IKASTORRATZA. Didaktikarako e-aldizkaria

IKASTORRATZA. e-journal on Didactics

IKASTORRATZA. e-Revista de Didáctica

ISSN: 1988-5911 (Online) Journal homepage: http://www.ehu.eus/ikastorratza/

A study about the presence of marine terms in Spanish Primary Education curricula

Peio Gómez-Sánchez
pgomez045@ikasle.ehu.eus

Mª Arritokieta Ortuzar-Iragorri
arritxu.ortuzar@ehu.eus

To cite this article:

Gómez-Sánchez, P., & Ortuzar-Iragorri, M.A. (2022). A study about the presence of marine terms in Spanish Primary Education curricula. *IKASTORRATZA. e-Revista de Didáctica*, 29, 50-71. DOI: 10.37261/29_alea/3

To link to this article:

https://doi.org/10.37261/29_alea/3

Published online: 30 Sep. 2022

A study about the presence of marine terms in Spanish Primary Education curricula

Un estudio en torno a la presencia de términos relacionados con el mar en los currículos españoles de Educación Primaria

Peio Gómez-Sánchez
Universidad del País Vasco / Euskal Herriko Unibertsitatea (UPV/EHU)
pgomez045@ikasle.ehu.eus

Mª Arritokieta Ortuzar-Iragorri
Universidad del País Vasco / Euskal Herriko Unibertsitatea (UPV/EHU)
arritxu.ortuzar@ehu.eus

Abstract

Oceans provide the Earth with a wide range of fundamental benefits, and yet, they are in danger. To protect them, marine literacy should be taught in schools. The main objective of this study is thus to determine whether ocean-related terms are included in the primary education curricula of the autonomous communities of Spain (PEC). The results indicate a scarce presence of ocean-related terms in the natural sciences area of the PEC. In addition, analysis revealed that there is no relationship between the relative mention of the term "coast" and the relative length of local coastlines, indicating that the PEC do not take advantage of the place attachment factor. According to the natural sciences Basque curriculum, it is the responsibility of the primary education schools and teachers to determine to what extent marine elements are to be taught and how they are implemented for the development of the scientific competencies.

Resumen

Los océanos proporcionan al planeta muchos beneficios fundamentales y, sin embargo, peligran. Para protegerlos deberían trabajarse en las escuelas. El objetivo principal de este trabajo es determinar si los términos relacionados con el océano están incluidos en los currículos autonómicos de Educación Primaria (CAEP) de España. Los resultados indican una escasa presencia de términos relacionados con el océano en el área de Ciencias Naturales de los CAEP. También revelaron que los CAEP no promueven el apego al lugar puesto que no se

encontró relación entre el número relativo de veces que se menciona en ellos el término “costa” y la longitud relativa de la línea de costa autonómica. En cuanto al área de Ciencias Naturales del currículo vasco, queda a merced de los centros y profesores en qué medida se enseñan los elementos marinos y cómo se implementan para el desarrollo de las competencias científicas.

Espainiako Lehen Hezkuntzako curriculumetan itsasoarekin loturiko terminoen presentziari buruzko azterketa

Laburpena

Ozeanoek oinarrizko onura ugari eskaintzen dizkiote planetari, baina, hala ere, arriskuan daude. Horiek babesteko, eskoletan landu behar dira. Beraz, lan honen helburu nagusia da zehaztea ozeanoarekin lotutako terminoek Espainiako Lehen Hezkuntzako curriculum autonomikoetan (ELHCA) presentzia duten ala ez. Emaitzek ozeanoarekin lotutako terminoen presentzia urria adierazten dute ELHCAko Natura Zientzien eremuan. Gainera, agerian utzi dute ELHCAek lekuarekiko atxikimendua ez dutela sustatzen, ez baita erlaziorik aurkitu horietan "kosta" terminoa aipatzen den kopuruaren eta kostalde autonomikoaren luzera erlatiboen artean. Euskal curriculumeko Natur Zientzien arloari dagokionez, Lehen Hezkuntzako ikastetxeen eta irakasleen eskuetan dago itsasoko elementuak zenbateraino landu behar diren eta lanketa hori nola gauzatzen den gaitasun zientifikoak garatzeko.

Key words: curriculum, marine literacy, place attachment, primary education.

1. Introduction

In 2015, all United Nations member states adopted 17 "Sustainable Development Goals" (SDGs) as part of the 2030 Agenda for Sustainable Development to confront the current situation of the world. Namely, the differences in access to food, drinking water, health care and education across the planet which are exacerbated by the depletion of natural resources and the negative effects of environmental degradation, including desertification, drought, soil degradation, scarcity of fresh water and loss of biodiversity (United Nations [UN], 2015). The 2030 Agenda for Sustainable Development sets out a 15-year plan to achieve these goals. Among the SDGs, the 14th, "conserve and sustainably use the oceans, seas and marine resources for sustainable development", recognises the indispensable role of marine science and that of the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in setting standards to address all challenges or dimensions of ocean sustainability (U.N., n.d.).

Oceans provide a wide range of fundamental benefits, such as producing half of the oxygen in the world, holding 50 times more carbon dioxide than our atmosphere, and regulating the climate (National Oceanic and Atmospheric Administration [NOAA], 2021); they are a fundamental part of biodiversity and marine ecosystems and are closely linked to global issues such as climate change, water sustainability and food security (Pecl et al., 2017). However, studies report that people are not aware of the wide range of ecosystem services oceans provide the planet (Pew Oceans Commission, 2003), and many students do not consider the understanding and connection between human beings and marine environments to be of great importance (Mogias et al., 2019). This insensitivity contributes to the phenomenon of serious marine ecosystem degradation across the planet due to a vast number and variety of human activities (Halpern et al. 2007, Thushari, & Senevirathna, 2020).

