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Primary School Curriculum Contributing to Plant Blindness: Assessment Through the Biodiversity Perspective

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Abstract: Biodiversity loss is already an important issue as planet Earth loose species at an alarming rate. This loss has a direct effect on humanity for the capacity of ecosystems to provide welfare, depends on biodiversity. So, no organism can be ignored or be underestimated, as this is happening with plants according to the "Plant Blindness" hypothesis. The limited plant references in subject matter taught in schools are listed among the causes of this phenomenon. Aim of this research is to analyze Greek primary school curriculum according to the grounded theory principles in order to clarify whether they shape attitudes and add to knowledge regarding plant life. According to the results, plant morphology and plant physiology seem to be adequately analyzed throughout the science curriculum. On the contrary, references about the importance of plants for human welfare and life's evolution on earth are almost lacking. Plant life seems to be examined rather incompletely in the Greek primary school. These findings bring to light issues relating to curricular effectiveness and enhance the general concern about the reduced emphasis on plant life in educational systems worldwide. Hence, a need emerges for revising curriculum and textbooks in order to eliminate deficiencies in plant knowledge.

Key words: Plant Blindness, Primary school, Attitudes, Biodiversity, Curriculum

1. Introduction

During the past decades the environmental movement has been supported by many intergovernmental, non-governmental and educational organizations. International conferences on environment and sustainable development, massive environmental protests and the consolidation of environmental education in school systems worldwide, were the main concerted actions to prevent or to reverse environmental crisis. Promoting the environmental literacy as a major component of environmental citizenship became a top priority in the political and the social context worldwide. However, despite all these joint actions, the pressing environmental

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issues haven't been resolved. People's environmental awareness is yet in low levels and there is still much to do in this area. People continue to consider themselves separate from nature as the majority selects an increasingly urban lifestyle. In order to reverse this situation, profound changes such as a biophilic transformation of culture may be imperative (Skorpikova, 2013).

One of the main environmental problems is the ongoing extinction of species worldwide. Population growth, along with a trend of increasing consumption and production, has led to a greater demand for food and other resources. This change has affected severely the ecosystems and the organisms that live in them. Species have decreased or become extinct. This situation has worsened over the past 50 years leading to a significant biodiversity loss. All the existing set of laws in regard to placing species or habitats 'under protection' have proved ineffective (Plutzar, Erb, Gaube, Haberl, & Krausmann, 2016). This ineffectiveness could be explained by people's inability to realize that all living things are linked through a web of life. In order to change, it is crucial to understand that biodiversity loss is much more than a strange colored tiger or an unusual fish that we cannot encounter any more during our life on earth. According to the literature, a deeper understanding of biodiversity is generally needed, even for groups such as science teachers (Köklükaya, Demirhan, & Beşoluk, 2014) that are supposed to have high levels of scientific literacy.

As it was clearly stated in the Millennium Ecosystem Assessment (MEA, 2005), humans' welfare depends on the ecosystems' capacity to provide provisioning, regulating and habitat services. This capacity however, is not something eternal or immune since it depends on biodiversity. In fact, there is a direct connection between these two, as biodiversity indicators affect ecosystem values in a countable manner (Ojea, Nunes, & Loureiro, 2010). Even more recent studies highlight this connection, as they underline the positive relationship between energy availability and species richness numbers (Plutzar et al., 2016). Hence, biodiversity loss is much more than a philosophical problem. It is a matter of necessity and this is why 2010 was declared to be the International Year of Biodiversity by the United Nations. Likewise, the years 2011-2020 were declared as the decade of biodiversity. The term biodiversity or biological diversity refers theoretically to the variety of life on Earth, while practically refers to the notion: "every organism is valuable" (UNESCO, 2014). This is a key principal in order to understand biodiversity and also the core of education for sustainable development (ESD). Every living thing, from the small insects to the largest mammals, contributes to Earth's sustainability. In this context, no organism can be ignored or be underestimated, let alone the plants that are 98% of planet earth's biomass.

