The impacts of animal farming. A critical review of secondary and high school textbooks

Rui Pedro Fonseca[1]

Abstract

The exploitation of animals for human purposes raises several ethical concerns in the educational realm that ought to be carefully dealt with. Derived from the content analysis of sample of 39 Portuguese secondary and high school textbooks, this study aims to understand how factory-farmed animals are represented within the following themes: food and health, environment and sustainability, and animal welfare. This work examines whether textbooks suggest the continuation or reduction of the consumption of animal-based products for a healthy diet; discuss the correlation between meat and severe environmental impacts; treat whether plant-based diets are considered healthy, viable and sustainable; and if the agency and welfare of non-human animals is considered. The results show that animals are consistently classified as consumable, with rare mentions of plant-based proteins as a healthy option. Animal farming is inaccurately portrayed as being extensive and is presented from the point of view of maximum production. The suffering and agency of animals are never dealt with. Even though there are some references to the environmental impacts of animal farming, fishing and hunting, there are no recommendations to reduce the consumption of animal-based products as a way of mitigating environmental impacts. The resolution of current environmental challenges is dependent on there being profound shifts in science education that can provide students with the necessary information to create effective change. In seeking to create a more sustainable planet, this study endorses a more ecocentric pedagogy that frames other animals as sentient beings with intrinsic value. It is hoped that the results of this study can motivate authors, reviewers, and scientific and pedagogical consultants to redefine the guidelines in Portugal's Frame of Reference for Environmental Education, as well the editing criteria for textbooks. Furthermore, this paper seeks to encourage changes in the behaviour of young people and communities towards animals, food and the environment.

Keywords: school textbooks · animals · food · environment · sustainability

Resumo

A exploração de animais para consumo humano acarreta repercussões éticas que deveriam ser cuidadosamente mencionadas no contexto educacional. Através de uma amostra de 39 livros portugueses do terceiro ciclo e do ensino secundário, e mediante a análise de conteúdo, este estudo visa compreender como é que os animais explorados para fins alimentares são representados no âmbito das temáticas: alimentação e saúde; ambiente e sustentabilidade; animais e bem-estar. Isto é, se, para uma alimentação saudável, os livros escolares concebem a

Lead Editor: Mariona Espinet

Rui Pedro Fonseca
rppfa1@iscte-iul.pt

[1] Centro de Investigação Estudos de Sociologia – Instituto Universitário de Lisboa (CIES-ISCTE), Lisbon, Portugal

manutenção, ou a redução, de produtos de origem animal; se correlacionam a carne ou peixe a impactos ambientais severos; se consideram as dietas de base vegetal saudáveis, viáveis e sustentáveis; se atendem à agência e ao bem-estar dos animais. Os resultados denotam uma consistente classificação dos animais como consumíveis, com ténues menções ao recurso das proteínas de base vegetal como opções viáveis e saudáveis. As técnicas de produção animal são inadequadamente representadas como extensivas, apresentadas do ponto de vista da maximização da exploração, sem ser abordado o sofrimento ou a agência dos animais. Ainda que se tenham encontrado algumas menções em relação aos impactos ambientais da produção animal, pesca e caça, não existe qualquer recomendação para que se reduza consumo de produtos de origem animal como forma de mitigar os impactos ambientais. Os atuais desafios ambientais estão dependentes de profundas mudanças nas ciências da educação, que devem proporcionar a informação necessária aos estudantes para se criarem mudanças efetivas. Para um planeta mais sustentável, este estudo endorsa uma pedagogia mais ecocêntrica que enquadre os outros animais com seu devido valor intrínseco. Espera-se que os resultados deste estudo possam motivar os autores, revisores, consultores pedagógicos e científicos a redefinir o Referencial de Educação Ambiental para a Sustentabilidade em Portugal, assim como o critério de edição dos livros escolares. Adicionalmente, espera-se que os resultados deste artigo possam encorajar a mudança de comportamentos das comunidades mais jovens em relação aos animais, à alimentação e ao ambiente.

Palavras-chave: livros escolares · animais · alimentação · ambiente · sustentabilidade

Critical concerns about animal farming

While animal agriculture and the consumption of animal-based products continue to rise (Ritchie and Roser 2019), there is a growing scientific consensus that the associated impacts deserve attention from all stakeholders, including educational actors. Animal farming accounts for nearly 80% of global agricultural emissions (O'Mara 2011). According to the FAO (2013), the livestock sector is responsible for environmental degradation, accounting for 14.5% of greenhouse gas (GhG) emissions. Animal farming and processing and the enteric production of ruminants are two major sources of emissions, representing 45% and 39% of the sector's emissions, respectively; the remainder is attributable to the processing and transportation of animal-based products (Gerber, Steinfeld, Henderson, Mottet, Opio, Dijkman, Falcucci and Tempio 2013). Red meat (41%) and cow milk (20%) are the animal-based products with the highest GHG emissions (Gerber, Steinfeld, Henderson, Mottet, Opio, Dijkman, Falcucci and Tempio 2013). The management of pig effluents is responsible for the highest rate of global methane emissions from animal production (O'Mara 2011). Other environmental consequences include deforestation to make way for cattle, with the ensuing destruction of biodiversity as well as coastal flooding, soil contamination, erosion and degradation, the depletion of aquifer reserves and the reduction of areas of productive soil in several regions (Young 2010).

Traditional diets that include animal-based products are a clearly inefficient use of natural resources (water, cereals, soil) at a time when hunger affects one billion people around the world (Grainger 2016). It will only be possible to reverse these serious impacts on sustainability by distancing societies from animal products and encouraging a greater adherence to plant-based diets (IPSRM 2010), which are less harmful to the environment and may be the key to reversing anthropogenic global warming (IPCC 2019).

Health professionals have long been recommending a substantial reduction in meat consumption (Grainger 2016). The overconsumption of red and processed meat contributes significantly to high rates of obesity, type 2 diabetes (Liu, Zong, Wu, Hu, Li, Willet, Eisenberg, Hu and Sun 2018), cardiovascular diseases (Zhong, Horn and Greenland 2020) and colorectal cancer (WCRF 2007).

The existing impacts of animal agriculture are alarming, but they cannot be considered in isolation from animal suffering (e.g., Garnett 2010). In today's capitalist world, animal agriculture is highly focused on production efficiency (De Jonge and Van Trijp 2013), aiming at rapid animal growth and high production rates at lower costs. There are approximately 70 billion land animals slaughtered worldwide each year (Ritchie and Roser 2019). Over 70% of these animals are bred in overcrowded and confined spaces (FAIRR 2016), many of them are tethered (European Convention for the Protection of Animals Kept for Farming Purposes), suffer from several types of diseases derived from current husbandry practices (Algers, Blokhuis, Botner, Broom, Costa, Domingo, Greiner and Hartung 2009), and are unable to breathe fresh air, see daylight, walk, access land, or interact with other animals. They are commonly subject to castrations and mutilations without anaesthetics (Eur-Lex 2008), and the separation of parents and their offspring (*e.g.*, cows and calves, pigs and piglets) is normalised. In slaughterhouses, animals face fatigue, prolonged thirst and hunger, pain, fear and distress. These and other current legislated farming practices provide evidence that animals, as sentient beings (Eur-Lex 1997), experience different types of physical and emotional pain during their short life spans, which clearly contradicts the globally recognised welfarist Five Freedoms (freedom from hunger and thirst; freedom from discomfort; freedom from pain, injury, and disease; freedom to express normal and natural behaviour, and freedom from fear and distress) defined in the Brambell Report (Brambell 1965).

Considering the relevance of environmental protection, a healthier and more sustainable food system, and animal wellbeing, this study seeks to understand how these challenging interconnected issues are addressed in dominant discourses in school curricula. In terms of both these and other topics, school textbooks have a predominant role in educational institutions. They are very important pedagogical instruments for teachers and students and ought to address relevant knowledge for sustainable development and environmental education. To achieve the main goal for this article, I analysed how a sample of school textbooks presented animal-related issues in the contexts of *(a) food and health*; *(b) animal welfare*; and *(c) environment and sustainability*. In other words, I examine if the textbooks advocate for the continuation or reduction of animal-based products for achieving a healthy diet; if pedagogical practices address animal agency and welfare; if the correlation of meat and fish with severe environmental impacts is considered; and whether plant-based diets are considered healthy, viable, sustainable and more ethical. In the results section, I analyse how the collected samples address each topic and the topics' interconnectedness. In the final section of this article, I endorse feasible (ecocentric) recommendations for a more sustainable educational school program.

(Re)framing "food" animals as a socioenvironmental issue in school education (through the lenses of ecofeminism and critical animal studies)

The (neoliberal) compulsive pursuit of economic growth associated with population growth and increasing demands for natural resources reveals three major factors affecting environmental unsustainability (Kopnina 2020). Paradoxically, while maintaining a predominant role in education reforms and pedagogies (e.g., Bazzul 2012), the dominant discourse in education for

sustainable development continues to value economic development (Kopnina 2012). Ralph Levinson (2012) points out the dilemma in making effective socioscientific issues a social justice topic in educational curricula when schools are institutions that respond to competitive forces. A taken-for-granted hegemonic assumption (Anderson, Datta, Dyck, Kayira and McVittie 2016) embedded in schools and educational programs continues to be human necessity as the prime reference for interacting with the planet (Jeong, Sherman and Tippins 2021), for the naturalization of the anthropocentric framing of other animals as economic assets, and for food resources (Pedersen 2010) being considered "absent referents" (Adams 2003). While animals (and food choices) remain outside the scope of socioscientific issues considered relevant for science education (e.g., dos Santos 2014), animal agriculture will continue to be disregarded as a major factor of animal suffering, environmental degradation, anthropogenic global warming, and injustice in food systems.