The preservation of the oceans depends fundamentally on the degree of effectiveness in raising the visibility and public awareness of these habitats and their values and the threats responsible for their degradation (Costa et al., 2022). However, environmental awareness is not necessarily about producing more information in a society where an overabundance of information is globalised through the internet. Counterproductively, this information can become overwhelming and difficult for individuals to understand and might drive the global population to ignore the scale of the problem and reject a change in their consumption pattern. Environmental education could help reduce the gap and improve the framework for sustainability (Alonso et al., 2006). Educating for sustainability entails adopting a holistic

perspective that allows for the integration of multiple aspects of environmental awareness (Álvarez-Lires et al., 2017); it involves educating about processes that picture the system as a whole, engaging innovation in the curriculum and teaching and learning experiences and promoting processes of active and participatory learning. Furthermore, environmental education should be addressed at all educational stages, from early childhood to the university stage and, also, in nonformal education (Gómez Galindo et al., 2007).

Such a challenge requires collaboration and dialogue for more dynamic and effective networking between scientists, science communicators, the media and educators (Duarte et al., 2008; Tilbury, 2011). There is clear evidence of misconceptions and limited literacy about global change in general, but even more seriously, this problem requires tackling misinformation about the interrelation between human well-being and the preservation and conservation of ecosystems (Alonso et al., 2006). If we narrow the range of ecosystem studies to marine and oceanic biodiversity to effectively engage the public in marine ecosystems and help generate demand to conserve these environments, scientists must collaborate with educators and professional communicators in addition to generating and conveying information on the status and role of marine ecosystems. It is only through the development of solid partnerships between marine environmentalists and educator networks in first-hand experience with children and the media that recognition and diffusion can be broadened in an effective and consistent manner (Duarte et al., 2008). At a fundamental level, marine science education should improve the capacity of students to learn about this natural resource (Veiga et al. 2016).

Environmental education is fundamental to attaining environmental awareness, values and attitudes, and skills and conduct in line with sustainable development (Gough, 2017). Someone who is marine literate is able to understand fundamental ocean concepts and principles, can communicate about ocean issues and can make informed, responsible decisions regarding the oceans and ocean resources (Cava et al., 2005). Someone who is marine literate has the potential to engage individuals in behaviours that are less destructive to the ocean environment and to aid in the capacity for creative solutions (Steel et al., 2005). Nevertheless, marine education is frequently marginalized, and it is a struggle to find an appropriate place for it in the curriculum of many countries (Gough, 2017). If ocean sustainability is to be achieved, marine environmental education should be taught in schools (De Lara et al., 2017), and Gough (2017) suggests that the places for it in the curricula are in science and geography.

Gough (2017) also suggests that marine literacy needs to engage students in social issues and give them experience in working on solving them so that the task is much more satisfactory

and the context more meaningful. Thus, they may experience critical reflection, social negotiation and social organisation, which may enable them to pursue other ecological and marine environment problems. This proposal is in alignment with the new educational paradigm encouraged and fostered by the European Union's Agenda 2030 (U.N., n.d.), which is intended to provide an adequate response to the requirements of modern society. Within this paradigm, according to Izquierdo-Aymerich (2007), Morin (2011) and Tilbury (2011), it is important for young pupils to formulate critical questions, to consider constructive and more sustainable futures, to clarify their own personal values, to think in a systematic way and to apply what they have been taught to other settings and different situations. Within this frame, the objective of science education is to help students become scientifically literate citizens so that they are able to engage with science-related issues and ideas as reflective citizens (Organisation for Economic Cooperation and Development [OECD], 2019). This objective requires knowledge of scientific concepts, theories, and practices and how these allow the advancement of science (Jiménez-Aleixandre & Crujeiras, 2017) as well as how to appropriately apply them in various contexts and settings (De Pro, 2013). The selection of socioscientific topics that engage students in finding solutions to real problems contributes to the development of critical thinking (Blanco López et al., 2017). Therefore, teaching needs to involve students in real scientific practices that provide opportunities to use their inquiry skills to generate new ideas, assess the validity of new claims using arguments based on empirical evidence, and model answers to generate explanations from existing evidence (Osborne, 2014). Along this line, teachers are advised to use real-world situations that are close and relevant to students (Gilbert, 2006; Sanmartí et al., 2011).

The success of the shift in approach to learning might be dependent in considerable part on whether the new curriculum relates to the sociocultural proximity of the learners, i.e., considers the actual physical, cultural and contextual background of learners (Mukama, 2014). Particularly in subjects that have a practical application (Hernández et al., 2011), such as environmental education, the setting of the learning context becomes more significant. Science is relevant for students' lives and futures when it is place-based because it enables them to act in the best interest of their local environment (Kuwahara, 2013).

Therefore, the objectives of this work are the following:

1. To determine the presence of marine science in the curriculum by determining the frequency of related terms.

2. To state the relation between the frequency of ocean-related scientific terms and the physical context of the learning community.

3. To determine whether the mention of these terms in the natural sciences curriculum of the Basque Country pursues the development of scientific skills.

2. Methodology

In accordance with the Organic Law 8/2013 for the quality of education (LOMCE) and the recent Organic Law 3/2020 that modifies it (LOMLOE), it is the duty of the Ministry of Education and Vocational Training to design the basic primary education curriculum. Hence, the autonomous communities plan their own curriculum for primary education by building on the aforementioned basic curriculum (Eurydice, 2022). Thus, there are 17 different primary education curricula (PEC) for each of the 17 autonomous communities of Spain (Table 1). They will soon be rearranged to meet the standards of the new LOMLOE.