Even though plants' contribution to human life is commonly accepted, it is worthwhile to emphasize some main aspects. They convert light energy into chemical energy that later can be released to fuel other organisms' activities. All food that people eat comes directly or indirectly from plants. Regarding human health,

plants contribute essentially to the pharmaceutical industry. But no matter how important are plants for humanity, people do not seem to find them interesting. When a child has the opportunity to spend time with an animal or a plant, most of the times it chooses the animal (Wandersee, 1986). Students can recall easier animal images than plant images (Schussler & Olzak, 2008) while biology students' ability to recognize and name plant species is usually poor comparing to animal identification (Kose, 2011). In their everyday life, people rarely notice the flora around them.

This phenomenon is called "Plant Blindness" (Balas & Momsen, 2014; Gagliano, 2013; Hoekstra, 2000; Lindemann-Matthies, 2005; Pany, 2014; Wandersee & Schussler, 2001) and it was first assigned by James Wandersee during the mid 80s (Wandersee, 1986). According to a more recent definition, "plant blindness refers to the human's inability to see or notice the plants in one's own environment, the inability to recognize the importance of plants in the environment and human affairs, the inability to appreciate the aesthetic and unique biological features of plants and the tendency to rank plants as inferior to animals" (Strgar, 2007, p. 19).

According to the literature, there are specific causes for this phenomenon. Plants' lacking intense motion was one of the first explanations of plant blindness (Kinchin, 1999). Some human and animal external characteristics look alike so people feel more familiar or can compare themselves easier to animals (Hoekstra, 2000). Additionally, human brain appears to be incapable of processing the whole amount of data that are being sent from the eyes, so some information end up disregarded. To be more specific, among 10 million bits of information that are being sent, only 10-40 bits are being processed. These 10-40 bits usually refer to something already common or something with intense motion and color. Consequently, plants usually belong to the unprocessed information (Balas & Momsen, 2014). There is also a notion that educational systems worldwide are in a sense more "animal oriented" and less "plant-friendly". Plants receive less coverage in biology chapters or textbooks (Hersey, 2005) and photographs with animal subjects are more numerous than those with plant subjects. It is remarkable that animal photographs in course books were found three times more likely to be provided with a specific label comparing to plant photographs (Link-Perez, Dollo, Weber, & Schussler, 2009). In general, biology classes and biology teachers are being characterized by "zoochauvinism" (Hersey, 2005). The term zoochauvinism refers to the consideration of plants as inferior to animals (Bozniak, 1994) and it is a widespread phenomenon in society (Hersey, 1996). In the aggregate, Balding and Williams (2016) suggest that plant blindness is a complex phenomenon with its causes rooted in biologically based patterns of perception and cognition along with cultural factors.

In order to face the issue of plant blindness, some researchers conducted and evaluated educational activities in order to elucidate the plants' importance and make them more interesting to humans (Cil, 2016; Fančovičová & Prokop, 2011; Frisch, Unwin, & Saunders, 2010; Lindemann-Matthies, 2005; Stagg & Verde, 2018; Strgar,

2007). The majority of these activities were based on emphasizing plants' qualities while students having personal contact with plants. It is really impressive that the results of all these studies suggested that educational interventions can to a certain extend enhance the interest of students about plants and reduce plant blindness. So education in both formal and informal context may have a significant role to play in this matter (Sanders, 2007).

Curriculum is one of the main key elements of every educational system. It determines the learning framework through an analytic description of educational activities, instructional goals, materials and information about every subject (Doll, 2015; Parkay, Anctil, & Hass, 2014). Even though every teacher can up to a point plan his own sequence of instruction, curriculum is a basic path that he/she must follow. As a result, creating a curriculum plan should always be approached with caution. A deficient or improper curriculum can be a negative determining factor in a child's general development (Ellis, 2004). In our case, ignoring plants while designing a curriculum implies overlooking one of the life sciences cores and can allow the existence of negative phenomena such as plant blindness. On the contrary, a rich and rational curriculum can contribute to a person's cultivation and enhance positive individual's values and beliefs. One of these values can be environmental citizenship as science literacy is connected to good citizenship (Lee & Roth, 2003).