Ecofeminist theory is very important for disrupting hegemonic thinking through environmental education, which is rooted in the value-hierarchical and dualistic thinking in Western philosophy about women and nature (Warren and Cheney 1991). Central to this devaluation are the Cartesian, Darwinist, and conventional scientific conceptual frameworks in which humans are conceived of as the only "subjects" (Noske 1989). Warren (2000) suggests that the (patriarchal) oppressive conceptual framework maintained by institutions and dominant groups functions to preserve the "isms of domination" (sexism, racism, classism, heterosexism, ethnocentrism, colonialism). Adams and Donovan (1995) argue that both the social construction and oppression of minorities and of non-human animals are inextricably connected. Noske (1989) states that the capitalist organisation defines other animals as resources, particularly from the "animal-industrial complex", alienating them from other species and from nature. In this sense, the practice of meat eating is inseparable from any reinforcing oppression and therefore a significant ecofeminist issue (Houde and Bullis 1999). Ecofeminist pedagogy helps in questioning dominant discourses and practices, interrupting human–animal power relations, and encouraging critical-relational consciousness (Houde and Bullis 1999). Furthermore, the ecopedagogy can enable more social justice, sustainable practices and environmental justice (Gaard 2008).

This study is also grounded in the analytical practice of critical animal studies (CAS) – an ethically committed intersectional approach that envisions the liberation of humans, animals and the planet as a common struggle. There is a strong affinity between the ecofeminist and CAS theories. Both aim to expose the naturalised and interconnected forms of oppression, power, and the abuse of gender, class, race and species (Harper 2010). CAS can also be used with other scientific tools (e.g., in animal agricultural science, biomedicine, nutrition, sustainability) to subvert the humanist assumptions about animals being property whose purpose is to be exploited (Taylor and Twine 2014). In the educational domain, the interdisciplinary pedagogies of CAS can enable a deep understanding of the anthropocentric and objectifying representations of other animals (e.g., Lloro-Bidart 2019) and provide students with the necessary skills for understanding the complex ways in which animal, environmental, and human oppressions intersect (Dinker and Pedersen 2016).

Farmed animals in environmental education: a review of the literature

There is still a historical and conceptual gap between the various ways that farmed non-human animals are depicted in environmental education programs and animal rights organisations, and conveyed in some published research (e.g., Spannring 2017). In general, environmental education still tends to be taught from an anthropocentric perspective (Dolby 2019) according to an instrumental view of non-human animals and nature, which conceives of them as resources to be exploited and therefore contributes to their degradation and devaluation (Oakley

2019). Even when valued, the concept of sustainability tends not to establish a clear relationship between animal production and animal ethics (Rawles 2017). According to Matthew Cole and Kate Stewart (2015), in the UK, primary and secondary school textbooks recognise the role of "food" in agriculture and the environment but do not explicitly describe the negative impacts of animal farming. When environmental issues are raised, textbooks encourage the "seasonal, local and organic" consumption of animal products, while the feasibility of plant-based options is virtually never addressed (Cole and Stewart 2015).

Schools normalise and neutralise the consumption of animal-based products rather than framing it as a sociopolitical issue in need of urgent attention (Twine 2010). At the same time, the oppression of non-human animals used for consumption is silenced (Cole and Stewart 2015), reducing such animals to resources meant to serve human purposes with unlimited accessibility (Pedersen 2010). In addition, the education system fosters an absence of moral codes concerning non-human animals (Dolby 2019) while tending to ignore their agency (Lindgren 2020). For Helena Pedersen (2010), classrooms reproduce rigid classificatory schemes, which teach "facts" about animals that dictate how they should be used, leaving little room for negotiation or any critical questions. As an extension of societal culture and one of its main socialising agents, much of the European school systems encourages the consumption of animal-based products, thereby marginalising plant-based diets (Cole and Stewart 2015).

There is an emerging body of research on students' perceptions about farmed animals. Arcken (1989), Pedersen (2010), Twine (2010), Dinker and Pedersen (2016), Spannring (2017) and Dolby (2019) have all produced relevant work focusing on how farmed animals and human-animal relations are taught in environmental education classes. Their methodology is based on focus groups including students and teachers. Pedersen (2010), in particular, uses a critical animal studies framework to explore how animal taxonomy in the education system sets rigid boundaries that devalue certain animal species (such as cows and pigs) and enable emotional detachment to help students accept the idea that these species are killable. However, there is a glaring lack of research on how textbooks address the impacts of animal farming in the three areas of food and health, animal welfare, and the environment and sustainability. For example, McCrindle and Odendaal (2015) determined how frequently animal topics appear in South African preschool books and looked into the type of animal depictions (realistic, anthropomorphic, fantasy) preferred by children. The most complete study on these related topics was published by Cole and Stewart (2015), who pointed out the silence of British textbooks on the suffering of non-human animals, including highlighting how animals are addressed as "products" and how plant-based diets are not presented as feasible options. However, their work does not explain how the theme of the environment and sustainability is approached in textbooks and does not present a sufficiently extensive and rigorous data collection to enable the reader to verify the results through occurrence counting.

Textbooks in education and the Portuguese environmental education frame of reference

Textbooks prepared for use by students are a widespread learning device (Tracana 2009) and a *"relevant didactic-pedagogical resource (...) which aims to contribute to the development of skills and learning"* (Diário da República 2006), bringing together the interests of schools with those of future citizens (Rego, Gomes and Balula 2012). Textbooks are also an instrument for most teachers, influencing how they organise their curriculum and serving as a source of information to prepare for classes (Rego, Gomes and Balula. 2012). The evaluation, certification and adoption of textbooks is based on guiding principles such as giving teachers freedom and autonomy, encouraging autonomous critical thinking, and conveying accurate and relevant knowledge (Diário da República 2006).

In virtually all textbooks, particularly in the subjects of environmental studies, the natural sciences, biology and geology, environmental education is key for promoting certain attitudes and developing essential skills for students to respond to the societal challenges of the 21st century (Câmara, Proença, Teixeira, Freitas, Gil, Vieira, Pinto, Soares, Gomes, Gomes, Amaral and de Castro 2018). Since environmental education is imbued with citizenship values, aimed at raising awareness of more sustainable economic and social development, seeks to foster respect for others and for differences within and between species, it teaches students how to exist on and interact with the planet (Tracana 2009). It is important that such education enables students to use knowledge to interpret and evaluate phenomena such as climate change, threats to biodiversity, the depletion of resources, and environmental crises, among others (Câmara, Proença, Teixeira, Freitas, Gil, Vieira, Pinto, Soares, Gomes, Gomes, Amaral and de Castro 2018). The relationship between the environment and education has been highlighted by the United Nations, the European Union, and various universities and NGOs, with an eye to making current social and environmental problems visible and resolvable.

It is up to the Directorate-General for Education (Direção Geral da Educação) of the Portuguese Ministry of Education and Science to establish mandatory environmental education guidelines. A relevant document entitled Portugal's Frame of Reference for Environmental Education (Câmara, Proença, Teixeira, Freitas, Gil, Vieira, Pinto, Soares, Gomes, Gomes, Amaral and de Castro 2018) is reflected in national environmental education curricula (including textbooks) at the secondary and high school levels. However, a closer look at the document shows an absence of observations regarding the negative impacts of intensive animal farming and the consumption of animal-based products on the environment, sustainability, human health and non-human animals – critical issues that ought to be on the agenda of policymakers and in textbooks.

Methods: data collection and analysis

A convenience sample was gathered, as the REUTILIZAR school movement provided all thirty-eight textbooks, ranging from grade 8 to 13 (published between 2011 and 2020). A publisher provided another school textbook. Thus, the final sample for this article comprised 39 school textbooks. The target data occur more frequently in textbooks for biology, geology, the natural sciences, Portuguese, and philosophy than for other subjects (see Fig. 1 and index). The textbooks obtained for each of the six grades are as follows: three books for biology, five books for the combined study of biology and geology, one book for geology, twelve books for the natural sciences, sixteen books for Portuguese, and two books for philosophy (Fig. 1). The sample were predominantly published in 2020 (twenty-one books), followed by 2014 (five books), 2017 (four books), 2012 (three books), 2015 (two books) and, finally, the remaining years (2018, 2016, 2013, and 2011 with one book each). The sample used for analysis reflects a wide range, and the specificities within each theme identified are in line with the research objectives.

School subject	Number of school textbooks analysed/year of publication					
Grade	**8**	**9**	**10**	**11**	**12**	**13**
Biology	-	-	-	-	-	**3** (2020, 2020, 2020)
Biology and Geology	-	-	-	**4** (2015, 2020, 2017, 2020)	**1** (2017)	-
Geology	**1** (2012)	-	-	-	-	-
Natural Sciences	**4** (2012, 2012 2014, 2017)	**5** (2014, 2014, 2014, 2016, 2020)	**3** (2020, 2015, 2020)	-	-	-
Portuguese	**5** (2011, 2013, 2020, 2020, 2020)	**3** (2020, 2020, 2020)	**3** (2014, 2020, 2020)	**3** (2018, 2020, 2020)	-	**2** (2017, 2020)
Philosophy	-	-	-	**1** (2020)	**1** (2020)	-

Fig. 1 Sample characteristics: number of school textbooks gathered per subject, grade and year of publication.

- Note: The data have been adapted from the Portuguese school model (grades 7, 8, 9, 10, 11, and 12) to the UK school model (grades 8, 9, 10, 11, 12, and 13).