2.1. Frequency of marine terminology in Spanish primary education curricula (PEC)

Since the dispersion of documents is high (Alonso et al., 2015), the “text mining” technique was selected (Kaushik & Naithani, 2016) to make a global analysis of the PEC (Table 1), as displayed in the additional documents shown in Table 1 or in Annex I (or II in Aragon) of the corresponding legislation. Thus, a preliminary search for the terms "ocean", “coast”, “sea”, “water” (with reference to only marine bodies of water) and “hydrosphere” was carried out (Table 1). It should be noted that “coast” stands for the Spanish words “costa” and “litoral” and that the Spanish word “marisma” was also included in the frequency of the term “sea”. These terms were mainly found in the areas corresponding to natural sciences and social sciences. Hence, subsequent searches were limited to these areas of the PEC. Next, in addition to observing the area in which each of the terms was mentioned, their frequency of appearance in the natural sciences and social sciences areas of each primary education curriculum was determined.

Subsequently, the relative frequency of each term in each curriculum was calculated. Relative frequency is defined as the product of the frequency of the term in the curriculum and 100, divided by the addition of the frequencies of all search terms in both the natural and social sciences.

Table 1.

Regulation corresponding to the primary education curricula in each autonomous community and the documents corresponding to the curricula that were included in the analysis.

Autonomous Community	Regulation	Additional information
Andalusia	Autonomous Community Decree 97/2015, 3rd of March	Junta de Andalucía, Consejería de Educación, Cultura y Deporte (2015).
Aragon	Order of the 16th of June of 2014 and Order ECD/850/2016, of the 29th of July	Educaragón. Departamento de Educación, Cultura y Deporte (2016).
Asturias	Autonomous Community Decree 82/2014, 28th of August	Gobierno del Principado de Asturias, Consejería de Educación, Cultura y Deporte (2014)
Balearics	Autonomous Community Decree 32/2014, 18th of July	
Canary Islands	Autonomous Community Decree 89/2014, 1st of August	
Cantabria	Autonomous Community Decree 27/2014, 5th of June	
Castile La Mancha	Autonomous Community Decree 54/2014, 10th of July	
Castile and Leon	Autonomous Community Decree 26/2016, 21st of July	
Catalonia	Decree 119/2015, 23rd of July	Generalitat de Catalunia (2017).
Valencian Community	Autonomous Community Decrees 108/2014, 4th of July and 88/2017 of July the 7th	
Extremadura	Autonomous Community Decree 103/2014, 10th of June	
Galicia	Autonomous Community Decree 105/2014, 4th of	
Madrid	Autonomous Community Decree 89/2014, 24th of July	
Murcia	Autonomous Community Decree 198/2014, 5th of	
Navarra	Autonomous Community Decree 60/2014, 16th of July	
Basque Country	Autonomous Community Decree 236/2015, 22nd of December	Gobierno Vasco. Departamento de Educación, Política Lingüística y Cultura (2019)
La Rioja	Autonomous Community Decree 24/2014, 13th of June	

2.2. Relationship between the length of the coastline of each autonomous community and the relative frequency of the term "coast"

The Spanish coastline, with a length of 7,905 km, extends across 10 autonomous communities, 2 cities, 25 provinces and 428 municipalities. The 10 km strip that defines the perimeter of this zone between land and sea has a surface area of 80,000 km^2. Approximately 3% of this surface is dedicated to industrial facilities, 7% is dedicated to port facilities, 8% is dedicated to agricultural exploitation and 40% of the coastline is urbanized (Spanish Ministry for the ecological transition and the demographic challenge [MITECO], 2007).

The relative extension of the coastline is defined as the product of the length of the coastline in the autonomous community (MITECO, 2007) and 100, divided by the length of the whole perimeter of the autonomous community. The perimeter of the autonomous community was calculated with spatial data from the Instituto Nacional de Geografía (2019) using QGIS software (QGIS org, 2022). The relative extension of the coastline was calculated for each of the autonomous communities and then compared with the relative frequency of the term "coast" in each primary education curriculum.

2.3. Ocean-related terms connected with scientific practice in the Basque primary education curriculum

To study whether the Basque curriculum shows signs of raising tasks that imply the development of the students' scientific skills in marine literacy, four types of task categories were established (Garcia Barros et al., 2021). They included the following: type 1, those that imply basic skills, i.e., identifying characteristics, establishing relationships, classifying, comparing, and defining; type 2, those that denote skills related to the ability to describe, explain causes or effects or justify phenomena scientifically on the basis of a theoretical model; type 3, skills related to searching for information, formulating hypotheses, and designing and performing experiments are entailed; and type 4, skills linked to the scientific interpretation of data and evidence are implied (using evidence/data; formulating conclusions and elaborating arguments justifying the validity of an idea or the adoption of a behaviour, based on theoretical or empirical knowledge).

3. Results

3.1. Frequency of marine terminology in Spanish primary education curricula (PEC)

After an initial search, the vast majority of the terms studied were found in the fields corresponding to the areas of natural and social sciences, which is why Table 2 shows the frequency of each of these words in these areas in each primary education curriculum.

As shown in Table 2, the term "ocean" is mentioned 57 times in the 17 PEC; however, this is limited to the social sciences because the term does not appear at all in the natural sciences. The highest frequency is 8 times in the social sciences area of the curriculum of the autonomous community of Castile la Mancha, which has no coastline. Similarly, the presence of the terms “sea”, "hydrosphere", and "water" is higher in the social sciences than in the natural sciences (Table 2). Such words are generally mentioned in relation to the physical geography of the planet, as the following examples denote: "*Describes the surface of the Earth and distinguishes between continents, seas and oceans*", "*Locates and names continents and oceans on globes and world maps*" and "*Ocean waters and their movements: tides, waves and ocean currents*".

