documents. *Sustainability* **2022**, *14*, 5651. <https://doi.org/10.3390/su14095651>

Academic Editor: David González-Gómez

Received: 5 April 2022

Accepted: 6 May 2022

Published: 7 May 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The commitment to the 2030 Agenda for Sustainable Development [1] and the Sustainable Development Goals [2] implies the inclusion of sustainability issues in formal education programs and curricula.

The Portuguese Ministry of Education, through the Directorate General of Education, has assumed its role in achieving the Sustainable Development Goals, emphasizing that “*children and young people are central in this global call for participation and that the school is essential to make known this new global agenda, inspire and encourage people to participate in community development*” [3]. The Directorate General of Education also states that the 17 Sustainable Development Goals “*focus on people, human rights and the response to growing social inequalities, as well as encompass central issues such as peace, security and climate change*” [3], emphasizing their commitment and clearly valuing the different dimensions of Sustainable Development (SD).

Environmental Education for Sustainability is currently a transversal and fundamental aspect of the curriculum in Portugal. However, the formal integration of an education that promotes SD into Portuguese Curricular Guidelines has taken several years, and it is worth highlighting some milestones (Figure 1).

In 1989, the Reform of the Educational System [4] established the guidelines for citizenship implementation in educational curricula of different grades of schooling. This Reform also introduced the School Area concept and complementary curricular activities, important references in this context as they enable interaction between the school and the community, thus promoting the development of Environmental Education projects.

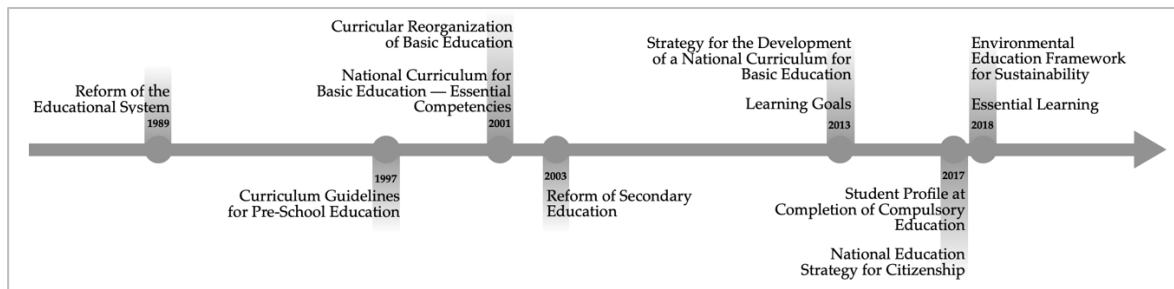


Figure 1. The integration of Sustainable Development concerns among Portuguese Curricular Guidelines during the last three decades.

Later, in 1997, the *Curriculum Guidelines for Pre-School Education—OCEPE* [5] were published, encouraging the approach of issues related to the environment from a very early age.

The Curricular Reorganization for Basic Education (1st to 9th grade—ages 6 to 15), in 2001 [6] and the Reform of Secondary Education (10th to 12th grade—ages 16 to 18), in 2003 [7] enhanced the education for citizenship implementation in a more systematic way, since this became a mandatory transversal area and, therefore, present in all disciplines. This Reorganization of Basic Education [6] determined the establishment of three non-disciplinary curricular areas—Project Area, Accompanied Study, and Civic Education—and defines Education for Citizenship as transdisciplinary.

Also in 2001, the *National Curriculum for Basic Education—Essential Competencies* [8] was presented and entered into force. This document defines the competencies to be achieved at the end of Basic Education (BE), taking the Basic Law of the Portuguese Educational System assumptions as reference. This document proposes a set of transversal competencies, common to the three BE cycles and specific competencies defined for each disciplinary area, per BE cycle. It is proposed that science education in the three cycles is based on four themes: Earth in Space, Earth in Transformation, Sustainability on Earth, and Living Better on Earth. An exploration of these themes in an interdisciplinary perspective is valued, in which the Science Technology Society and Environmental interaction should constitute an integrative aspect of scientific knowledge:

“Living better on planet Earth presupposes critical and thoughtful human intervention, aiming at sustainable development that, considering the Science, Technology, Society and Environment interaction, is based on social and ethical options and on scientific knowledge, enlightened on the dynamics of systemic relationships that characterize the natural world and on the influence of these relationships on individual and community health” [8].

(p. 133)

The *National Curriculum for Basic Education—Essential Competencies* was revoked in 2011 [9].

The *Learning Goals* [10] were recommended guidelines for the 2013–2014 academic year [11], within the scope of the Strategy for the Development of a National Curriculum for Basic Education (Ministry of Education), aiming to promote clarification and operationalization of the curricular documents that guide educational action. Not being normative documents, they propose curriculum management references for each discipline or disciplinary area, in each education cycle. These documents are developed by grade of schooling, from Pre-School to Secondary Education, and identify competencies and students’ expected performance in each subject area, as well as in transversal areas.

Issues related to sustainability are explicitly proposed in *The Learning Goals* document, arising in different disciplines or disciplinary areas and in different school grades. As an example, in the Natural Sciences subject (8th grade), we can highlight the sustainability on land domain and the sustainable resource management sub-domain.

In 2017, the *Student Profile at Completion of Compulsory Education* was approved [12]. This document claims to be a:

“ . . . reference for the decisions to be adopted by decision-makers and educational actors at the level of educational establishments and entities responsible for educational policies, constituting a common matrix for all schools and educational offerings within the scope of compulsory education, namely at the curricular level, in the planning, implementation, and internal and external evaluation of teaching and learning” [12].

(p. 6)

The *Student Profile at Completion of Compulsory Education* aims to guide curriculum management and contribute to the definition of strategies and methodologies to be used in the context of teaching practice.

This document is organized into Principles, Vision, Values, and Areas of Competence.

The eight Principles presented are: Learning; Inclusion; Stability; Adaptability and Boldness; Consistency and Flexibility; Sustainability; Humanist Base; and Knowledge.

The Vision, based on the defined Principles, explains what is expected of a student leaving compulsory schooling, to be a literate, free, autonomous, and responsible citizen; able to deal with the change and uncertainty that characterize today's world; able to think critically and autonomously; able to continue learning autonomously throughout life; that respects values of human dignity, solidarity, and the exercise of citizenship; and that rejects any form of discrimination and/or exclusion.