The discourses in educational institutions about animals used for food are a central topic in this study. Naturally, representations are never wholly unbiased and neutral (Houde and Bullis 1999). They play a relevant role in power relations (Dijk 1997), influencing humans' views of other animals and therefore affecting how they are treated (Stibbe 2001). Hence, it is important to analyse the content of textbooks and their potential impact on classroom teachers and children (Wade 1993). Content analysis, which is concerned with theme meanings, consequences, cultural patterns and beliefs (Downe-Wamboldt 1992), was used to examine the collected sample. According to the predefined thematic categories (themes *a*, *b*, and *c*), the frequency and intensity of occurrences were measured (Weber 1985). Each occurrence from the sample corresponds to either an image or an idea in a text, not both. In the first phase, the analysis grid was created, defining the themes and subthemes to be studied (Fig. 10). In the second phase, the grid was applied to all the books in the sample. The subthemes presented in the textbooks were observed, and the number of times they appear was counted. An individual form was created for each textbook, making it possible to count the total number of occurrences: 1366 (see Fig. 10). In the third phase, the data obtained were validated through two recounts. In the fourth phase, a bar chart was created for each theme, and the occurrence frequencies were converted into percentages (see Fig. 2, Fig. 4, Fig. 8).

The analysis of each occurrence and interpretation of results followed the objectives and theoretical framework of this study. Three main themes stand out in the sample: *(a)* food and

health; *(b)* animal welfare; and *(c)* the environment and sustainability. Within these, the following subthemes were observed.
(a) In the category of *food and health* (Fig. 2), the following factors were examined: the frequency with which textbooks classify animals as consumables (e.g., meat, fish, etc.); whether plant-based foods are also labelled protein sources; if there are recommendations to reduce the intake of animal-based products, particularly red meat; and if plant-based diets are considered to be feasible.
(b) In the category of *animal welfare* (Fig. 4), the following factors were examined: whether the textbooks depict non-human animals in representative locations (intensive farming) or non-representative locations (extensive farming); if the suffering of non-human animals is made visible; and if, compared to pets, wild animals and tested animals, factory-farmed animals are portrayed as subjects worthy of moral protection.
(c) In the category of *environment and sustainability* (Fig. 8), the following factors were examined: whether the textbooks make the environmental impacts of intensive animal farming visible and examine the management of the natural resources involved (soil, water, cereals); what recommendations are made for students to alter their individual behaviours to protect the environment; whether these recommendations involve reducing the intake of animal-based products; and if plant-based diets are discussed as being viable.

Framing non-human animals as resources

Within the theme of *food and health* (Fig. 2), 135 sample entries (70%) predominantly classify animals as food or tradable/huntable/wearable goods used to meet human needs (Fig. 10). Therefore, the human species is portrayed as being dependent (Carrajola 2020) on animals, which in turn are destined to be exploited as biological resources or food sources from land (Delgado, Canha & Trinca 2014; Antunes, Bispo & Guindeira 2020; Oliveira, Ribeiro & Silva 2014; Carrajola, Martim & Hilário 2015; Matias, Martins, Dias, Guimarães & Rocha 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020); and sea (Paiva, Almeida, Jorge and Junqueira 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020) . In science textbooks for grade 13, in particular, the status of animals as mere products is reinforced when more intensive farming techniques are approached from the perspective of maximising production and economic efficiency. For example, techniques to make animals produce more offspring and be more resistant to disease and parasites are described, as are procedures for making meat more tender (Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020; Carrajola 2020) . In a textbook for Portuguese (Amorim, Araújo & Militão 2013) , the right to kill animals is trivialised and joked about. Animals appear in different images as footwear (Dias & Campos 2012; Amorim, Araújo, & Militão 2013; Costa & Mendonça 2020; Costa, Barros, Motta, Viana & Santos 2020; Salda & Cunha 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020; Carrajola 2020), as the targets of hunting (Campos & Dias 2014), as being used in bullfights (Pinto & Baptista 2020) and as trophies (Pinto & Baptista 2020). Students also learn that it is okay (and are encouraged) to use animals in scientific experiments (e.g., the sample includes images of rabbit kidneys and sheep brains and practical exercises in which students have to dissect pig kidneys) (Costa, Barros, Motta, Viana & Santos 2020; Salda & Cunha 2020).

The sample includes 29 entries (17%) in which animals appear in food charts in the form of meat, derivatives and fish (Pinto & Baptista 2020), which are protein sources deemed essential to human health (Fig. 2) (Fig. 10, Fig. 3). Fish are mentioned 3 times (1.5%) as a healthy protein. In 17 entries (=9%), mainly in textbooks for grade 10 (Costa, Barros, Motta, Viana & Santos 2020; Salda & Cunha 2020; Carrajola, Martim & Hilário 2015; Silva, Mesquita, Gramaxo, Santos, Baldaia, Félix, 2020), the consumption of plant-based proteins is described as a viable and healthy option.

In one entry, in a textbook for Portuguese (Pinto 2020)), lentils are depicted as a minor source of protein (Fig. 2). Another textbook from the natural sciences (Carrajola, Martim & Hilário 2015) points to chickpeas, beans, lentils and tofu as healthy protein options (Fig. 3). Students are warned 24 times, mainly in textbooks for grade 10, about the dangers of processed foods, fat, sugar and other factors (stress, tobacco, drugs, alcohol) for human health (Salda, Cunha, 2020; Paiva, Jorge, Junqueira & Almeida 2014; Costa, Barros, Motta, Viana & Santos 2020). Seven books (= 3.5%) in the sample mention the harmful effects of animal-based products. In particular, books for grade 13 mention cow milk, bacon and butter; hormones and antibiotics given to animals; and bacteria (e.g., Salmonella and Listeria) often present in meat (Salda & Cunha 2020; Ribeiro, Silva & Oliveira 2020) (Fig. 2).

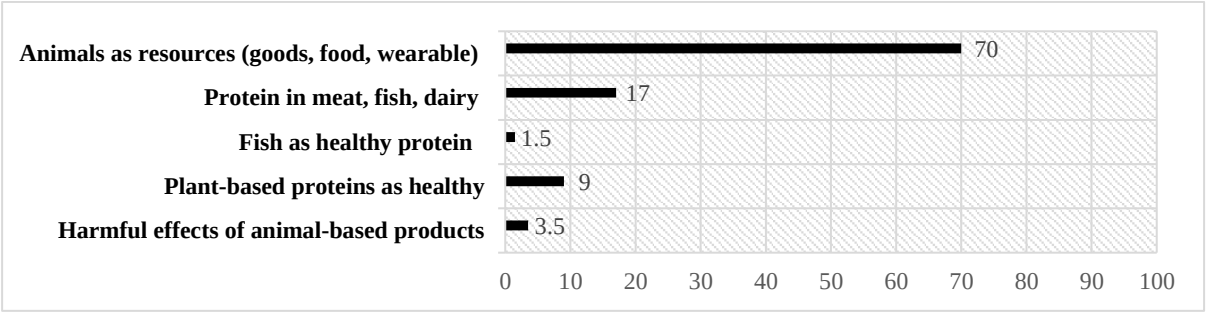
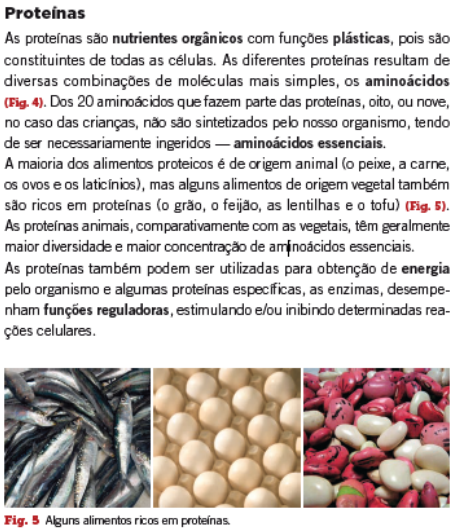


Fig. 2 Subject: food and health (%) bar chart (191 occurrences out of 1390).



Proteínas

As proteínas são **nutrientes orgânicos** com funções **plásticas**, pois são constituintes de todas as células. As diferentes proteínas resultam de diversas combinações de moléculas mais simples, os **aminoácidos** (Fig. 4). Dos 20 aminoácidos que fazem parte das proteínas, oito, ou nove, no caso das crianças, não são sintetizados pelo nosso organismo, tendo de ser necessariamente ingeridos — **aminoácidos essenciais**.

A maioria dos alimentos proteicos é de origem animal (o peixe, a carne, os ovos e os laticínios), mas alguns alimentos de origem vegetal também são ricos em proteínas (o grão, o feijão, as lentilhas e o tofu) (Fig. 5).

As proteínas animais, comparativamente com as vegetais, têm geralmente maior diversidade e maior concentração de aminoácidos essenciais.

As proteínas também podem ser utilizadas para obtenção de **energia** pelo organismo e algumas proteínas específicas, as enzimas, desempenham **funções reguladoras**, estimulando e/ou inibindo determinadas reações celulares.

Fig. 5 Alguns alimentos ricos em proteínas.

Fig. 3 From *"Ciências Naturais 9 – Livro do Professor"*. Animals are predominantly classified as food, particularly as protein sources that are indispensable for human health. In this rare example, plant-based proteins (chickpeas, beans, lentils and tofu) are depicted as healthy options.