Thus, PEC give importance to the location of water on Earth but leave aside marine resources and their scientific relevance for scientific practice, leaving little opportunity for the development of marine literacy. Similar to what McPherson (2018) detected in a study of secondary education in Nova Scotia, the natural sciences of the Spanish primary education curricula do not create opportunities for students to develop the skills necessary to make informed decisions about ocean health, understanding it not only as a valuable resource but as a necessary means for life on the planet. However, all learners and community members should have some awareness of the significance and the magnitude of the challenges in marine protection, both through identification and through understanding what they can do both as individuals and as a collective (Gough, 2017). Nevertheless, without the inclusion of explicit references and terminology about marine literacy principles within the natural sciences, education about marine ecosystems and biodiversity will remain incoherent and peripheral in the classroom. Without the use of precise and accurate terminology, it will not be possible for primary school students to understand the sea and develop a comprehensive understanding of the ocean in secondary school.

Table 2.

Frequency of the identified words in each of the regional curricula in the areas of natural sciences (NS) and social sciences (SS).

AUTONOMOUS COMMUNITY	OCEAN		COAST		SEA		WATER		HYDROSPHERE		TOTAL
	NS	SS	NS	SS	NS	SS	NS	SS	NS	SS	
Andalusia	-	2	1	4	-	5	1	9	-	8	30
Aragon	-	4	2	3	-	2	-	12	-	4	27
Asturias	-	3	3	-	-	-	1	7	-	4	18
Balearics	-	2	2	-	-	2	-	4	-	6	16
Canary Islands	-	2	1	2	-	5	-	9	-	5	24
Cantabria	-	4	2	3	-	1	-	9	-	6	25
Castile-La Mancha	-	8	1	13	-	14	-	12	-	3	51
Castile and Leon	-	6	4	4	-	8	4	10	-	7	43
Catalonia	-	-	-	-	-	-	1	-	1	-	2
Valencian Community	-	1	2	-	-	1	-	5	-	3	12
Extremadura	-	4	6	-	-	4	-	9	-	18	41
Galicia	-	2	2	1	-	2	2	4	-	3	16
Madrid	-	5	1	1	-	5	-	3	-	2	17
Murcia	-	1	5	-	-	1	-	2	-	2	11
Navarra	-	6	2	3	3	-	2	14	-	3	33
Basque Country	-	3	1	2	3	4	-	9	-	3	25
La Rioja	-	4	2	5	-	2	2	9	-	2	26
Total	-	57	37	41	6	56	13	127	1	79	417

*Note: "Knowledge of the Natural Environment" and "Knowledge of the Social and Cultural Environment" in Catalonia are equivalent to the natural sciences and social sciences, respectively.

The only term whose frequency is quite balanced within the studied curricular areas is "coast", which appears 37 times in the natural sciences and 41 times in the social sciences (Table 2). Thus, this term was chosen to assess the relationship between the coastline length of each autonomous community and the relative frequency of the term.

3.2. Relationship between the length of the coastline of each autonomous community and the relative frequency of the term "coast"

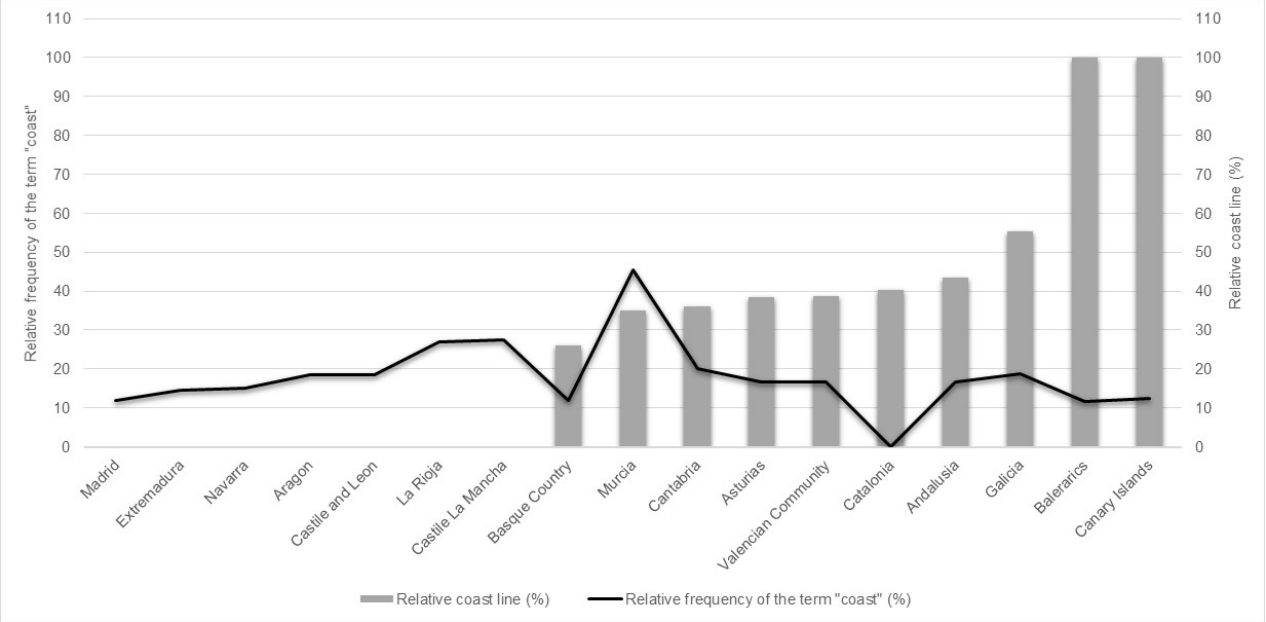
In this study, it was observed that the term "coast" has a relative presence of more than 12% in most of the Spanish autonomous communities. It is the term that shows the most balanced usage between the natural and social sciences (Table 2), which is why this section of the study focuses on it.

The primary education curriculum of Murcia stands out because it shows the highest relative frequency of the term "coast" (45%). However, it is not the autonomous community with the largest relative coastal length; in fact, at (35%), Murcia has only the second shortest relative coastal length behind the Basque Country (Figure 1). It is also remarkable that the relative frequencies of the term "coast" in Galicia, the Balearics and the Canary Islands (respectively 19%, 12% and 12,5%) with the three highest relative coastal lengths (respectively 55%, 100% and 100%) are smaller than the relative frequency of the term in communities without coastline such as Castile la Mancha, la Rioja or Castile and Leon (27%, 27% and 19%, respectively) (Figure 1).