It is also important that by searching the available literature in the topic area of plant blindness, there are no studies about the role of curriculum. As it was mentioned above, there are researches that examine textbooks regarding this issue (Hersey, 2005; Link-Perez, Dollo, Weber, & Schussler, 2009). However, a more wide research perspective about the general, predetermined schools' educational plan is absent. Considering that, aim of this study is to analyze the Greek primary curriculum in order to clarify how plant life is being presented through them. The research questions we address here are as follows:

1. What do children learn at primary school in regard to plant life?
2. Does the Greek primary school curriculum give prominence to plants importance as being determined in the context of biodiversity?
3. Are animals as a learning topic more emphasized comparing to plants in the Greek primary school curriculum?

2. Methodology

The Greek Framework

The duration of the Greek primary school is six years. Primary school students are between six and twelve years old and their education consist mainly of reading, writing, mathematics, arts, history, study of the environment and gym class. After the first two years, foreign languages are being introduced and besides English, children can learn German and French. Additionally, during the late years of primary school, there are science, geography and civic education. Aspects of science education can also be found in the study of the environment, however the dedicated science class takes place only during the last two school years. The total amount of subjects in the primary school is twelve (MINEDU, 2017).

Data Sources

The curriculum of all subjects mentioned before was examined in order to clarify whether they add to knowledge about plant life. There was a search for dedicated curriculum parts that clearly and definitely refer to any aspect of plant knowledge such as physiology, morphology, classification or their importance for life on Earth. It is important to say, that apart from some basic ideas and their short descriptions, Greek curriculum is goal oriented. Hence, all learning outcomes related to plants were noted down. Through this process only three out of the twelve subjects were found containing such outcomes and therefore contributing to plant knowledge: "Study of the Environment", "Geography" and "Science". It is noteworthy, that these subjects are not present throughout the six years of primary school. "Science" and "Geography" lessons are only for fifth and sixth grade students while the "Study of the Environment" class takes place every school year until fourth grade (Table 1).

Considering that plant blindness as a phenomenon includes the tendency to rank plants as inferior to animals, learning outcomes related to the animals were also spotted and noted down. Throughout the whole curriculum, learning goals about animals were again, included only in the subjects "Study of the Environment", "Geography" and "Science". Considering that, a clarification of a probable disproportion between flora and animals in the whole curriculum can be brought to light.

Data Analysis

Every learning outcome of "Geography", "Science" and "Study of the Environment" was one unit of analysis. The scrutinizing of these units can give us quantitative and qualitative conclusions about the content of these three subjects and consequently, of the whole curriculum.

The first analysis step was to determine the whole amount of learning outcomes that can be found in "Study of the Environment", "Geography" and "Science". Afterwards we assessed how these units are distributed per grade and how many of them are related to plant life. Insights into to animals' life knowledge and their own distribution were also examined in order to assess whether the Greek primary school curriculum is "animal-oriented" and is characterized by zoochauvinism (Hersey, 2005). Through this assessment, it is possible to determine the plant knowledge content of every examined school subject and assort "Study of the Environment", "Geography" and "Science" according to this criterion. It is also possible to determine the plant knowledge content per each primary school grade and compare it to the respective amount of knowledge about animals.

Regarding the main qualitative research approach, data analysis was iterative and it was based on the principles of the grounded theory and the constant comparative method by Glaser and Strauss (1967). The purpose was to examine and compare all learning outcomes, to sort them into groups and let these units of analysis define and name the main categories of plant knowledge that can be found in the Greek curriculum. "Constant comparison is an inductive (from specific to broad) data analysis procedure in grounded theory research of generating and connecting categories by comparing incidents in the data to other incidents, incidents to categories, and categories to other categories. The overall intent is to “ground” the categories in the data" (Creswell, 2008, p. 434). The constant comparative method can offer accuracy and assure that the emerging categories will be solid and reliable (Charmaz, 2006) as units were organized inductively through an initial, focused and theoretical coding. The data were coded and the first categories were formed. Memo-writing and revision enhanced the whole process as the coded data were fitting in new or existing categories. Data that did not fit in any existing category were examined with caution. In order to assure the reliability of the analysis, a second analyst was involved in order to group all units independently and discuss the results afterwards. This discussion was continued until there were no arguments at all. Regarding the methodology, grounded theory was selected rather than the qualitative content analysis, as we would like to generate a considerable theory that can explain the contribution of the Greek curriculum to the plant blindness phenomenon (Cho & Lee, 2014) and the relations between the plant knowledge categories that emerged.