The Values considered, in line with an exercise of citizenship that promotes sustainability, are Responsibility and Integrity; Excellence and Demand; Curiosity; Reflection and Innovation; Citizenship and Participation; and Freedom.

The Areas of Competence, which are absolutely central in this document, are considered complementary to each other and presented without any hierarchy: languages and texts; information and communication; reasoning and problem solving; critical thinking and creative thinking; interpersonal relationships; personal development and autonomy; well-being, health, and environment; aesthetic and artistic sensibility; scientific, technical, and technological knowledge; and awareness and mastery of the body.

In the same year (2017), the *National Education Strategy for Citizenship* was presented by the Directorate-General for Education (DGE) [13]. This Strategy is a reference document, to be implemented from pre-school education to the end of secondary education, in convergence with the *Student Profile at Completion of Compulsory Education* and, currently, with the *Essential Learnings* document (mentioned later).

Education for Citizenship integrates different domains, organized into three groups of six domains each. The first group, which includes the SD and Environmental Education domains as it includes transversal and longitudinal areas, is mandatory for all levels and cycles of schooling. The second group, which includes the domains institutions and democratic participation and financial literacy and consumer education, is mandatory in at least two cycles of BE, while the third, which includes the domain of citizenship, is optional in any school grade.

The reference curriculum document for Environmental Education implementation in schools is the *Environmental Education Framework for Sustainability* [14], provided in the *National Environmental Education Strategy* [15].

The *Environmental Education Framework for Sustainability* [14] is organized by education levels, contemplating guidelines from Pre-School Education to Secondary Education.

This document proposes eight global themes: Sustainability, Ethics and Citizenship, Sustainable Production and Consumption, Territory and Landscape, Climate change, Biodiversity, Energy, and Water and Soils. For each of these themes, sub-themes, objectives, and performance descriptors are defined. The themes, sub-themes, and objectives are common to different educational levels, although they are suitable for each level and for the age of the students they are intended for.

In 2018, the *Essential Learnings* document was homologated [16], which, in articulation with the *Student Profile at Completion of Compulsory Education* document, replaces the subject programs. *Essential Learnings* constitutes a reference for students' learning, defined according to the knowledge, skills, and attitudes to be developed throughout the curricular progression [17].

In summary, the documents and legal regulations highlighted in this brief systematization allow us to perceive that the issues related to an education that promotes SD are present in the legal guidelines and emerged, in the Portuguese curriculum, as being very related to Environmental Education, Education for Citizenship, and Natural Sciences. However, it is important to understand the SD concepts that are present in these documents and whether or not they are in agreement with each other.

The current organization of the Portuguese education system, which covers pre-school education and, later, the 12 years of schooling, includes 1st, 2nd, and 3rd cycles of Basic Education and Secondary Education. The 1st cycle is 4 years (6 to 10 years), the 2nd cycle is 2 years (10 to 12 years), the 3rd cycle is 3 years (12 to 15 years). These 9 years of schooling correspond to Basic Education, which is composed of the same subjects for all (with some exceptions). Secondary education lasts for 3 years (from 15 to 18 years old), a cycle in which students select the area of study that interests them (Scientific, Humanities, Arts, . . .), with the subjects varying depending on the area they are interested in. Thus, the present study aimed to identify and characterize the understandings of the SD concept in Basic Education (1st, 2nd, and 3rd cycles) in Portugal, through the analysis of official curricular guidance documents for the teaching and learning of Natural Sciences—*Essential Learning*, as well as in two documents of reference, transversal to the different disciplines, which cover this theme—*Student Profile at Completion of Compulsory Education* [12] and *Environmental Education Framework for Sustainability* [14].

2. Methodology

From a methodological point of view, this is a qualitative approach that fits into the interpretive paradigm [18,19]. For its implementation, we opted for a descriptive-interpretative strategy of an exploratory nature [18], privileging the content analysis [20] of the documents that constituted the corpus of analysis.

The collected corpus consists of official curricular guidance documents (*Essential Learning*) for the teaching and learning of Natural Sciences in Portuguese BE (1st, 2nd, and 3rd cycles of BE; ages 6 to 15), as well as the two reference documents that are also important to assess the understanding of the SD concept, available at the time on the website of the Directorate-General for Education, making a total of 11 documents (Table 1).

Table 1. Official documents for Basic Education (BE) Sciences in Portugal.

Document Organization	Documents
Essential Learning	
1. 1st Cycle of BE Environmental Studies	Essential Learning. Environmental Studies. First grade [21] Essential Learning. Environmental Studies. Second grade [22] Essential Learning. Environmental Studies. Third grade [23] Essential Learning. Environmental Studies. Fourth grade [24]
2. 2nd Cycle of BE Natural Sciences	Essential Learning. Natural Sciences. Fifth grade [25] Essential Learning. Natural Sciences. Sixth grade [26]
3. 3rd Cycle of BE Natural Sciences	Essential Learning. Natural Sciences. Seventh grade [27] Essential Learning. Natural Sciences. Eighth grade [28] Essential Learning. Natural Sciences. Ninth grade [29]
Student Profile	Student Profile at Completion of Compulsory Education [13]
Environmental Education for Sustainability	Referential Environmental Education for Sustainability [15]

The analysis instrument applied is presented in Figure 2 [30]. It includes three dimensions of analysis—environmental, economic, and sociocultural, understood as organizing thematic axes and which emerged from the main dimensions of the SD concept identified in the reference literature [31–34]. These three dimensions are interconnected and intricate in different ways, because the essential is the balance between them. For example, achieving economic development implies that society knows the limits that determine sustainable consumption, without harmful implications for the environment. Social development is associated with the knowledge of social institutions and the role of each one, within the framework of a participatory democracy. In the environmental dimension, it is essential to know the weaknesses of natural systems in the face of human action, and to promote their sustainable management with the implementation of appropriate political and social measures [35].