This lack of relation between the relative frequency of the term coast and the relative coastal length is also perceptible in cases such as that of the autonomous community of Catalonia. In fact, the Catalonian coast is 699 kilometres long (MITECO, 2007), which is 40% of the perimeter of the entire community (Figure 1), yet neither the term coast nor almost any reference to other terms related to marine ecosystems were found in its primary education curriculum (Table 2). This absence of connection might lead to a decline in learning achievement, as Mukama (2014) states that developmental processes may depend to a considerable extent on whether they are related to the sociocultural surroundings of learners, taking into account their physical, cultural and contextual environment.

Figure 1.

Relative coastline of the autonomous community (%) versus the relative frequency with which the term "coast" is found in primary school curricula (%).



3.3. Ocean-related terms connected with scientific practice in the Basque primary education curriculum

As shown in Table 2, the analysed marine terms were found 25 times in the Basque curriculum for primary education (Gobierno Vasco. Departamento de Educación, Política Lingüística y Cultura, 2019), namely, 4 times in the natural sciences and 21 times in the social sciences.

Within the natural sciences, in the objective section, the Basque primary education curriculum specifies that students are to develop scientific skills and critical thinking (i.e., "*Identify, pose and solve questions and problems related to significant elements of the natural environment, using, both individually and cooperatively, strategies of scientific methodology…", "Apply the procedures of science and technology using knowledge of the properties of some materials, substances and objects to plan, design and carry out projects…", "Actively and critically interpret messages, products, facts or scientific phenomena"* and *"Analyse some manifestations of human intervention in the natural environment, critically assessing them from parameters of sustainability and quality of life, in order to adopt behaviours in daily life for the defence and recovery of ecological balance*".

However, the terms sea and coast were found within the content section of the natural sciences curriculum, where none of the skills mentioned in the objective section was specifically related

to them. Thus, it is on the mercy of primary education schools and teachers to determine to what extent marine science is to be taught and how it is implemented for the development of scientific competencies. Considering the place attachment factor (Kuwahara, 2013), it would be expected that schools and teachers, mainly those of coastal villages and cities, would include marine literacy in their science lessons. However, since the inclusion of marine science and the terms on which it is included depends on schools and teachers, a secure knowledge of marine literacy principles and positive attitudes towards the marine environment among teachers might be a key factor affecting the presence of marine science in primary education (Boubonari et al., 2013).

Regarding the social sciences, 38% of the marine terms occurred in the content section. However, the other 62% were cited as part of the evaluation section of the social sciences Basque curriculum, where specific actions were included. Such actions belonged mainly to type 1: examine, describe, locate, compare, identify, and represent, as in "*Locate oceans, seas, continents and large climatic zones on the world map at different scales and on the globe*".

4. Conclusions

Despite the general consensus on the educational, environmental and social relevance of the oceans, their relative presence in the Spanish natural sciences PEC is rather limited. The implementation of terminology relevant to marine literacy is mostly integrated in the social sciences, which may cause a loss in its scientific relevance, distancing this literacy from the scientific practices in marine and oceanic environments.

On the other hand, it has not been possible to establish a relationship between the relative coastline in the autonomous community and the relative frequency of the term "coast" in the PEC. In coastal autonomous communities, such a deficit may denote a lack of connection between the physical, cultural and contextual environment of the learners and the contents they must apprehend, thus dismissing the place-attachment factor that favours the developmental processes of the students. Furthermore, when the Basque primary education curriculum was analysed for the promotion of scientific skills in marine literacy, it was found that primary education schools and teachers determine which marine elements are to be taught and how they are implemented within the natural sciences. Thus, the teachers' marine literacy and positive attitudes towards the marine environment might be decisive factors for it to be taught at Basque schools.

The upcoming restructuring of PEC contents to accommodate the new LOMLOE law provides the opportunity to update marine science, recovering a neglected resource that must be studied to obtain oceanic literacy. Such renovation should comprehensively include content and activities on marine science that enable students to approach the topic from both the social sciences and natural sciences and to develop scientific skills.

Bibliographic references

Alonso, S., Benito, G., Dachs, J., Montes, C., Pardo, M., Ríos, A.F., Simó, R. & Valladares, F. (2006). *Cambio Global. Impacto de la actividad humana sobre el sistema Tierra.* CSIC, Consejo superior de investigaciones científicas. http://hdl.handle.net/10016/8520

Alonso, D. M., Fernández-Río, J., Giménez, A. M., & Sabori, J. A. P. (2015). Análisis de los currículos autonómicos LOMCE de Educación Física en Educación Primaria. *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación, 28,* 15-20. http://www.redalyc.org/articulo.oa?id=345741428003

Álvarez-Lires, M. M., Arias-Correa, A., Lorenzo-Rial, M. A., & Serrallé-Marzoa, F. (2017). Educación para la sustentabilidad: cambio global y acidificación Oceánica. *Formación Universitaria, 10*(2), 89-102. http://dx.doi.org/10.4067/S0718-50062017000200010

Autonomous Community Decree 27/2014, of June the 5th which establishes the Education curriculum Primary Education in the Autonomous Community of Cantabria. *Official Bulletin of Cantabria 29* of June the 13th, 2014. 1-431. https://boc.cantabria.es/boces/verAnuncioAction.do?idAnuBlob=269550

Autonomous Community Decree 103/2014, of June the 10th, which establishes the curriculum of Primary Education for the Autonomous Community of Extremadura. *Official Bulletin of Extremadura 114* of June the 16th, 2014, 18965-119962. http://doe.juntaex.es/pdfs/doe/2014/1140o/14040122.pdf

Autonomous Community Decree 24/2014, of June the 13th, which establishes the curriculum of Primary Education in the Autonomous Community of La Rioja. *Official Bulletin of La Rioja 74* of June the 16th, 2014, 11203-11464-33056. https://ias1.larioja.org/boletin/Bor_Boletin_visor_Servlet?referencia=1641947-1-PDF-480396-X

Autonomous Community Decree 108/2014, of July the 4th, which establishes the curriculum and develops the general organization of Primary Education in the Valencian Community. *Official Bulletin of the Valencian Community 7311* of July the 7th, 2014, 16325-16993. https://dogv.gva.es/datos/2014/07/07/pdf/2014_6347.pdf

Autonomous Community Decree 54/2014, of July the 10th, which establishes the curriculum for Primary Education in the Autonomous Community of Castile La Mancha.