Avoiding mention of the suffering of farmed animals while portraying pets as friends

There are 149 relevant occurrences within the theme *animal welfare* (Fig. 4 and Fig. 10). Animals exploited for human consumption tend to be portrayed in extensive farming (52 occurrences = 35%) in an apparent state of well-being (Dias & Campos 2012; Neto, Nunes, Amaral, Guimarães & Brochado 2020; Delgado, Canha & Trinca 2014; Campos & Dias 2014; Costa, Motta, Santos, Barros & Viana 2016; Carrajola, Martim & Hilário 2015; Freitas, Ferreira & Barbosa, 2018;

Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020; Pinto & Nunes 2017; Silva, Cardoso, Rente & 2020; Carrajola & 2020)(Fig. 4). For example, cows appear in vast green pastures (Fig. 5), and rabbits, chickens and pigs appear in the open air (Antunes, Bispo & Guindeira 2020; Oliveira, Ribeiro & Silva 2014; Salda & Cunha 2020) or in nondescript places (Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020). Only 4 entries (=2.6%) portray or refer to animals exploited for food in intensive farms (Delgado, Canha & Trinca 2014; Campos & Dias 2014; Ribeiro, Silva & Oliveira 2020; Carrajola 2020) – the most common location for such animals in the real world – highlighting the production of poultry (in the USA), piglets and older pigs. The advantages of this model of production (Delgado, Canha & Trinca 2014; Silva, Ribeiro & Oliveira 2017; Ribeiro, Silva & Oliveira 2020) for land and sea animals (through genetic manipulation, selective breeding (Fig. 6), fattening, and the administration of antibiotics, hormones, enzyme supplements, etc.) are endorsed as ways to increase productivity (Ribeiro, Silva & Oliveira 2020; Carrajola 2020). Never are the hazardous conditions to which animals are subjected mentioned, nor are their agency or welfare. Two textbooks for grade 9 mention trawling (Delgado, Canha, Trinca & 2014; Campos & Dias 2014) but never address the suffering of the animals involved.

There are 9 occurrences (=7.3%), all of them in one single textbook, of wild animals hunting for animals of other species (Campos & Dias 2014) (e.g., lions eating zebras, eagles hunting rabbits, a bear hunting fish, a tiger hunting a buffalo) (Fig. 4). Not once is the killing of animals in slaughterhouses documented. Although hunting is valued and defended in many textbooks, there are no entries portraying the ugliness of animals being killed by humans during hunting (Fig. 4).

Some textbooks mention how important it is for humans – and, therefore, students – to adopt behaviours that value and protect different species. The sample reflects the type of exploitation being discussed and the students' physical proximity to animals. In 74 occurrences (=49.6) (Fig. 4), mainly in books for grades 8 and 9, the seagull and cat appear as animals that are valued (Silva, Cardoso & Rente 2020) and have feelings (Santiago & Paixão 2011), while dogs are described as "friendly", "cute", and dependent on humans (Santiago & Paixão 2011) and as animals with which humans create emotional bonds (Costa, & Mendonça 2020; Pinto, Saraiva & Baptista, 2020; Costa & Magalhães, 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020) (Fig. 4) (Fig. 7). Wolves (Pinto, Saraiva & Baptista 2020; Silva, Ribeiro & Oliveira 2017), polar bears, orangutans, penguins, elephants, rhinoceroses, Komodo dragons, dolphins (Pinto, Saraiva & Baptista 2020), lynxes and otters (Silva, Ribeiro & Oliveira 2017) are also mentioned as species that should be protected by hunters. The sample includes information about the immorality of the exotic animal fur trade (Costa & Magalhães 2020) and questions about the ethicality of animal experimentation (Borges, Paiva & Tavares 2020) (Fig. 4). As for animals exploited for food, there are only 6 occurrences (=4%) where animal welfare is, to an extent, valued/questioned (Fig. 4). For example, in a story found in a book for Portuguese (Paiva, Almeida, Jorge & Junqueira 2020), a pig adopted by a family gains the status of an individual and a pet. A philosophy book (Borges, Paiva & Tavares 2020) based on the work of Tom Regan (1986) and Peter Singer (1975) discusses the adoption of vegetarianism and the principle of equality between humans and animals. Another book introduces the work of Singer (Amorim & Pires 2020) and explains the importance of students promoting the welfare of all inhabitants of the Earth. However, the text is not specific about which species are exploited for food. Another entry (Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020) uses the production of *foie gras* in France to discuss animal ethics, without ever mentioning the welfare of animals produced in Portugal. The same book encourages students to engage in a debate on animal farming in Portugal without failing to "consider the cost–benefit relationship" (Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020).

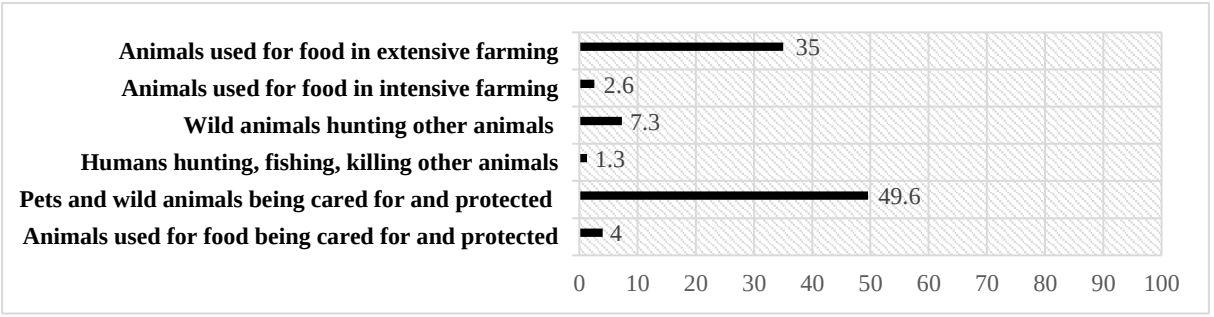


Fig. 4 Subject: animal welfare (%) bar chart (149 occurrences out of 1390).

Fig. 5 From "*Planeta com Vida - Biologia 12*". Animals used for food tend to be represented in green pastures in an apparent state of well-being.

Fig. 6 From "*Planeta com Vida – Biologia 12*". Factory farming is framed from a production efficiency standpoint, particularly through genetic manipulation and selective breeding – methods that produce "better meat", "higher reproductive rates" and "animals [that are] more resistant to diseases and parasites".

Fig. 7 The movie *Marley & Me* is discussed in the textbook "*Diálogos - Português 7*". Cats and dogs tend to be depicted as cute, friendly, and capable of feelings; as species with which students can create emotional bonds; and as animals that humans should look after (credits to Wallpaper Flare).

Animal agriculture linked to environmental degradation (with no recommendations to eat fewer animal-based products)

Within the theme *environment and sustainability* (Fig. 8), there are 374 relevant occurrences (Fig. 10), with the highest frequency in textbooks for grade 13. The sample includes 201 entries (=35.6%) that mention climate change, the degradation of ecosystems and several causes of

pollution as a result of human activity (Fig. 8). Examples of this activity include excessive urbanisation (Antunes, Guindera & Bispo 2014; Dias & Campos 2012; Silva, Ribeiro & Oliveira 2017; Ribeiro, Silva & Oliveira 2020; Delgado, Canha, & Trinca 2014; Antunes, Guindera & Bispo 2014); forest fires (Antunes, Bispo & Guindeira 2020; Matias, Martins, Dias, Guimarães & Rocha 2020); deforestation; water, soil and air pollution (Oliveira, Ribeiro & Silva 2017; Antunes, Guindera & Bispo 2014; Dias & Campos, 2012; Delgado, Canha & Trinca 2014; Antunes, Bispo & Guindeira 2020; Costa, Motta, Santos, Barros & Viana 2016; Matias & Martins, 2015; Silva, Ribeiro & Oliveira, 2017; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Silva, Ribeiro, Oliveira, 2017; Silva, Ribeiro & Oliveira 2017; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020); the construction/mining industry (Oliveira, Ribeiro & Silva 2017; Dias & Campos 2012; Delgado, Canha & Trinca 2014; Matias, Martins, Dias, Guimarães & Rocha 2020; Silva, Ribeiro & Oliveira, 2017; Ribeiro, Silva & Oliveira 2020); fossil fuels (Delgado, Canha & Trinca 2014; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Amorim & Pires 2020; Ribeiro, Silva & Oliveira 2020); and dumps (Costa, Motta, Santos, Barros, Viana, 2016; Pinto, Fonseca & Baptista 2020; Silva, Ribeiro & Oliveira 2017). Soil contamination (Antunes, Bispo & Guindeira 2020) is mentioned as a result of the use of agrochemicals in agriculture (Oliveira, Ribeiro & Silva 2017; Silva, Ribeiro & Oliveira 2017; Matias, Martins, Dias, Guimarães & Rocha 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020). The ecological footprints of many industries are described, namely, the energy, nuclear and chemical industries (Delgado, Canha & Trinca 2014; Ribeiro, Silva & Oliveira 2020; Carrajola 2020). Concerning Portugal specifically, it is mentioned that the introduction of eucalyptus and mimosa reduces oak groves (Silva, Ribeiro & Oliveira 2017), which exacerbates biodiversity loss. With regard to sustainability, agriculture is mentioned as being the primary perpetrator of wasting water (Campos & Dias 2014). Structural factors that threaten the planet are also mentioned, namely, economic and social inequalities (Antunes, Bispo & Guindeira 2020) and international capitalism (Oliveira, Ribeiro & Silva 2017; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020) .