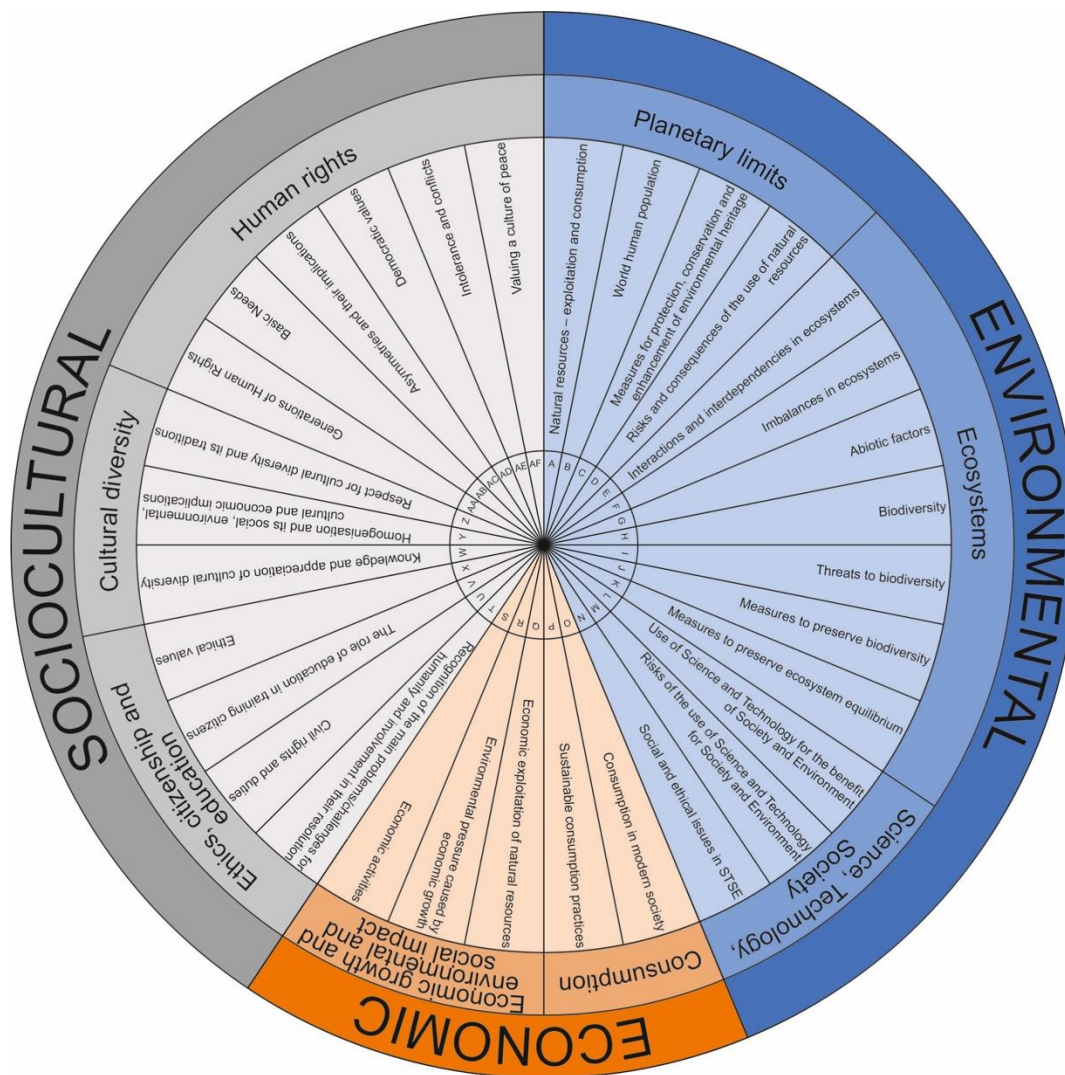


Figure 2. Dimensions, categories, and subcategories of the analysis instrument (adapted from [30]).

Each of these dimensions includes categories (total of 8) and subcategories (total of 32).

In this study, the categories are understood as rubrics with specific meanings according to which the content of the corpus was classified by the researcher [36]. They are, therefore, super-ordered concepts that allowed the researcher to situate his/her apprehension of the object of analysis in order to make it relevant in relation to his/her objectives [18]. The sub-categories, as they explain the broadest meaning of the categories, favor the identification of registration units and, consequently, the categorical analysis.

The entire corpus was analyzed and categorized using the webQDA software (www.webqda.net, accessed on 30 November 2021). This software allows organizing the entries by unit of analysis and the export of a final table with the number of references by category and subcategory, as well as the creation of matrices between different units of analysis. Then, an inferential analysis was carried out, which consists of a process of logical deduction and reduction of the meaning of all the organized information. The inferential analysis implied a reconfiguration of the data that, by being grouped according to a set of affinities, allowed the emergence of nuclei of meaning; these, in turn, were the object of interpretive analysis.

3. Results

In order to make reading the results easier and before moving on to their presentation and systematization, the codes assigned to each document integrating the corpus of analysis are defined in Table 2.

Table 2. Codification of the analyzed documents.

Code	Documents	Characterization
1	Essential Learning. Environmental Studies. First grade	Guiding document
2	Essential Learning. Environmental Studies. Second grade	Guiding document
3	Essential Learning. Environmental Studies. Third grade	Guiding document
4	Essential Learning. Environmental Studies. Fourth grade	Guiding document
5	Essential Learning. Natural Sciences. Fifth grade	Guiding document
6	Essential Learning. Natural Sciences. Sixth grade	Guiding document
7	Essential Learning. Natural Sciences. Seventh grade	Guiding document
8	Essential Learning. Natural Sciences. Eighth grade	Guiding document
9	Essential Learning. Natural Sciences. Ninth grade	Guiding document
10	Student Profile at Completion of Compulsory Education	Transversal document
11	Referential Environmental Education for Sustainability	Transversal document

Given the diversity of documents analyzed, it was decided to systematize the vertical and horizontal analyses performed in Table 3. Thus, the table summarizes the number of references that appear, by dimension, category, and subcategory, in each of the twenty documents that make up the corpus. This form of presentation allows one to simultaneously perceive the presence of each category of analysis in all the analyzed documents and to characterize each of them individually for all categories of analysis.

Table 4 presents a compilation of data per document and per analysis dimension based on the information of Table 3.

Table 3. Number of references found in the analyzed documents by subcategory.