Official Bulletin of Castile La Mancha 132 of July the 11th, 2014, 18498-18905. https://docm.jccm.es/portaldocm/descargarArchivo.do?ruta=2014/07/11/pdf/2014_9028.pdf&tipo=rutaDocm

Autonomous Community Decree 60/2014, of July the 16th, which establishes the curriculum of Primary Education in the Autonomous Community of Navarra. . *Official Bulletin of Navarra 174* of September the 5th, 2014. http://www.lexnavarra.navarra.es/detalle.asp?r=34404&d=1=9

Autonomous Community Decree 32/2014, of July the 18th which establishes the primary education curriculum in the Balearic Islands. *Official Bulletin of the Balearic Islands 97* of July the 19th, 2014. 33178-33331. https://www.caib.es/eboibfront/eli/es-ib/d/2014/07/18/32/dof/spa/pdf

Autonomous Community Decree 26/2016, of July the 21st which establishes the curriculum for Primary Education in the Autonomous Community of Castile and Leon. *Official Bulletin of Castile and Leon 142* of July the 21st, 34184-34729. https://bocyl.jcyl.es/boletines/2016/07/25/pdf/BOCYL-D-25072016-3.pdf

Autonomous Community Decree 89/2014, of July the 24th, of the Governing Council, which establishes for the Community of Madrid the Primary Education Curriculum. *Official Bulletin of the Community of Madrid 175* of July the 25th, 2015, 1-80. https://www.bocm.es/boletin/CM_Orden_BOCM/2014/07/25/BOCM-20140725-1.PDF

Autonomous Community Decree 89/2014, of the 1st of August which establishes the organization and curriculum of Primary Education in the Autonomous Community of the Canary Islands. *Official Bulletin of the Canary Islands 156* of August the 13th, 2014, 21929-3616. http://sede.gobiernodecanarias.org/boc/boc-a-2014-156-3616.pdf

Autonomous Community Decree 82/2014 of the 28th of August which regulates the organization and establishes the curriculum for Primary Education in the Principality of Asturias. *Official Bulletin of the Principality of Asturias.* 202 of August the 30th, 2014, 1-414. https://sede.asturias.es/bopa/2014/08/30/2014-14753.pdf

Autonomous Community Decree 105/2014, of September the 4th, which establishes the curriculum of the Primary Education in the Autonomous Community of Galicia. *Official Bulletin of Galicia 171* of September the 9th, 2014, 37406-38087. https://www.edu.xunta.gal/portal/sites/web/files/protected/content_type/advertisement/2014/09/09/20140909_curriculo_primaria.pdf

Autonomous Community Decree 198/2014, of September the 5th, which establishes the curriculum of the Primary Education in the Autonomous Community of Murcia. *Official Bulletin of Murcia 206* of September the 6th, 2014, 33054-33056. https://www.carm.es/web/descarga?ARCHIVO=Decreto%20198-2014%20de%20Educacion%20Primaria%20%28BORM%206%20sept%202014%29.pdf&ALIAS=ARCH&IDCONTENIDO=106397&IDTIPO=60&RASTRO=c1655$m3993,21259

Autonomous Community Decree 97/2015, of the 3rd of March which establishes the organization and curriculum of Primary Education in the Autonomous Community of Andalusia. *Official bulletin of the Junta de Andalucía, 50* of March the 13th, 2015, 11-22. https://www.juntadeandalucia.es/boja/2015/50/BOJA15-050-00436.pdf

Autonomous Community Decree 236/2015, of December the 22nd, which establishes the Basic Education curriculum of the Autonomous Community of the Basque Country. *Official Bulletin of the Basque Country 9* of January the 15th, 2016, 1-279. https://www.euskadi.eus/bopv2/datos/2016/01/1600141a.pdf

Autonomous Community Decree 88/2017, of July the 7th, which modifies Autonomous Community Decree 108/2014, of July the 4th, which the establishes the curriculum and develops the general organization of Primary Education in the Valencian Community. *Official Bulletin of the Valencian Community 8084* of July the 14th, 2017, 24839-24842. https://dogv.gva.es/datos/2017/07/14/pdf/2017_6394.pdf

Blanco-López, Á., España-Ramos, E., & Franco-Mariscal, A. J. (2017). Estrategias didácticas para el desarrollo del pensamiento crítico en el aula de ciencias. *Ápice, 1*(1), 107–115. https://ruc.udc.es/dspace/bitstream/handle/2183/19977/Apice_2017_1_1_art._7.pdf

Boubonari, T., Markos, A., & Kevrekidis, T. (2013). Greek pre-service teachers' knowledge, attitudes, and environmental behavior toward marine pollution. *The Journal of*

Environmental Education, 44(4), 232-251. https://doi.org/10.1080/00958964.2013.785381

Cava, F., Schoedinger, S., Strang, C., & Tuddenham, P. (2005). *Science content and Standards for Ocean Literacy: A Report on Ocean Literacy*. http://coexploration.org/oceanliteracy/documents/OLit200405