The sample includes 48 occurrences (=4.5%) (Fig. 8), especially in textbooks for grade 13 (38 entries), which correlate animal farming, fishing and hunting with environmental and sustainability problems (Fig. 8). The livestock industry is mentioned as a source of soil, water and air pollution (Silva, Ribeiro & Oliveira 2017; Ribeiro, Silva & Oliveira 2020) (Campos & Dias 2014; Carrajola 2020) . For example, the discharge of effluents from intensive pig farms in Rio Maior (Portugal) is noted (Delgado, Canha & Trinca 2014). Animal farming and trawling are also mentioned as contributing to biodiversity loss (Campos & Dias 2014; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020). Agricultural production in the Amazon, driven by the demand for cereals to feed animals in Europe and North America, is noted as a factor associated with deforestation (Antunes, Bispo & Guindeira 2020; Carrajola 2020). "Excessive" hunting (Silva, Ribeiro & Oliveira 2017; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020) practised in modern societies is also discussed as a threat to the survival of at-risk species, affecting food chains and ecosystems (Campos & Dias 2014) and contributing to the loss of biodiversity.

There are 628 mentions (=59.8%) of threats to the environment and sustainability, particularly frequently in textbooks for grade 13 (568 entries), along with recommendations that certain behaviours be changed (Fig. 8 and Fig. 10). For example, to mitigate environmental impacts, it is recommended that individuals adopt certain practices such as the 3Rs policy (reduce, reuse and recycle products) (Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020), support the use of sustainable agriculture (Oliveira, Ribeiro & Silva 2017; Antunes, Bispo & Guindeira 2020; Matias, Martins, Dias, Guimarães & Rocha 2020; Matias & Martins 2015; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020) and local markets where there is direct trade between producers and consumers (Ribeiro, Silva & Oliveira 2020), use public transport, save water (Antunes, Bispo & Guindeira 2020), and choose renewable energies (Antunes, Bispo & Guindeira 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020).

Collective sustainable and ecological practices are mentioned as well, including recovering degraded areas, controlling pesticides and fertilisers, forbidding the introduction of invasive species (Antunes, Bispo & Guindeira 2020), carrying out afforestation projects that avoid monoculture (Antunes, Bispo & Guindeira 2020; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020), engaging in land-use planning and the conservation of areas of geological interest (Matias & Martins 2015; Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020), creating green corridors between different areas (Silva, Ribeiro & Oliveira 2017), strengthening the construction of wastewater treatment plants to treat effluents (Costa, Motta, Santos, Barros & Viana 2016), controlling population growth (Silva, Mesquita, Gramaxo, Santos, Baldaia & Félix 2020; Ribeiro, Silva & Oliveira 2020), and treating (urban, hospital, etc.) waste (Ribeiro, Silva & Oliveira 2020).

The sample included no mention of mitigating environmental problems by eating fewer animal-based products (e.g., meat, fish, dairy) or eating vegetarian meals (Fig. 8) (Fig. 9).

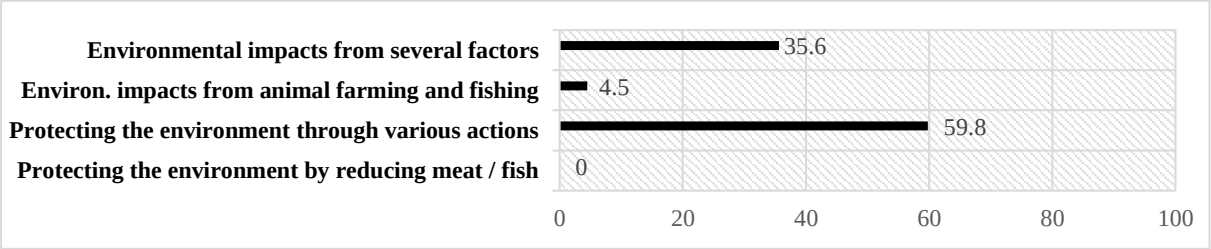


Fig. 8 Subject: environment and sustainability (%) bar chart (1050 occurrences out of 1390).

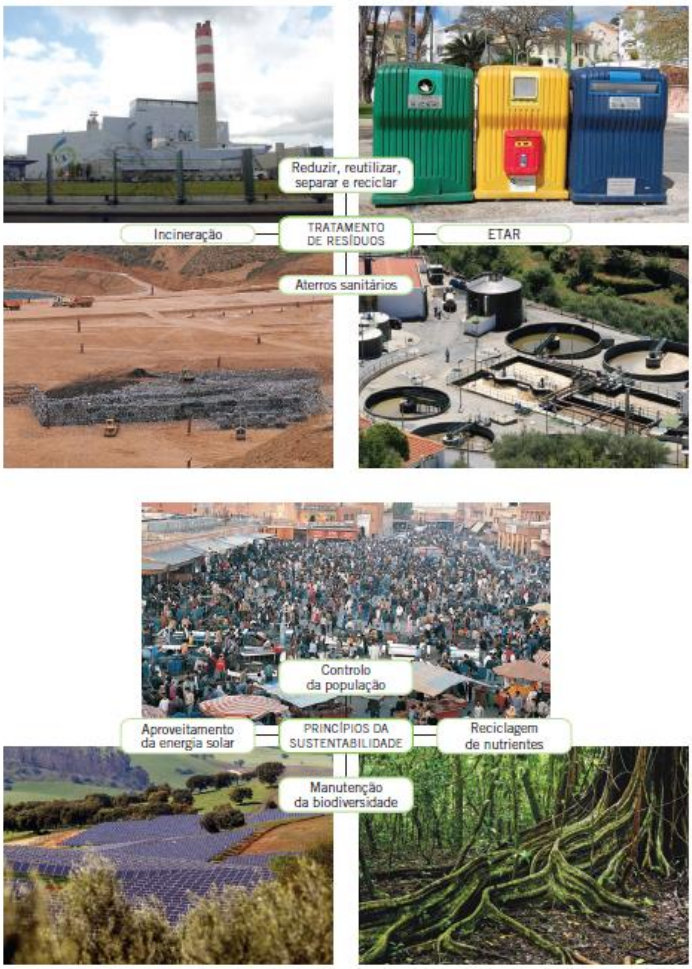


Fig. 9 From *"Planeta com Vida 12 –Biologia 12"*. The recycling and reuse of items, waste treatment, population control, and the use of solar energy are some of the environmental preservation measures presented. There are no recommendations to mitigate anthropogenic environmental impacts by reducing the intake of animal-based products or adopting plant-based diets.

Themes	**Grades**						
	8	**9**	**10**	**11**	**12**	**13**	**Total**
Food and Health	Occurrences						
Animals classified as food, tradable/huntable/wearable goods (e.g., dairy, meat, and fish; use as footwear, in hunting, and for bullfighting)	12	33	23	3	2	62	**135**
Animal-based products as sources of protein and calcium.	-	-	26	1	-	2	**29**
Fish as healthy protein.	-	-	3	-	-	-	**3**
Plant-based proteins as healthy.	-	-	16	1	-	-	**17**
Harmful effects of animal-based products.	-	-	5	-	-	2	**7**
Animal Welfare							
Animals used for food with extensive farming.	2	8	4	3	4	31	**52**
Animals used for food with intensive farming.	-	2	-	-	-	2	**4**
Wild animals hunting.	-	11	-	-	-	-	**11**
Humans hunting, fishing, and slaughtering other animals.	-	2	-	-	-	-	**2**
Dogs, cats, wolves, dolphins, bears, elephants, etc., being cared for and protected.	19	34	1	8	11	1	**74**
Animals used for food being cared for and protected.	-	1	-	2	-	3	**6**
Environment and Sustainability							
Environmental impacts of several factors.	24	68	1	59	21	201	**374**
Environmental impacts from animal farming, hunting, and fishing.	1	10	-	5	-	32	**48**
Various actions for protecting the environment.	3	23	-	31	3	568	**628**
Protecting the environment by reducing meat/fish consumption.	-	-	-	-	-	-	**-**

Fig. 10 Occurrences within the themes studied. Sample: 39 Portuguese textbooks (years 8 to 13).

Teaching caring about dogs while commodifying cows and ignoring meat environmental impacts

In textbooks for all grades, with greater incidence in those for biology (grades 12 and 13), the natural sciences (grades 8 and 9), Portuguese (grade 8) and geology (grade 10), animals are consistently classified as consumable, huntable, wearable, and tradable goods and as resources to be exploited for human needs, ranging from food, clothing and entertainment to scientific experiments. These results are aligned with other findings (e.g., Dolby 2019) where animals are mostly framed as resources that should be used. The theme of *food and health* is virtually absent from most textbook subjects (for grades 8, 9, 11 and 12). Even though a few natural science and biology textbooks (grades 10 and 13) refer positively to plant-based proteins as being healthy, animal-based proteins continue to be widely highlighted as the main sources of protein

and essential to human health. Two natural science books (grade 10) and one biology book (grade 13) point out the harmful effects of animal-based products (such as milk, bacon, butter and meat) on human health.

Within the theme of *animal welfare*, textbooks from all subjects at most grade levels portray animals used for food in extensive farming settings and in an apparent state of well-being. School textbooks from the natural sciences (grade 10) and biology (grade 13) inform students about some intensive farming techniques (i.e., genetic manipulation, selective breeding, fattening, and administration of antibiotics and enzyme supplements to make meat as tender and cheap as possible). This approach favours economic efficiency and maximum production, without ever mentioning the hazardous conditions to which animals are subjected (e.g., forced breeding, mutilation, separating individuals within the same and other species, confinement, alienation from nature, stress, physical and emotional pain, forced death). Textbooks from all grade levels in the sample, particularly for the natural sciences and biology, are very inconsistent in describing intensive farming in the text but show images of extensive farming, where animals appear in the open air in an apparent state of well-being. Animals' welfare and agency are never dealt with. The tendency of textbooks to portray animals in extensive farming situations alienates students from the predominant contexts of animal farming in Portugal and other European countries –, i.e., intensive farming, where most animals (pigs, poultry, cattle, etc.) never experience being outside in nature or seeing the light of day. In this way, students may be misled, mistaking intensive for extensive farming and assuming that animal husbandry is benevolent and benign towards animals. Although the ugliness of death appears to be represented in the predatory relationships of other animal species, no images are found of animals being killed in slaughterhouses or hunted by humans. Therefore, by being left out of school curricula, particularly from natural science, biology and geology textbooks, death and real farming practices appear dissociated from meat and animal-based products, making the idea that animals are edible more acceptable. The two times fishing appears in the sample reflect the greater tolerance (also observable in popular culture) towards the death of some water-dwelling species, which is seen as less disturbing than the death of land animals.