Documents Analyzed		1	2	3	4	5	6	7	8	9	10	11
ENVIRONMENTAL	Planetary Limits	1	0	1	6	9	2	3	9	0	0	96
	A	0	0	1	2	5	0	2	3	0	0	41
	B	0	0	0	1	0	0	0	0	0	0	12
	C	1	0	0	1	1	2	1	5	0	0	29
	D	0	0	0	2	3	0	0	1	0	0	14
	Ecosystems	2	11	7	8	19	7	1	30	0	0	98
	E	0	0	1	0	2	1	1	12	0	0	9
	F	0	0	1	2	0	0	0	4	0	0	6
	G	0	3	1	2	7	1	0	4	0	0	17
	H	2	4	1	3	8	3	0	4	0	0	26
	I	0	1	1	1	1	0	0	2	0	0	20
	J	0	2	1	0	0	1	0	0	0	0	18
	K	0	1	1	0	1	1	0	4	0	0	2
	Science, Technology, and Society	5	3	4	3	2	7	5	3	8	5	11
L	5	2	3	3	2	5	5	1	7	4	11	
M	0	1	0	0	0	1	0	1	0	1	0	
N	0	0	1	0	0	1	0	1	1	0	0	
ECONOMI	Consumption	0	1	0	2	1	1	0	0	0	0	81
	O	0	1	0	1	0	1	0	0	0	0	19
	P	0	0	0	1	1	0	0	0	0	0	62
	Economic Growth and Environmental and Social Impacts	0	0	0	0	0	0	0	0	0	1	8
	Q	0	0	0	0	0	0	0	0	0	0	3
	R	0	0	0	0	0	0	0	0	0	0	4
S	0	0	0	0	0	0	0	0	0	0	1	1
SOCIOCULTURAL	Ethics, Citizenship, and Education	4	2	2	0	0	1	3	0	2	33	262
	T	2	2	1	0	0	0	0	0	0	7	50
	U	1	0	0	0	0	0	0	0	0	3	108
	V	0	0	1	0	0	1	3	0	2	23	104
	X	1	0	0	0	0	0	0	0	0	0	0
	Cultural Diversity	2	2	0	3	0	0	0	0	0	5	13
	W	1	2	0	1	0	0	0	0	0	2	6
	Y	0	0	0	0	0	0	0	0	0	0	0
	Z	1	0	0	2	0	0	0	0	0	3	7
	Human Rights	3	4	1	4	0	0	0	0	0	32	21
	AA	0	2	1	1	0	0	0	0	0	2	6
	AB	0	0	0	0	0	0	0	0	0	1	9
	AC	0	0	0	1	0	0	0	0	0	1	5
AD	2	0	0	0	0	0	0	0	0	13	0	
AE	0	1	0	1	0	0	0	0	0	1	1	
AF	1	1	0	1	0	0	0	0	0	14	0	

The gray background color signals the division by Dimensions laterally and Categories in the rows along the table.

Table 4. Number of references in each document by analysis dimension.

DOCUMENTS	1	2	3	4	5	6	7	8	9	Total BE	10	11	Total Transversal Documents	Total
Environmental Dimension	8	14	12	17	30	16	9	42	8	156	5	205	210	366
Economic Dimension	0	1	0	2	1	1	0	0	0	5	1	89	90	95
Sociocultural Dimension	9	8	3	7	0	1	3	0	2	33	70	296	366	399
TOTAL	17	23	15	26	31	18	12	42	10	194	76	590	666	860

3.1. References by Dimension, Category, and Subcategory of Analysis of the Entire Corpus

The results of the horizontal analysis carried out on all the documents in the corpus show that the most privileged dimension is the “Sociocultural” one, with a total of 399 identified references. In this dimension, “Ethics, Citizenship, and Education”, with 309 references, is the most represented category. However, it is important to note that the “Environmental” dimension also has a high number of references (366).

Of the three dimensions that make up the categorical matrix, the “Economic” dimension is the least represented, with only 95 references. The category “Economic Growth and Environmental and Social Impacts,” with only 9, displays the fewest references in the entire corpus.

The only subcategory that has no reference in the analyzed documents is “Homogenization and its Social, Environmental, Cultural and Economic Implications” from the “Cultural Diversity” category related to the “Sociocultural” dimension. Furthermore, in the “Economic” dimension, among the 11 analyzed documents, 5 do not present any reference to this dimension.

Overall, compared in percentage, it is the “Sociocultural” dimension that presents the largest number of references (46.4%), followed by the “Environmental” dimension (42.6%); the “Economic” dimension presents only 11% of the references.

3.2. References of Transversal Documents (Documents 10 and 11 of the Corpus)

The documents displaying guidelines for all disciplinary areas were considered transversal, including the Environmental Studies of the 1st cycle of BE and the Natural Sciences of the 2nd and 3rd cycles of BE, namely: (i) *Student Profile at Completion of Compulsory Education*; and (ii) *Referential Environmental Education for Sustainability*.

From the analysis carried out on these two documents, it is clear that document 11, *Referential Environmental Education for Sustainability* [14], displays the higher number of references, totaling 590, while document 10, *Student Profile at Completion of Compulsory Education*, has 76 references. (Figure 3).

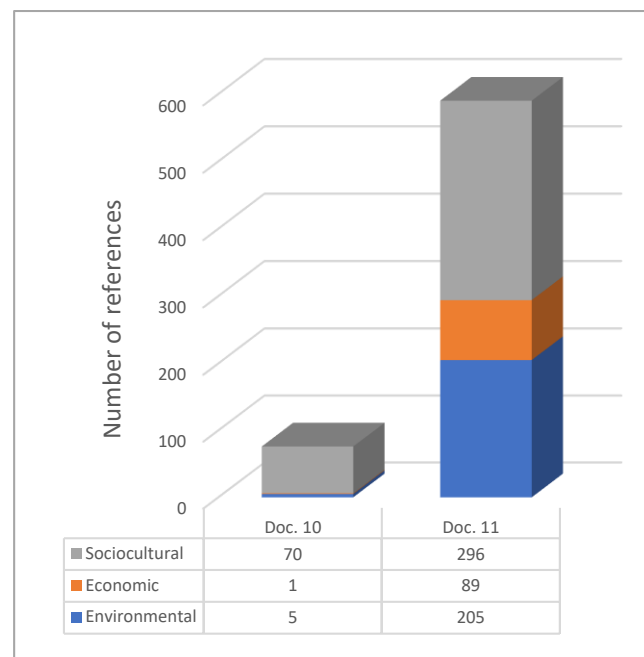


Figure 3. Number of references per dimension in documents 10—*Student Profile at Completion of Compulsory Education*—and 11—*Referential Environmental Education for Sustainability*.