Costa, D. D. A., de Lucena, R. F. P., Christoffersen, M. L., Piñeiro-Corbeira, C., & Dolbeth, M. (2022). Improving environmental awareness and ocean literacy through hands-on activities in the tropics. *Applied Environmental Education & Communication*, *21*(2), 120-139. https://doi.org/10.1080/1533015X.2021.1887778

De Lara, A. D., Txintxurreta Agirre, A., Ortega Lasuen, U., & Díez López, J. R. (2017). Itsasoari buruzko alfabetizazio zientifikoa DBHko ikasle eta etorkizuneko DBHko irakasleengan: proposamen didaktikoa. *Ikastorratza. e-Revista de Didáctica*. *19*, 91-113. http://www.ehu.es/ikastorratza/19_alea/4.pd

De Pro Bueno, A. J. (2013). Enseñar procedimientos: por qué y para qué. *Alambique: Didáctica de las Ciencias Experimentales*, *73*, 69-76.

Decree 119/2015, of June the 23rd which establishes the teaching of Primary Education. *Official Gazette of the Generalitat de Catalunya 6900* of June the 26th, 2015, 1-136. https://portaldogc.gencat.cat/utilsEADOP/PDF/6900/1431926.pdf

Duarte, C. M., Dennison, W. C., Orth, R. J., & Carruthers, T. J. (2008). The charisma of coastal ecosystems: addressing the imbalance. *Estuaries and Coasts, 31*(2), 233-238. https://doi.org/10.1007/s12237-008-9038-7

Educaragón. Departamento de Educación, Cultura y Deporte (2016). *Anexo II. Ciencias Sociales*. https://educa.aragon.es/documents/20126/519073/5+Anexo+II+Ciencias+Sociales.pdf/258ec3b0-d5cd-dd1c-3b45-708aba52fa35?t=1578921125063

Eurydice (2022). *Organización y Administración general del Sistema Educativo*. https://eacea.ec.europa.eu/national-policies/eurydice/content/organisation-and-governance-79_es

Generalitat de Catalunia (2017). *Curriculum Educació Primária*.

https://agora.xtec.cat/ceiparturmartorell/wp-content/uploads/usu99/2016/04/curriculum-educacio-primaria.pdf

Garcia Barros, S. G., Losada, C. M., & Rivadulla López, J. R. (2021). Actividades de textos escolares. Su contribución al desarrollo de la competencia científica. *Enseñanza de las Ciencias. Revista de Investigación y Experiencias Didácticas*, *39*(1), 219–238. https://doi.org/10.5565/rev/ensciencias.3099

Gilbert, J. K. (2006). On the nature of "context" in chemical education. *International Journal of Science Education, 28*(9), 957-976. https://doi.org/10.1080/09500690600702470

Gobierno del Principado de Asturias, Consejería de Educación, Cultura y Deporte (2014). *Currículo Educación Primaria y relación entre criterios de evaluación y estándares de aprendizaje evaluables.* https://redined.mecd.gob.es/xmlui/bitstream/handle/11162/107521/2014_curriculo_primaria.pdf?sequence=1&isAllowed=y

Gobierno Vasco. Departamento de Educación, Política Lingüística y Cultura (2019) *Currículum de carácter orientador que completa el Anexo II del Decreto 236/2015.* https://www.euskadi.eus/contenidos/informacion/inn_heziberri_dec_curriculares/es_def/adjuntos/EB_curriculo_completo.pdf

Gómez Galindo, A. A.; Sanmartí Puig, N. S., & Pujol, R. M. (2007). Fundamentación teórica y diseño de una unidad didáctica para la enseñanza del modelo ser vivo en la escuela primaria. *Enseñanza de las Ciencias: Revista de Investigación y Experiencias Didácticas*, 25 (3), 325-340. https://raco.cat/index.php/Ensenanza/article/view/87930

Gough, A. (2017). Educating for the Marine Environment: Challenges for Schools and Scientists. *Marine Pollution Bulletin, 124*(2), 633-638. https://doi.org/10.1016/j.marpolbul.2017.06.069

Halpern, B. S., Selkoe, K. A., Micheli, F., & Kappel, C. V. (2007). Evaluating and ranking the vulnerability of global marine ecosystems to anthropogenic threats. *Conservation Biology*, *21*(5), 1301-1315. https://doi.org/10.1111/j.1523-1739.2007.00752.x

Hernández, H., Gómez, E., Maltes, L., Quintana, M., Muñoz, F., Toledo, H., & Pérez, E. (2011). La actitud hacia la enseñanza y aprendizaje de la ciencia en alumnos de Enseñanza Básica y Media de la Provincia de Llanquihue, Región de Los Lagos-Chile.

Estudios Pedagógicos, 37(1), 71-83. http://dx.doi.org/10.4067/S0718-07052011000100004

Instituto Nacional de Geografía (2019). *Bases de datos geográficos.* https://www.ign.es/web/ign/portal/cbg-area-cartografia,

Izquierdo-Aymerich, M. (2007). Enseñar Ciencias: una nueva ciencia. *Enseñanza de las Ciencias Sociales*, 6, 125-138. http://hdl.handle.net/11162/99665

Jiménez-Aleixandre, M. P., & Crujeiras, B. (2017). Epistemic Practices and Scientific Practices in Science Education. In: Taber, K.S., Akpan, B. Editors, *Science Education*. *New Directions in Mathematics and Science Education* (pp. 69–80). Sense Publishers. https://doi.org/10.1007/978-94-6300-749-8_5.

Junta de Andalucía, Consejería de Educación, Cultura y Deporte (2015). *Enseñanzas Propias para la Educación Primaria. Anexo 1*. https://www.juntadeandalucia.es/educacion/descargas/recursos/curriculo-primaria/areas.html

Kaushik, A., & Naithani, S. (2016). A comprehensive study of text mining approach. *International Journal of Computer Science and Network Security (IJCSNS)*, *16*(2), 69-76.