The subject of "human education" regarding specific species (Kahn 2008), including encouragement for students to adopt behaviours that value animals and protect them, appears with the greatest frequency in textbooks for Portuguese (grade 9). Pets stand out as the species with which students should establish emotional bonds; wild species, once threatened with extinction, appear as groups that ought to be protected from hunters; and the trade of exotic animal fur and animal experiments are also questioned. In comparison, animals exploited for food are hardly valued. Their suffering is highlighted in only one biology textbook (grade 13) in the example of foie gras production in France. In other words, by not questioning animal farming practices, textbooks continue to legitimise and normalise all animal farming. Based on the works of Tom Regan and Peter Singer, philosophy textbooks (grade 13) discuss animal liberation and vaguely mention vegetarianism.

Similar to what Matthew Cole and Kate Stewart (2015) found in the U.K., the results of this study revealed that Portuguese secondary and high school textbooks tend to omit the coercive handling, slaughter and suffering of factory-farmed animals. Furthermore, analogous to what Reingard Spannring (2017) and Nicklas Lindgren (2020) observed in different school settings, the intrinsic value of pets and their relations with humans is highlighted, but there is an absence of discussion on the moral principles relevant to animals used for food. In addition, factory-farmed animals are predominantly othered, represented as resources (i.e., meat and other animal-based products), and highlighted as essential for human health (see Twine 2010), while plant-based diets are marginalized. In this regard, these educational narratives provide what Gaard (2008) describes as the "logic of domination", fostering disconnection and alienation between students and other animals. In this sense, as Carolina Rodriguez notes

(2016), schools (textbooks) inculcate, whether explicitly or implicitly, oppressive views and attitudes towards other animals.

Regarding the theme of *environment and sustainability*, in all years, but especially in books for biology, the natural sciences and geology, there are clear teaching guidelines on climate change, the degradation of ecosystems and various causes of pollution due to human activity. It is worth highlighting that two biology textbooks (grade 13) and two natural science textbooks (grades 8 and 9) do refer to animal farming, fishing and hunting as activities that pollute the soil, water and air. Relevant examples are mentioned, such as the production of soy in the Amazon, the conversion of cereals into animal feed, the impacts of pig farms on the water and soil, and the impacts of intensive farming and fishing on biodiversity. Two biology books (grade 13) point to hunting as a factor that affects food chains and ecosystems. The most common themes, mainly appearing in biology, natural science, and geology textbooks, is the recommendation to adopt different types of behaviours (such as recycling and reusing items, choosing organic produce, using public transport, and saving water) to reduce environmental impacts. Although some impacts of animal farming and fishing on the environment are mentioned (see Fig. 8), it is worrisome that there are no recommendations to reduce the consumption of meat, fish and other animal-based products as a way to mitigate environmental impacts. Although food has become a focus area in recent education research and calls have been made to consider school food a serious subject in the research agenda (Weaver-Hightower 2011), the dominant discourses in school books do not provide information about animal suffering caused by the animal-industrial-complex (Noske 1989). Furthermore, plant-based diets (or even the reduced consumption of animal products) as a means to mitigate humans' environmental impacts continue to be marginalized (e.g., Lloro-Bidart 2015).

The differences among the total occurrences (1390) of the three themes analysed (food and health (191), animal welfare (149), and environment and sustainability (1050) are even more substantial considering the subthemes in which animals being used for food are evoked. The consistent framing of animals as food (135), the limited promotion of plant-based diets as healthy options (6), the lack of appeal for animals used for food to be protected and cared for (6), and the total absence of recommendations for reducing or stopping meat consumption as an essential way to protect the environment support the main thesis of this paper. Most of the secondary and high school textbooks used in Portugal continue to frame animals used for food in an anthropocentric and exploitative way, marginalising them as important stakeholders in a more sustainable future. These educational topics might be more than a by-product of a hegemonic Western culture reproduced by educational agents (i.e., teachers, educators, editors) who usually share similar values, conventions, perceptions and beliefs about the legitimacy of animal consumption. In addition, animal exploitation and consumption in modern societies must also be seen as a broader phenomenon that is constantly reinforced by a set of profit-oriented private organisations involved in implementing collective decisions and a structure of domination (Rueschemeyer, Stephens and Stephens 1992). Like any other powerful private sector in our capitalist market, the livestock industry also assumes a legal and institutional form, wielding significant external power (Buick and Crump 1986) beyond territorial borders. In our modern economies, state power continues to (economically and legally) support factory farming enterprises that are still not held unaccountable for their role as a serious threat to biodiversity, planetary natural resource depletion, environmental crimes and climate change.

Endorsements

Following the guidelines in Portugal's Frame of Reference for Environmental Education, the textbooks included in this sample reflect some limitations in the way they address the themes examined in this article. Considering the challenges faced by the planet and humanity as a result

of animal farming and fishing, the Ministry of Education, alongside textbook authors and editors, ought to create and disseminate school textbooks that take into account the warnings and recommendations of internationally recognised sources. Regarding the theme of *food and health*, it would be appropriate to highlight the dangers associated with the high consumption of certain animal-based products, such as red and processed meat (Zhong, Horn and Greenland 2020). Within the theme of *environment and sustainability*, although the sample includes appropriate information on the impacts of animal farming and fishing, it is essential to share recommendations on reducing the consumption of meat and fish and to highlight plant-based diets as a healthy option (Silva, Pinho, Borges, Santos, Santos and Graça 2015) that requires less water and soil and is more sustainable and better able to reduce ecological footprints and mitigate climate change (e.g., IPCC 2019). There is a lack of incentive for collective action, especially related to food options and their environmental impacts. If school textbooks cite transportation emissions as a concern, it is not understandable that the animal production industry is not also mentioned, as it produces higher emissions than the transportation industry (Oakley 2019). Simultaneously, school curricula ought to use theory and scientific knowledge as a means to build holistic consciousness among humans that is not divorced from animals, the natural world and environmental justice (Horsthemke 2018). Therefore, presenting a holistic approach towards the damaging effects of dietary choices on animals and the environment (Kheel 2008) and suggesting that students reduce meat, dairy and fish and even adopt planted-based diets can be understood as an environmental act (Oakley 2019).

Within the theme of *animal welfare*, the way animals are represented also depends on the background (Baker 2001) of the images displayed in books. Images of farmed animals should represent the places where they are actually farmed, i.e., factory farms, which are the most common. In other words, instead of depicting animals in extensive farming situations, students should be shown animals in intensive farming contexts and be alerted to the fact that many of the practices and conditions to which the animals are subjected are harmful and cause them to suffer. In addition to that of pets, wild animals, species used in the fur trade and animals used for scientific purposes, the cognition and ability of animals exploited for human consumption (including fish) to experience pain also ought to be recognised (e.g., Lund, Mejdell, Röcklinsberg, Anthony and Håstein 2007). Teachers and students are potential agents of change (Houde and Bullis 1999). Within an ecocentric and intersectional framework, science education can help maximise the well-being of the nonhuman world (Jeong, Sherman and Tippins 2021). Castano (2016) proposes that teachers create science classes that encourage critical thinking and caring attitudes among students. A more ecocentric pedagogy, grounded in the ethics of care (e.g., Lloro-Bidart and Semenko 2017), can enable students to think more ethically about the animals in factory farms as sentient individuals with intrinsic value and not as mere tools for human purposes (Horsthemke 2018). Solutions to the world's current environmental and social challenges are dependent on profound shifts in science education that ought to provide students with the necessary information to create change. The establishment of a more flourishing and sustainable planet is also dependent on the well-being of other animals.

;

;

;

;

;

;

;

;

Index- List of textbooks (39) included in the sample.

Amado, E., Baptista, J. E., Baptista, J. C. (2012). Geodiversidades Manual do Professor – Geografia. 7º ano. Didáctica Editora.

Amorim, C., Pires, C. (2020). Clube das Ideias 10 – Filosofia. 10º ano. Areal Editores.

Amorim, F. Araújo, I., Militão, P. (2013). Em progresso 7 - Português. 7º ano. Plátano.

Antunes, C., Guindera, P., Bispo, M. (2014). Descobrir a Terra 7. Ciências Naturais 7º ano. Areal Editores.

Antunes, C., Bispo, M., Guindeira, P. (2020). Descobrir a Terra 8 – Ciências Naturais. 8º ano. Areal Editores.

Borges, J. F., Paiva, M., Tavares, O. (2020). Novos Contextos – Filosofia – 11º Ano. Porto Editora.

Campos, C., Dias, M. (2014). Terra CN – Ciências Naturais. 8º ano. Texto Editores.

Carrajola, C. (2020). Planeta com Vida. 12º Ano. Biologia. Santillana.

Carrajola, C., Martim, L., Hilário, T. (2015). Ciências Naturais 9 – Livro do Professor. Santillana.

Costa, F. (2020). Diálogos 9 – Português. 9º ano. Porto Editora.

Costa, F., Magalhães, V. (2020). Diálogos 8 – Português. 8º ano. Porto Editora.