The analysis carried out shows that the 590 references in document 11 are divided by the three dimensions of analysis as follows: 205 in the “Environmental”, 89 in the

“Economic”, and 296 in the “Sociocultural”. These results point to an overvaluation of the “Environmental” and “Sociocultural” dimensions in relation to the “Economic” one. The category where the most references were identified is “Ethic, Citizenship, and Education”, with 262, included in the “Sociocultural” dimension, followed by the categories “Ecosystems” and “Planetary Limits”, with 98 and 96 references, respectively, both included in the “Environmental” dimension. Moreover, in document 11, the subcategories “Civil Rights and Duties” and “The Role of Education in Training Citizens” stand out, with 108 and 104 references, respectively, both included in the “Ethic, Citizenship, and Education” category of the “Sociocultural” dimension. Without any reference in this document, we can identify the subcategories “Risks of the use of Science and Technology for Society and Environment” and “Social and Ethical issues in STSE” belonging to the category “Science, Technology in Society” of the “Environmental” dimension; the subcategory “Ethical Values” of the category “Ethic, Citizenship, and Education”, the subcategory “Homogenization and its Social, Environmental, Cultural, and Economic Implications” of the category “Cultural Diversity”, as well as the subcategories “Democratic Values” and “Valuing a culture of peace” from the “Human Rights” category, all included in the “Sociocultural” dimension.

In document 10—*Student Profile at Completion of Compulsory Education* [12]—76 references were identified, highlighting the “Sociocultural” dimension, with a total of 70 references. In this dimension, the categories “Ethics, Citizenship, and Education” and “Human Rights” have the highest number of references, 33 and 32, respectively. The subcategory with the highest number of references, with a total of 23, is “The Role of Education in Training Citizens”, belonging to the category “Ethic, Citizenship and Education”, which shows the appreciation of “... the school as an environment conducive to learning and the development of skills, where students acquire the multiple literacies they need to mobilize, [which] has to be reconfigured to respond to the demands of these times of unpredictability and accelerated change. [...]” [12] (p. 7). In this document, in the “Environmental” dimension, there are two categories without references: “Planetary Limits” and “Ecosystems”; in addition, in the “Economic” dimension for the “Consumption” category, no references were found.

3.3. References of “Essential Learning” (Documents 1 to 9 of the Corpus)

For this focus of analysis, the documents that define the *Essential Learning* of Study of the Environment (1st cycle of BE) and of Natural Sciences (2nd and 3rd cycles of BE) were considered. With a total of 194 references in the 9 documents of the *Essential Learning*, the “Environmental” dimension stands out, which has the largest number of references, with a total of 156 (Figure 4).

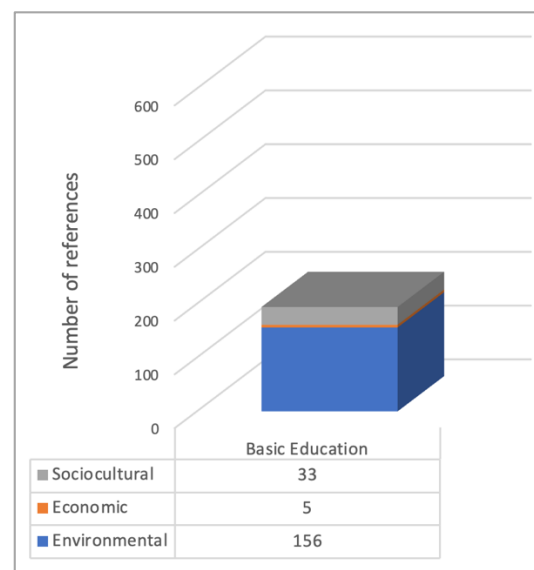


Figure 4. Number of references by Dimension in the *Essential Learning* of BE.

In the “Environmental” dimension, it is the “Ecosystems” category that also has the highest number of references (85). The subcategory “Use of Science and Technology for Society and the Environment”, included in the category “Science, Technology, and Society”, also in the “Environmental” dimension, is the one with the highest number of references, with a total of 33. For example, it is identified as *Essential Learning* in Environmental Studies for the 1st grade “Recognizing that technology responds to everyday needs and problems (electricity network, water pipes, telecommunications, etc.)” [21] (p. 7), and “Recognize the importance of technological evolution for the evolution of society, relating objects, equipment and technological solutions with different needs and everyday problems” [24] (p. 9) for the 4th grade, two of the recording units categorized in this dimension.

The “Economic” dimension presents itself as the least represented, having only 5 references (Figure 3); one of its categories, “Economic Growth and Environmental and Social Impacts”, has no reference in the analyzed guiding documents.

In the analysis carried out by educational grade, we can highlight the 8th grade with the highest number of references (42), all referred to the “Environmental” dimension. The 9th grade guiding documents display only 10 references (Figure 5).

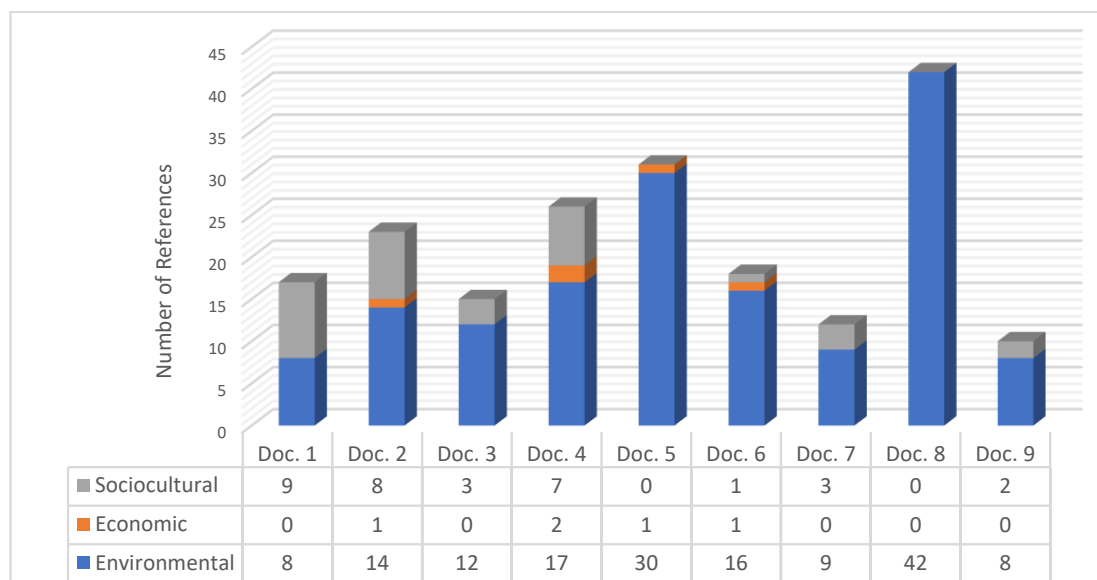


Figure 5. Number of references by dimension in the *Essential Learning* from 1st to 9th grades.