Kuwahara, J. L. (2013). Impacts of a place-based science curriculum on student place attachment in Hawaiian and Western cultural institutions at an urban high school in Hawai. *International Journal of Science and Mathematics Education*, *11*(1), 191-212. https://doi.org/10.1007/s10763-012-9387-3

McPherson, K. L., Wright, T., & Tyedmers, P. H. (2018). Examining the Nova Scotia science curriculum for international ocean literacy principle inclusion. *International Journal of Learning, Teaching and Educational Research*, *17*(11), 1-16. https://doi.org/10.26803/ijlter.17.11.1

Mogias, A.; Boubonari, T.; Realdon, G.; Previati, M.; Mokos, M.; Koulouri, Pan. & Cheimonopoulou, M. T. (2019). *Evaluating Ocean Literacy of Elementary School Students: Preliminary Results of a Cross-Cultural Study in the Mediterranean Region. Frontiers in Marine Science 6,* 396. https://doi.org/10.3389/fmars.2019.00396

Morin, E. (2011). *La vía: para el futuro de la humanidad*. Grupo Planeta

Mukama, E. (2014). Bringing technology to students' proximity: a sociocultural account of technology-based learning projects. *International Journal for Research in Vocational Education and Training, 1*(2), 125-142. https://doi.org/10.13152/IJRVET.1.2.3

National Oceanic and Atmospheric Administration (2021). *Why should we care about the ocean?* https://oceanservice.noaa.gov/facts/why-care-about-ocean.html

Order of the 16th of June 2014 of the Minister of Education, University, Culture and Sports, by which the Primary Education curriculum and its application in schools by teachers of the Autonomous Community of Aragon is approved, *Official Bulletin of Aragon, 119* of June the 20th, 2014, 19288-20246. http://www.boa.aragon.es/cgi-bin/EBOA/BRSCGI?CMD=VEROBJ&MLKOB=798381820606

Order ECD/850/2016, of the 29th of July amending the Order of June 16, 2014, of the Minister of Education, University, Culture and Sports, by which the Primary Education curriculum and its application in schools by teachers of the Autonomous Community of Aragon is approved. *Official Bulletin of Aragon, 156* of August the 12th, 2016, 20713-20884. http://www.boa.aragon.es/cgi-bin/EBOA/BRSCGI?CMD=VEROBJ&MLKOB=921670621818

Organization for Economic Cooperation and Development (OECD). (2019). *PISA 2018 Assessment and Analytical Framework*, OECD Publishing. https://doi.org/10.1787/f30da688-en

Osborne, J. (2014). Teaching Scientific Practices: Meeting the Challenge of Change. *Journal of Science Teacher Education, 25(*2), 177-196. https://doi.org/10.1007/s10972-014-9384-1.

Pecl, G. T., Araujo, M. B., Bell, J., Blanchard, J., Bonebrake, T. C., Chen, I., Clark, T. D., Colwell, R. K., Danielsen, F., Evengard, B., Robinson, S. Scheffers, B.R., Shaw, J.D., Sorte, C.,J.B., Strugnell, J.M.. Sunday, J.M., Tuanmu, M-N., Vergés, A., Villanueva. C., Wernberg, T. , Wapstra, E. & Williams, S.E. (2017). Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. *Science*, *355*(6332), 1-9. https://doi.org/10.1126/science.aai9214

Pew Oceans Commission. (2003). *America's living oceans: charting a course for sea change. A report to the nation.* Pew Oceans Commission.

QGIS organization, (2022). *QGIS Geographic Information System*. http://www.qgis.org

Sanmartí, N., Burgoa, B. Etxaburu, B. B., & Nuño, T. (2011). ¿Por qué el alumnado tiene dificultad para utilizar sus conocimientos científicos escolares en situaciones cotidianas? *Alambique: Didáctica de las Ciencias Experimentales, 67*, 62-69.

Spanish Ministry for the ecological transition and the demographic challenge (MITECO) (2007), *Marco general. Perfil Ambiental de España 2006*. https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/informacion-ambiental-indicadores-ambientales/perfilamb2006_marcogral_tcm30-185487.pdf

Steel, B., Smith, C., Opsommer, L., Curiel, S., & Warner-Steel, R. (2005). Public Ocean Literacy in the United States. *Ocean and Coastal Management, 48,* 97-114. https://doi.org/10.1016/j.ocecoaman.2005.01.002

Thushari, G. G. N., & Senevirathna, J. D. M. (2020). Plastic pollution in the marine environment. *Heliyon*, *6*(8), e04709. https://doi.org/10.1016/j.ocecoaman.2005.01.002

Tilbury, D. (2011). Are we learning to change? Mapping global progress in education for sustainable development in the lead up to 'Rio Plus 20'. *Global Environmental Research*, *14*(2), 101-107.

United Nations. (2015). *Proyecto de resolución remitido a la cumbre de las Naciones Unidas para la aprobación de la agenda para el desarrollo después de 2015 por la Asamblea General en su sexagésimo noveno período de sesiones.* https://www.un.org/ga/search/view_doc.asp?symbol=A/70/L.1&Lang=S

United Nations (n.d.). *The 17 goals. Sustainable development.* https://sdgs.un.org/es/goals

Veiga, Joana M.; Vlachogianni, Thomais; Pahl, Sabine; Thompson, Richard C.; Kopke, Kathrin; Doyle, Thomas K.; Hartley, Bonny L.; Maes, Thomas; Orthodoxou, Demetra L.; Loizidou, Xenia I. & Alampei, Iro (2016). Enhancing public awareness and promoting co-responsibility for marine litter in Europe: The challenge of MARLISCO. *Marine Pollution Bulletin, 102* (2), 309-315. https://doi.org/10.1016/j.marpolbul.2016.01.031