Besides the initial determination of the learning outcomes included in Geography", "Science" and "Study of the Environment", we expanded the quantitative assessment of the analysis units inserting the categories that were found through the qualitative measurement. Firstly, the goal was to have a clear picture about the proportion of each of these categories in the whole curriculum. For example, are there more references to plant morphology or to plant ecology? Secondly, it was important to assess the inclusion of every category in each subject. Through descriptive statistics, the information gathered in research can be described more

comprehensively (Mills & Gay, 2015) and can also complement the qualitative results in order to reach major conclusions. Hence, determining these percentages can help us understand what the Greek students can discover in relation to plant life, when primary school will be over for them.

3. Results

As shown in the Table 1, the amount of learning outcomes found relating to plants in all three school subjects were thirty-five. This number is equal to the 5.95% of the whole amount of learning outcomes (five hundred eighty-eight) included in "Study of the Environment", "Geography" and "Science". The analogue proportion of the total learning outcomes related to animal knowledge is 4.59% (twenty seven learning units). By comparing these two percentages we can conclude that Greek primary school curriculum does not seem to be "animal-oriented".

Regarding the proportion of knowledge about plants in each school subject, "Study of the Environment" appears to be the richest source as twenty relative learning outcomes were spotted. Comparing them to the two hundred fifty eight learning outcomes that can be found in this subject in total, a 7.75% percentage arise as a dedicated part of knowledge about plants. The analogue percentages for "Geography" and "Science" are 2.36% and 5.91%. All three proportions are below 10%, reflecting an educational context of limited possibilities to gain insight to plant life.

During the final two years of primary school, students attend both the "Geography" and the "Science" class. However, by determining the aggregate percentage of knowledge about plants that offer these school subjects, one can assume that students learn even less about plants during the last two grades. These percentages are 3.57% for fifth grade and 5.97% for sixth grade, while the "Study of the Environment" class offers 7.86% in first grade, 6.34% in the second grade, 9.09% in the third grade and 7.84% in the fourth grade.

Table 1. Coverage of plant and animal topics in the Greek primary school curriculum.

	Study of the Environment			Geography			Science		
	Learning outcomes								
	Aggregate	Plants	Animals	Aggregate	Plants	Animals	Aggregate	Plants	Animals
A grade	89	7	6						
B grade	63	4	8						
C Grade	55	5	5						
D grade	51	4	3						
E Grade				77	3	1	119	4	4
F Grade				50	0	0	84	8	0
Total	258	20	22	127	3	1	203	12	4

Learning outcomes in Study of the Environment, Science and Geography	Regarding plants	Regarding animals
588 (100%)	35 (5.95%)	27 (4.59%)

Notes: Cells appearing blank for Study of the Environment are only for first, second, third and fourth grade students. Geography and Science are for fifth and sixth grade students.

Learning Outcome Categories

As it was mentioned above, the total number of found learning outcomes related to plants was thirty-five and these outcomes were considered as analysis units. By using the constant comparative method they were grouped into five major categories: morphology, physiology, classification, ecology and importance. The categories, as being defined by the units of analysis themselves, provide us with a clear picture about the aspects of plant knowledge that can be found in the curriculum. As detailed below, there are typical, representative examples of learning outcomes for every category. Next to every learning outcome example, there is a reference to the grade and the school subject that includes that goal according to the curriculum. (A

stands for First Grade, B: Second Grade, C: Third Grade, D: Fourth Grade, E: Fifth Grade, F: Sixth Grade. ES stands for the ‘‘Study of the Environment’’ subject, G: “Geography” subject and S: “Science” subject).