It should also be noted that in the 1st cycle of BE (1st to 4th grade), the percentage of references is 63.0% for the “Environmental” dimension, 3.7% for the “Economic” dimension, and 33.3% for the “Sociocultural” dimension., while in the 2nd and 3rd cycles of BE (5th to 9th grades), more than 90% of the references are related to the “Environmental” dimension (Figure 6).

In conclusion, with the exception of the 1st year (and even then, with a difference of only one reference) in all other *Essential Learning* documents (from the 2nd to the 9th grade), the highest number of references always belongs to the environmental dimension when compared to the remaining dimensions.

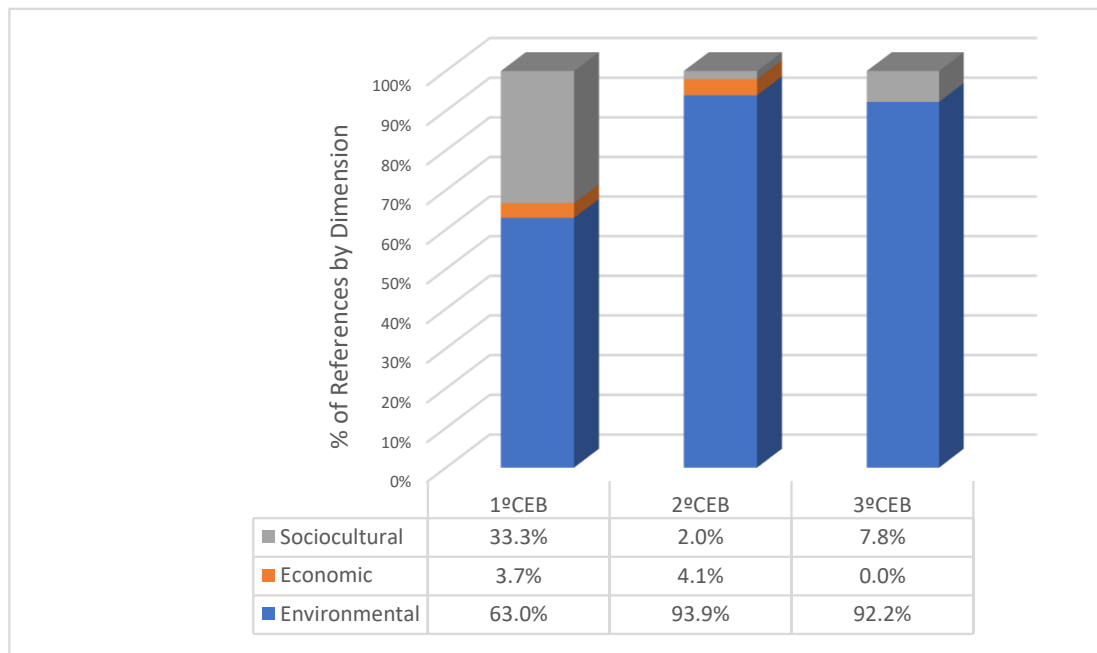


Figure 6. Percentage of references from each teaching cycle in the “Essential Learning” by dimension.

4. Discussion

Under the frame of the 2030 Agenda [1], SDG 4, regarding Quality Education, explicitly addresses ESD, and target 4.7 aims to make sure that people are given the knowledge and skills to promote SD. However, the SD concept appears in other SDGs, namely in SD12 focused on Responsible Consumption and Production, where target 12.8 aims to make sure that everyone has the information and awareness for sustainable development and lifestyles in harmony with nature, as well as target 12.B, which also aims to measure the impacts of SD on sustainable tourism to create jobs and promote local culture and products. This means that SD concerns should be a central issue for educators but intercepts different sectors of society that are co-responsible for its promotion. It is also up to educators to reflect the transversality of the DS concept in their educational practices, adequately supported by policy documents and curricula.

ESD is one of the main aims of national as well as international educational policies [37]. In Portugal, the subjects of Environmental Studies and Natural Sciences from the 1st to the 9th grades of schooling (the *Essential Learning* document) already reflect the appreciation of the SD, but always with an overestimation of the environmental dimension. This can be accentuated if teachers’ perceptions of ESD focus on concerns such as teaching about “*the fragility of the environment and its resources*”, without “*understanding of the importance ESD places on developing people’s values and attitudes necessary for the development of a sustainable and caring use of the environment for their benefits and that of the future*” [38] (p. 76). A study developed with Brazilian pre-service biology teachers about conceptions of sustainable development and dimensions related to this type of development showed that the ecological and environmental dimensions were almost unanimous, but around 30% did not consider the cultural and political dimensions to be linked to sustainable development [39]. A recent study focused on Slovenian and Austrian pre-service biology teachers about their understanding of SD and ESD also showed that they strongly link the term sustainability to environmental aspects and rarely to economic and social aspects of the concept [40]. Biology is a clear example of a university discipline with a one-to-one equivalence to school biology and it is the traditional stage for educational approaches regarding SD issues, and a study conducted with secondary school teachers from Sweden shows that teachers from different subject areas stress different yet complimentary dimensions of teaching and perspectives of ESD [41].

As such, the achievement of SDGs demands a new paradigm of sustainability, which is rooted in an inextricably both cultural and scientific approach through education, and requires overcoming the historical gap between the natural and the human and social sciences, and integrating natural and social and humanistic scientific knowledge with non-scientific and non-Western forms of knowledge [42].

The transversal documents analyzed in the present study (10—*Student Profile at Completion of Compulsory Education*, and 11—*Referential Environmental Education for Sustainability*), balance the sociocultural dimension, but they do not guarantee, in itself, its operationalization in the teaching and learning process. As teachers' perceptions of ESD play a major role in the way they teach and prepare learners for the future [38], the implementation of teacher education integrates the three pillars of SD, i.e., environmental, social, and economic, is of major relevance. The research performed with pre-service teachers from Spain revealed previous perceptions of ESD mainly related to caring for the environment and conserving natural resources, but those teachers changed their perceptions towards an increasing integration of the social sphere of SD into their practices after participating in a training process on Education for Sustainability [43]. In the present research, the economic dimension related to SD also shows a deficit in the analyzed transversal documents, but the implementation of cross-curricular teaching in ESD starting from regionally relevant issues can contribute to broadening the view on ESD and meet its interdisciplinary nature [44]. ESD-oriented development of initial as well as continuous teacher education can be a crucial key for the achievement of highly relevant SDGs.