Costa, F., Mendonça, L. (2020). Diálogos 7 - Português. 7º ano. Porto Editora.

Costa, I. A., Barros, J. A., Motta, L. Viana, M. A., Santos, R. P. (2020). Viva a Terra 9 – Ciências Naturais. 9º ano. Porto Editora.

Costa, I. A., Motta, L., Santos, R. P., Barros, J. A., Viana, M. A. (2016). Viva a Terra 8 – Ciências Naturais. 8º ano. Porto Editora.

Delgado, Z., Canha, P., Trinca, C. B. (2014). À descoberta da Vida – Ciências Naturais 8. 8º ano. Texto Editores.

Dias, M. Campos, C. (2012). Terra CN – Ciências Naturais. 7º ano. Texto Editores.

Freitas, E. M., Ferreira, I. G., Barbosa, M. L. (2018). O Caminho das Palavras – Português. 10º ano. Areal Editores.

Matias, O., Martins, P. (2015). Biologia e Geologia 10. 10º ano. Areal Editores.
Matias, O., Martins, P., Dias, A. G., Guimarães, P., Rocha, P. (2020). Biologia e Geologia 10. 10º ano. Areal Editores.
Moreira, J. R., Sant'Ovaia, H., Pinto, V. N. (2012). Compreender a Terra 7 Ciências Naturais. 7º ano. Areal.
Neto, C. M., Nunes, S., Amaral, R. A., Guimarães, L., Brochado, O. (2020). Conto Contigo 7 – Português. 7º ano. Areal Editores.
Oliveira, O., Ribeiro, E., Silva, J. C. (2014). Ciência & Vida 8. Ciências Naturais. 8º ano. Leya Educação.
Oliveira, O., Ribeiro, E., Silva, J. C. (2017). Ciência & Vida 7. Ciências Naturais. 7º ano. Leya Educação.
Paiva, A. M., Almeida, G. B., Jorge, N., Junqueira, S. G. (2020). (Para)Textos – Português. 8º ano. Porto Editora.
Paiva, A. M., Jorge, N., Junqueira, S. G., Almeida, G. B. (2014). (Para)Textos – Português. 9º ano. Porto Editora.
Pinto, A.D., Nunes, P. (2017). Entre Nós e as Palavras - Português 12º ano. Santillana
Pinto, E. C. (2020). Novo Plural 8 – Português. 8º ano. Raiz Editora.
Pinto, E. C., Baptista, V. S. (2020). Novo Plural 9 – Português. 9º ano. Raiz Editora.
Pinto, E. C., Fonseca, P., Baptista, V. S. (2020). Novo Plural 10 – Português. 10º ano. Raiz Editora.
Pinto, E. S., Baptista, V. S. (2020). Plural 7 - Português. 7º ano. Raiz Editora.
Ribeiro, E., Silva, J. C., Oliveira, O (2020). Biodesafios – Biologia. 12º. Asa.
Santiago, A., Paixão, S. (2011). P7 – Português. 7º ano. Texto Editora.
Salda, J., Cunha, R. (2020). CienTic 9 – Ciências Naturais. 9º ano. Porto Editora.
Silva, A. D., Mesquita, A. F., Gramaxo, F., Santos, M. E., Baldaia, L., Félix, J. M. (2020). Terra, Universo de Vida – Biologia e Geologia – 10º ano. Porto Editora.
Silva, A.D., Santos, M. E., Mesquita, A. F., Baldaia, L., Félix, J. M. (2020). Terra, Universo de Vida – Biologia – 12º ano. Porto Editora
Silva, J. C., Ribeiro, E., Oliveira, O. (2017). Desafios. Biologia e Geologia. 10º ano. Editora Asa.
Silva, J. C., Ribeiro, E., Oliveira, O. (2017) Desafios. Biologia e Geologia. 11º ano. Editora Asa.
Silva, P., Cardoso, E., Rente, S. (2020). Outras expressões – Português 10º ano. Porto Editora.
Silva, P., Cardoso, E., Rente, S. (2020). Outras Expressões - Português - 12.º Ano. Porto Editora.

References

Adams, C. J. (2003). The Pornography of Meat. Continuum.
Adams, C. & Donovan J. (Eds.) (1995). *Animals and Women: Feminist Theoretical Explorations*. Durham, NC: Duke University Press.
Algers, B., Blokhuis, J., Botner, A., Broom, D. M., Costa, P., Domingo M., Greiner M., Hartung, J. (2009). Scientific opinion on the overall effects of farming systems on dairy welfare and disease. European Food Safety Authority. *The EFSA Journal*, 1143, 1-38. https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/j.efsa.2009.1143
Anderson, V., Datta, R., Dyck, S., Kayira, J., McVittie, J. (2016). Meanings and implications of culture in sustainability education research. *The Journal of Environmental Education, 47*(1), 1–18. doi:10.1080/00958964.2015.1056077
Bazzul, J. (2012). Neoliberal ideology, global capitalism, and science education: engaging the question of subjectivity. *Cultural Studies of Science Education, 7,* 1001–1020. https://doi.org/10.1007/s11422-012-9413-3
Baker, S. (2001). *Picturing the beast. Animals, identity and representation.* University of Illinois Press.
Best, S. (2009). The Rise of Critical Animal Studies: Putting Theory into Action and Animal Liberation into Higher Education. *Journal for Critical Animal Studies.* (7), 9-52. http://www.criticalanimalstudies.org/wp-content/uploads/2012/09/JCAS-VII-Issue-1-2009.pdf
Brambell, R. (1965). Report of the Technical Committee to Enquire Into the Welfare of Animals Kept Under Intensive Livestock Husbandry Systems, Cmd. (Great Britain. Parliament), H.M. Stationery Office, 1–84. https://edepot.wur.nl/134379

Buick A., & Crump J. (1986). *State Capitalism in the West. In: State Capitalism: The Wages System under New Management.* Palgrave Macmillan. https://doi.org/10.1007/978-1-349-18426-2_2

Câmara, A., Proença, A., Teixeira, F., Freitas, H., Gil, H., Vieira, I., Pinto, R., Soares, L., Gomes, L., Gomes, M., Amaral, M., de Castro, S. (2018). Referencial de educação ambiental para a sustentabilidade para a educação pré-escolar, o ensino básico e o ensino secundário. *Ministério da Educação.* https://www.dge.mec.pt/sites/default/files/ECidadania/Educacao_Ambiental/documentos/referencial_ambiente.pdf

Castano, R. C. (2016). Which values regarding nature and other species are we promoting in the Australian science curriculum? *Cultural Studies of Science Education,* 11, 999–1021. https://doi.org/10.1007/s11422-015-9675-7

Cole, M., & Stewart, K. (2015). *Our children and other animals: the cultural construction of human-animal relations in childhood.* Routledge.

Diário da República. Lei n.º 165/2006. https://dre.pt/web/guest/legislacao-consolidada//lc/155873976/202103020846/73946527/element/diploma?p_p_state=maximized

De Jonge, J., & Van Trijp, H. C. (2013). The impact of broiler production system practices on consumer perceptions of animal welfare. *Poultry Science, 92*(12), 3080-3095. https://doi.org/10.3382/ps.2013-03334

Dijk, van T. (1997). Discourse as interaction in society. In Dijk, van T. (Ed.), *Discourse as social interaction*, 1-37. Sage.

Dinker, K. G. & Pedersen, H. (2016). Critical animal pedagogies: re-learning our relations with animal others. In Lees, H. E., Noddings, Nell (Eds.), *The Palgrave International Handbook of Alternative Education*, 415-430. Palgrave Macmillan.

Dolby, N. (2019). Nonhuman animals and the future of environmental education: Empathy and new possibilities. *The Journal of Environmental Education, 50*(4-6), 403-415. https://doi.org/10.1080/00958964.2019.1687411

Downe-Wamboldt, B. (1992). Content analysis: Method, applications, and issues. *Health care for Women International, 13*(3), 313-321. https://doi:10.1080/07399339209516006

dos Santos, W.L.P. (2014) Debate on global warming as a socio-scientific issue: science teaching towards political literacy. *Cultural Studies of Science Education,* 9, 663–674. https://doi.org/10.1007/s11422-014-9596-x

European Convention for the Protection of Animals Kept for Farming Purposes. Article 4.1. https://ec.europa.eu/food/sites/food/files/animals/docs/aw_european_convention_protection_animals_en.pdf

Eur-Lex (1997). On the protection and welfare of animals. Protocol (120006E/PRO/33). European Community. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12006E%2FPRO%2F33

Eur-Lex (2008). Council Directive 2008/120/CE laying down minimum standards for the protection of pigs. European Community. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0120&from=PT

FAIRR (2016). *Factory farming: assessing investment risks. Farm Animal Investment Risk & Return*. https://cdn.fairr.org/2019/01/09115655/FAIRR-Factory-Farming-Assessing-Investment-Risks-2016-Report.pdf

Gaard, G. (2008). Toward an ecopedagogy of children's environmental literature. *Green Theory & Praxis: The Journal of Ecopedagogy, 4*(2), 11-24. doi: 10.3903/gtp.2008.2.3

Garnett, G. (2010). Livestock and Climate Change. In D'Silva, J., Webster, J. (Eds.), *The Meat Crisis. Developing more sustainable production and consumption,* 34-56. Earthscan.