5. Conclusions

Over the last few years, there has been an effort to integrate international guidelines for ESD, assuming the SD concept in a multidimensional and transversal perspective, both in reference and curricular documents. The present study analyzes the official documents that frame and guide ESD implementation in Portugal, in all its dimensions, throughout BE (1st to 9th grade—ages 6 to 15).

Results show that although all of the considered SD dimensions are present in most of the documents that make up the corpus, they are not explored in an equitable way, highlighting the environmental dimension in relation to the sociocultural one and neglecting the economic dimension, which is absent in some documents.

However, the existence of guidelines and a legal framework for ESD implementation in BE in Portugal does not guarantee, in itself, its operationalization in the teaching and learning process. Teachers' conceptions and practices are essential in this process. In order to ensure ESD practices are in line with the international guidelines and the achievement of the Sustainable Development Goals, it is essential to rethink initial and continuous teacher education for SD.

The ambition that all students acquire the knowledge and develop the skills necessary to promote SD until 2030 (target 4.7 of objective 4), in particular, through ESD, necessarily implies a substantial increase in the number of qualified teachers (target 4c of objective 4). Knowing that most teachers (92%) systematically resort to textbooks for class preparation [45], it would also be important to identify and characterize the understanding of the SD concept present in BE science textbooks. Additionally, the development of quality educational resources to support teachers in the implementation of ESD also appears to be essential.

Author Contributions: P.J.: Conceptualization, Methodology, Data curation, Investigation, and Writing—Review and Editing. P.S.: Conceptualization, Methodology, Data curation, Investigation, and Writing—Review and Editing. M.H.H.: Conceptualization, Investigation, and Writing—Review and Editing. A.V.R.: Investigation and Writing—Review and Editing. All authors have read and agreed to the published version of the manuscript.

Funding: This work is financially supported by: (i) National Funds through FCT—Fundação para a Ciência e a Tecnologia, I.P., under the project UIDB/00194/2020 of I&D CIDTFF (University of Aveiro—

Portugal); (ii) Fundação para a Ciência e Tecnologia I.P. with a PhD grant (SFRH/BD/132272/2017), through the European Social Fund and Human Capital Operational Program; and (iii) Portuguese funds by Fundação para a Ciência e a Tecnologia, I.P. (Portugal) in the frame of the UIDB/00073/2020 and UIDP/00073/2020 projects of I&D unit Geosciences Center (University of Coimbra—Portugal).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors gratefully acknowledge the financial support provided by CIDTFF—University of Aveiro (Portugal). Thanks are also due to Gustavo Gonçalves Garcia for the graphic support, to Yasir Shahzad for the English revision of the manuscript, and to two anonymous reviewers for their helpful comments and suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. United Nations. Transforming Our World: The 2030 Agenda for Sustainable Development. Available online: https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (accessed on 3 March 2022).
2. UNESCO and Sustainable Development Goals. Available online: <https://en.unesco.org/sustainabledevelopmentgoals> (accessed on 3 March 2022).
3. DGE—ODS. Available online: <https://www.dge.mec.pt/objetivos-de-desenvolvimento-sustentavel-ods> (accessed on 3 March 2022).
4. ME—Decreto-Lei No. 286/89. Available online: <https://dre.pt/dre/detalhe/decreto-lei/286-1989-618310> (accessed on 3 March 2022).
5. ME. Orientações Curriculares para a Educação Pré-Escolar. 1997. Available online: https://www.dge.mec.pt/sites/default/files/Basico/orientacoes_curriculares_pre_escolar.pdf (accessed on 3 March 2022).
6. ME—Decreto-Lei No. 6/2001. Available online: <https://dre.pt/dre/detalhe/decreto-lei/6-2001-338986> (accessed on 3 March 2022).
7. ME—Decreto-Lei No. 74/2004. Available online: <https://dre.pt/dre/detalhe/decreto-lei/74-2004-210801> (accessed on 3 March 2022).
8. Ministério da Educação. *Currículo Nacional do Ensino Básico—Competências Essenciais*; Ministério da Educação: Lisboa, Portugal, 2013; p. 241.
9. ME—Despacho No. 17169/2011. Available online: <https://dre.pt/dre/detalhe/despacho/17169-2011-1011055> (accessed on 3 March 2022).
10. DGE—Metas de Aprendizagem. Available online: <http://www.dge.mec.pt/documentos-curriculares-em-vigor> (accessed on 3 March 2022).
11. MEC—Despacho No. 5122/2013. Available online: https://www.dge.mec.pt/sites/default/files/Basico/Legislacao/despacho_5122_2013.pdf (accessed on 3 March 2022).
12. Ministério da Educação/Direção Geral da Educação (Ed.) *Perfil dos Alunos à Saída da Escolaridade Obrigatória*; Editorial do Ministério da Educação e Ciência: Lisboa, Portugal, 2017; p. 33. Available online: https://dge.mec.pt/sites/default/files/Curriculo/Projeto_Autonomia_e_Flexibilidade/perfil_dos_alunos.pdf (accessed on 3 March 2022).
13. Monteiro, R.; Ucha, L.; Alvarez, T.; Neves, M.J.; Silva, M.; Prazeres, V.; Diniz, F.; Vieira, C.; Gonçalves, L.M.; Araújo, H.C.; et al. *Estratégia Nacional de Educação para a Cidadania*; XXI Governo Constitucional: Lisboa, Portugal, 2017; p. 15. Available online: https://dge.mec.pt/sites/default/files/Projetos_Curriculares/Aprendizagens_Essenciais/estrategia_cidadania_original.pdf (accessed on 3 March 2022).
14. DGE. *Referencial de Educação Ambiental para a Sustentabilidade para a Educação Pré-Escolar, o Ensino Básico e o Ensino Secundário*; Ministério da Educação: Lisboa, Portugal, 2018; p. 123. Available online: https://www.dge.mec.pt/sites/default/files/ECidadania/Educacao_Ambiental/documentos/referencial_ambiente.pdf (accessed on 3 March 2022).
15. DGE—Estratégia Nacional de Educação Ambiental. Available online: <https://dre.pt/dre/detalhe/resolucao-conselho-ministros/100-2017-107669156> (accessed on 3 March 2022).
16. ME—Despacho No. 6605-A/2021. Available online: <https://files.dre.pt/2s/2021/07/129000001/0000200003.pdf> (accessed on 3 March 2022).
17. DGE—Aprendizagens Essenciais. Available online: <https://www.dge.mec.pt/aprendizagens-essenciais-ensino-basico> (accessed on 3 March 2022).
18. Amado, J. *Manual de Investigação Qualitativa em Educação*, 3rd ed.; Imprensa da Universidade de Coimbra: Coimbra, Portugal, 2017. [CrossRef]
19. Coutinho, C. *Metodologia de Investigação em Ciências Sociais e Humanas: Teoria e Prática*, 2nd ed.; Edições Almedina S. A.: Coimbra, Portugal, 2018.
20. Bardin, L. *Análise de Conteúdo*; Edições 70: Lisboa, Portugal, 2014.
21. Aprendizagens Essenciais de Estudo do Meio—1.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/1_ciclo/1_estudo_do_meio.pdf (accessed on 3 March 2022).

22. Aprendizagens Essenciais de Estudo do Meio—2.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/1_ciclo/2_estudo_do_meio.pdf (accessed on 3 March 2022).
23. Aprendizagens Essenciais de Estudo do Meio—3.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/1_ciclo/3_estudo_do_meio.pdf (accessed on 3 March 2022).
24. Aprendizagens Essenciais de Estudo do Meio—4.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/1_ciclo/4_estudo_do_meio.pdf (accessed on 3 March 2022).
25. Aprendizagens Essenciais de Ciências Naturais—5.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/2_ciclo/5_ciencias_naturais.pdf (accessed on 3 March 2022).
26. Aprendizagens Essenciais de Ciências Naturais—6.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/2_ciclo/6_ciencias_naturais.pdf (accessed on 3 March 2022).
27. Aprendizagens Essenciais de Ciências Naturais—7.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/3_ciclo/ciencias_naturais_3c_7a_ff.pdf (accessed on 3 March 2022).
28. Aprendizagens Essenciais de Ciências Naturais—8.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/3_ciclo/ciencias_naturais_3c_8a_ff.pdf (accessed on 3 March 2022).
29. Aprendizagens Essenciais de Ciências Naturais—9.º ano. Available online: http://www.dge.mec.pt/sites/default/files/Curriculo/Aprendizagens_Essenciais/3_ciclo/ciencias_naturais_3c_9a_ff.pdf (accessed on 3 March 2022).
30. Sá, P.; João, P.; Rodrigues, A.V. Sustainable Development in Primary Education—A perspective from official Portuguese guiding documents. In *Computer Supported Qualitative Research; WCQR*: Kingsport, TN, USA, 2019; Advances in *Intelligent Systems and Computing*; Costa, P., Reis, L., Moreira, A., Eds.; Springer: Cham, Switzerland, 2020; pp. 262–273. [CrossRef]
31. Amador, F.; Oliveira, C.B.P. Integrating Sustainability into the University: Past, Present and Future. In *Sustainability Assessment Tools in Higher Education Institutions*; Caeiro, S., Leal Filho, W., Jabbour, C., Azeiteiro, U., Eds.; Springer: Cham, Switzerland, 2013; pp. 65–78. [CrossRef]
32. Sá, P. Educação para o Desenvolvimento Sustentável no 1ºCEB: Contributos da Formação de Professores. Ph.D. Thesis, University of Aveiro, Aveiro, Portugal, 2008.
33. Sá, P.; Lopes, J.B.; Martins, I.P. Sustentabilidade e Intercompreensão: Perspetivas e Contributos de um Centro de Investigação em Educação. *Rev. Lusófona De Educ.* **2019**, *43*, 91–107. [CrossRef]
34. Mensah, J. Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Soc. Sci.* **2019**, *5*, 1–21. [CrossRef]
35. UNESCO. *Década da Educação das Nações Unidas para um Desenvolvimento Sustentável, 2005–2014: Documento Final do Esquema Internacional de Implementação*; Organização das Nações Unidas para a Educação, a Ciência e a Cultura: Brasília, Brasil, 2005.
36. Vala, J. A análise de conteúdo. In *Metodologia das Ciências Sociais*, 6th ed.; Silva, A.S., Pinto, J.M., Eds.; Edições Afrontamento: Porto, Portugal, 1986; pp. 101–128.
37. UNESCO. *United Nations Decade of Education for Sustainable Development (2005–2014): International Implementation Scheme*; Section for Education for Sustainable Development; UNESCO: Paris, France, 2005; p. 31.
38. Anyolo, E.O.; Kärkkäinen, S.; Keinonen, T. Implementing Education for Sustainable Development in Namibia: School Teachers' Perceptions and Teaching Practices. *J. Teach. Educ. Sustain.* **2018**, *20*, 64–81. [CrossRef]
39. Araújo, M.; Pedrosa, M.A. Desenvolvimento Sustentável e Concepções de Professores de Biologia em Formação Inicial. *Rev. Ens.* **2014**, *16*, 71–83. [CrossRef]
40. Bezeljak, P.; Scheuch, M.; Torkar, G. Understanding of Sustainability and Education for Sustainable Development among Pre-Service Biology Teachers. *Sustainability* **2020**, *12*, 6892. [CrossRef]
41. Sund, P.; Gericke, N. Teaching contributions from secondary school subject areas to education for sustainable development—A comparative study of science, social science and language teachers. *Environ. Educ. Res.* **2020**, *26*, 772–794. [CrossRef]
42. Werlen, B.; Osterbeek, L.; Henriques, M.H. 2016 International year of global understanding: Building bridges between global thinking and local actions. *Episodes* **2016**, *39*, 604–611. [CrossRef]
43. García-González, E.; Jiménez-Fontana, R.; Azcárate, P. Education for Sustainability and the Sustainable Development Goals: Pre-Service Teachers' Perceptions and Knowledge. *Sustainability* **2020**, *12*, 7741. [CrossRef]
44. Niens, J.; Richter-Beuschel, L.; Stubbe, T.; Bögeholz, S. Procedural Knowledge of Primary School Teachers in Madagascar for Teaching and Learning towards Land-Use- and Health-Related Sustainable Development Goals. *Sustainability* **2021**, *13*, 9036. [CrossRef]
45. Esteves, M.H. Manual Escolar e mudanças curriculares em Portugal: Percepção dos docentes de Geografia. *Educação* **2021**, *46*, 1–21. [CrossRef]