Gerber, P.J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., Falcucci, A. &Tempio, G. (2013). *Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities.* Food and Agriculture Organization of the United Nations (FAO), Rome. https://www.fao.org/3/i3437e/i3437e.pdf

Grainger, M. (2016). *Flexitarianism: flexible or part-time vegetarianism.* United Nations. https://sustainabledevelopment.un.org/partnership/?p=2252

Harper, A. B. (2010). Race as a "feeble matter" in veganism: Interrogating whiteness, geopolitical privilege, and consumption philosophy of cruelty-free products. *Journal of Critical Animal Studies,*

8(3), 5–27. https://www.criticalanimalstudies.org/wp-content/uploads/2009/09/JCAS-Special-Issue-Women-of-Color-November-3-FINAL-2010.pdf

Houde, L. J., Bullis, C. (1999). Ecofeminist pedagogy: An exploratory case. *Ethics and the Environment, (4)* 2, 143-174. https://doi.org/10.1016/S1085-6633(00)88417-X

Horsthemke K. (2018). Environmental Education and Education for Sustainability, Biophilia and Ecophilia. In: *Animal Rights Education*. The Palgrave Macmillan Animal Ethics Series. Palgrave Macmillan. https://doi.org/10.1007/978-3-319-98593-0_5

IPCC (Intergovernmental Panel on Climate Change) (2019). *Climate Change and Land – Special Report.* United Nations. https://www.ipcc.ch/srccl/

IPSRM (International Panel for Sustainable Resource Management) (2010). *Assessing the environmental impacts of consumption and production.* United Nations. https://www.resourcepanel.org/reports/assessing-environmental-impacts-consumption-and-production

Jeong, S., Sherman, B. & Tippins, D.J. (2021) The Anthropocene as we know it: posthumanism, science education and scientific literacy as a path to sustainability. *Cultural Studies of Science Education, 16*, 805–820. https://doi.org/10.1007/s11422-021-10029-9

Kahn, R. (2008). Towards ecopedagogy: Weaving a broad-based pedagogy of liberation for animals, nature, and the oppressed people of the earth. In Darder, A., Baltodano, M., & Torres R. (Eds.), *The critical pedagogy reader*, 523– 538. Routledge.

Kheel, M. (2008). *Nature ethics: an ecofeminist perspective*. Rowman & Littlefield Publishers.

Kheel, M. (1990). Ecofeminism and Deep Ecology: Reflections on Identity and Difference. In Diamond, I. & Orenstein, G. F. (Eds.), *Reweaving the World: The Emergence of Ecofeminism*, 128– 137). Sierra Club.

Kopnina, H. (2012). Revisiting Education for Sustainable Development (ESD): Examining Anthropocentric Bias Through the Transition of Environmental Education to ESD. *Sustainable Development, 2*(22), 73-83. https://doi.org/10.1002/sd.529

Kopnina, H. (2020). Education for the future? Critical evaluation of education for sustainable development goals. *The Journal of Environmental Education*, 1–12. doi:10.1080/00958964.2019.1710444

Levinson, R. (2012). A perspective on knowing about global warming and a critical comment about schools and curriculum in relation to socio-scientific issues. *Cultural Studies of Science Education* 7**,** 693–701. https://doi.org/10.1007/s11422-012-9418-y

Lindgren, N. (2020). The political dimension of consuming animal products in education: an analysis of upper-secondary student responses when school lunch turns green and vegan. *Environmental Education Research.* Routledge, 684-700. https://doi.org/10.1080/13504622.2020.1752626

Liu, G., Zong, G., Wu, K., Hu, Y., Li, Y., Willet, W., Eisenberg, D. M., Hu, G., Sun, Q. (2018). Meat cooking methods and risk of type 2 diabetes: results from three prospective cohort studies. *Diabetes Journal*, *41*(5), 1049-1060. https://doi.org/10.2337/dc17-1992

Lloro-Bidart, T. (2019). The Bees Wore Little Fuzzy Yellow Pants: Feminist Intersections of Animal and Human Performativity in an Urban Community Garden. In Parker, B, Brady, J., Power, E. M., Belyea, S. (Eds.), *Feminist food studies: intersectional perspectives*, 33-56. Women's Press.

Lloro-Bidart, T. (2019). Intersectional and Interdisciplinary Approaches to Interspecies Food Justice Pedagogies. In Lloro-Bidart, T., Banschbach, V. (Eds.) *Animals in Environmental Education*, 53-76. Palgrave Studies in Education and the Environment. Palgrave Macmillan. https://doi.org/10.1007/978-3-319-98479-7_4

Lloro-Bidart, T., & Semenko, K. (2017). Toward a feminist ethic of self-care for environmental educators. *The Journal of Environmental Education*, *48*(1), 18-25. doi:10.1080/00958964.2016.1249324

Lund, V., Mejdell M., Röcklinsberg, H., Anthony, R., Håstein, T. (2007). Expanding the moral circle: farmed fish as objects of moral concern. *Inter-Research Science Publisher, 75*(2), 109-118. http://doi.org/10.3354/dao075109

McCrindle, C. M. E., & Odendaal, J. S. J. (2015). Animals in books used for preschool children. *Anthrozoös, 7*(2), 135-146. http://dx.doi.org/10.2752/089279394787001998

Noske, B. (1989). *Humans and other animals: beyond the boundaries of anthropology*. Pluto Press.

Oakley, J. (2019). What can an animal liberation perspective contribute to environmental education? In Lloro-Bidart, T. & Banschbach, V. (Eds.), *Animals in environmental education,* 19-34. Palgrave.
O'Mara, F.P. (2011). The significance of livestock as a contributor to global greenhouse gas emissions today and in a near future. *Elsevier,* 7-15. http://doi.org/10.1016/j.anifeedsci.2011.04.074
Pedersen, H. (2010). *Animals in schools. Processes and strategies in human-animal education.* Purdue Universtity Press.
Ritchie, H, & Roser M. (2019). *Meat and Dairy Production.* OurWorldInData.org. https://ourworldindata.org/meat-production
Rawles, K. (2017). *The meat crisis: developing ethical, sustainable and compassionate food policies*. Routledge.
Regan, T. (1986). *A case for animal rights.* In M.W. Fox & L.D. Mickley (Eds.), Advances in animal welfare science 1986/87, 179-189. Washington, DC: The Humane Society of the United States.
Rego, B., Gomes, C., Balula, J. P. (2012). A avaliação e certificação de manuais escolares em Portugal: um contributo para a excelência. In Patrício, M. P., Sebastião, L., Justo, J., Manuel M., Bonito, J. (Orgs.), *Da exclusão à excelência: caminhos organizacionais para a qualidade da educação,* 129-138. AEPEC.
Rueschemeyer, D., Stephens, E. H., Stephens J. D. (1992). *Capitalist development and democracy*. Chicago: University of Chicago Press.
Silva, S. C., Pinho, J. P., Borges, C., Santos, C. T., Santos, A., Graça, P. (2015) Linhas de Orientação para uma alimentação vegetariana saudável. *Direção Geral da Saúde.* https://repositorio-aberto.up.pt/bitstream/10216/80821/3/44969.pdf
Singer, P. (1975). *Animal Liberation. A new ethics for our treatment of animals.* Harper Collins.
Spannring, R. (2017). Animals in environmental education research. *23*(1), 63-74. *Environmental Education Research*. https://doi.org/10.1080/13504622.2016.1188058
Stibbe, A. (2001). Language, power and the social construction of animals. *Society and Animals, 9*(2), 145-161. doi:10.1163/156853001753639251
Taylor, N., Twine, R. (Eds.) (2014). *The Rise of Critical Animal Studies: From the Margins to the Centre* (1st ed.). Routledge. https://doi.org/10.4324/9780203797631
Tracana, R. (2009). Educação ambiental no ensino básico e secundário: concepções de professores e análise de manuais escolares. PhD Thesis. Universidade do Minho. https://hdl.handle.net/1822/9821
Twine, R. (2010). *Animals and biotechnology. Ethics, sustainability and critical animal studies.* University of Oxford. Washington: Earthscan.
Wade, R. C. (1993). Content Analysis of Social Studies Textbooks: A Review of Ten Years of Research. *Theory & Research in Social Education, 21*(3), 232–256. doi:10.1080/00933104.1993.10505703
Warren, K. J. (2000). *Ecofeminist Philosophy: A Western Perspective on What It Is and Why It Matters*. Lanham, MD: Rowman & Littlefield.
Warren, K. J., & Cheney, J. (1991). Ecological Feminism and Ecosystem Ecology. *Hypatia, 6*(1), 179–197. http://www.jstor.org/stable/3810040
Weber, R. P. (1985). *Basic content analysis*. Newbury Park, CA: Sage.
Weaver-Hightower, M.B. (2011). Why educational researchers should take school food seriously. *Educational Researcher 40*(1), 15-21. https://doi.org/10.3102/0013189X10397043
WCRF (World Cancer Research Fund) (2007). Food, nutrition, physical activity and the prevention of cancer: a global perspective. *American Institute for Cancer Research*. Washington, DC. https://discovery.ucl.ac.uk/id/eprint/4841/1/4841.pdf
Young, R. (2010). Does organic farming offer a solution? In D'Silva, J., Webster, J. (Eds.) *The Meat Crisis. Developing more sustainable production and consumption,* 80-96. Routledge.
Zhong, V., Horn, L. V., Greenland, P. (2020). Associations of processed meat, unprocessed red meat, poultry, or fish intake with incident cardiovascular disease and all-cause mortality. *Jama Internal Medicine, 180*(4), 503-512. doi:10.1001/jamainternmed.2019.6969

Acknowledgments
I am thankful to the Editor Mariona Espinet and the reviewers who provided important feedback to improve this article. Thanks also to REUTILIZAR movement for providing the textbooks

for this study. This study was supported by the Portuguese Foundation for Science and Technology (FCT), RD Unit UIDB/03126/2020.