Physiology

The term "plant physiology" refers to the biological processes that occur during the life circle of plants. In general, it is a very challenging cognitive field, especially for young students. However, it is prerequisite if we want them to understand the concept of plant life. Hence, without examining details about chemical elements or chemical reactions, Greek students are being informed about internal activities that cause plant reproduction and growth. Learning outcomes related to photosynthesis, nutrition and respiration are some of the main analysis's units grouped in this category. For example, pupils are expected to “*learn which factors influence plants' growth*” (B/ES), “*be able to describe photosynthesis and name the substances that are produced or consumed during this process*” (F/S) and *“be able to describe plant’s nutrition and relate the role of every plant’s part in it”* (F/S).

Morphology

Plant morphology refers to the study of plants' external structure. The main goal of this category is the determination plants' physical form. Greek students are expected to visually identify organisms as plants and name their basic parts. Bloom and flowers are the mostly emphasized parts. There are references to the external structure of many species, as there is a high degree of diversification among plant families. Typical examples that can be found in the Greek primary school curriculum in relation to plant morphology learning outcomes are *“to discriminate between the different types of flower roots”* (C/ES), *“to name and describe the main parts of a flower blossom”*(A/ES) and *“to describe the stem of typical flowers”* (D/ES).

Classification

Regarding the learning outcomes of this category, students have to identify, classify and name the major plant groups. Classification goals are mostly emphasized during the first years of the Greek primary school.*"Being able to name the most common flowering plants in Europe"* (F/G) is a representative example. Due to the abundance of plant species worldwide, the classification goals in the curriculum are limited to the Greek and the European natural habitats and its vegetation regions. Students learn about the majority of the Greek plants that flourish throughout their country. More typical examples of this category are *“learning about the Greek citrus plants”* (C/ES) and *“naming the Greek cereal plants"* (C/ES).

Ecology

Plant ecology refers mainly to the plant interactions with the natural environment. Plants' general role in the ecosystems and their distribution along the different landscapes are plant ecology aspects that can be found in the curriculum. Pupils learn how plants adapt to different environmental circumstances as they study "*how environment configure plants' characteristics*" (C/ES). It is noteworthy that the Greek natural habitats are again repetitively emphasized in order the students to become familiar with the different vegetation regions of their country. For example, they are expected to *"assess the interactions among and between plants and other organisms of the Mediterranean region"* (D/ES) and be able "*to name procedures through which plants acclimatize to different regions or climates"* (E/G).

Importance

Plants' importance is determined through their contribution to life phenomenon on Earth and to human welfare. This category refers to the essential role of plants in providing with energy all living things, in recycling oxygen, in regulating the water cycle, in maintaining health and prevent human diseases as well as in providing habitat for many organisms. Students *"giving up on their ideas about useful and not useful plants"* (E/G) and *"gaining an understanding of the role of plants in human nutrition*" (B/ES) are representative examples of intended learning outcomes regarding plants' importance that can be found in the Greek curriculum. This category is of great significance, as it is the only one that integrates in the curriculum directions of education for biodiversity and sustainable development. However, the references of this category are only passing, superficial and according to the quantitative assessment of our study, very restricted comparing to the other categories that were mentioned above.

Frequencies

By reference to Figure 1, one can see that throughout the whole curriculum plant physiology and morphology are the most emphasized cognitive fields. During almost every primary school year, Greek students will come across insights that will enhance their scientific literacy in relation to plant physiology and morphology. Moving on, a smaller portion belongs to classification and ecology. The references of these categories are more numerous during the first years of the Greek primary school but on the whole, they definitely fall short comparing especially to physiology. Plants' importance seems to be disregarded as we spotted only few, inconsistent references during the 1st and 3rd grade. To be more specific, the portion of this category in the whole curriculum is under 10%, a percentage quite limited considering the importance of plants to humanity and to life circle upon Earth in general (Table 2).

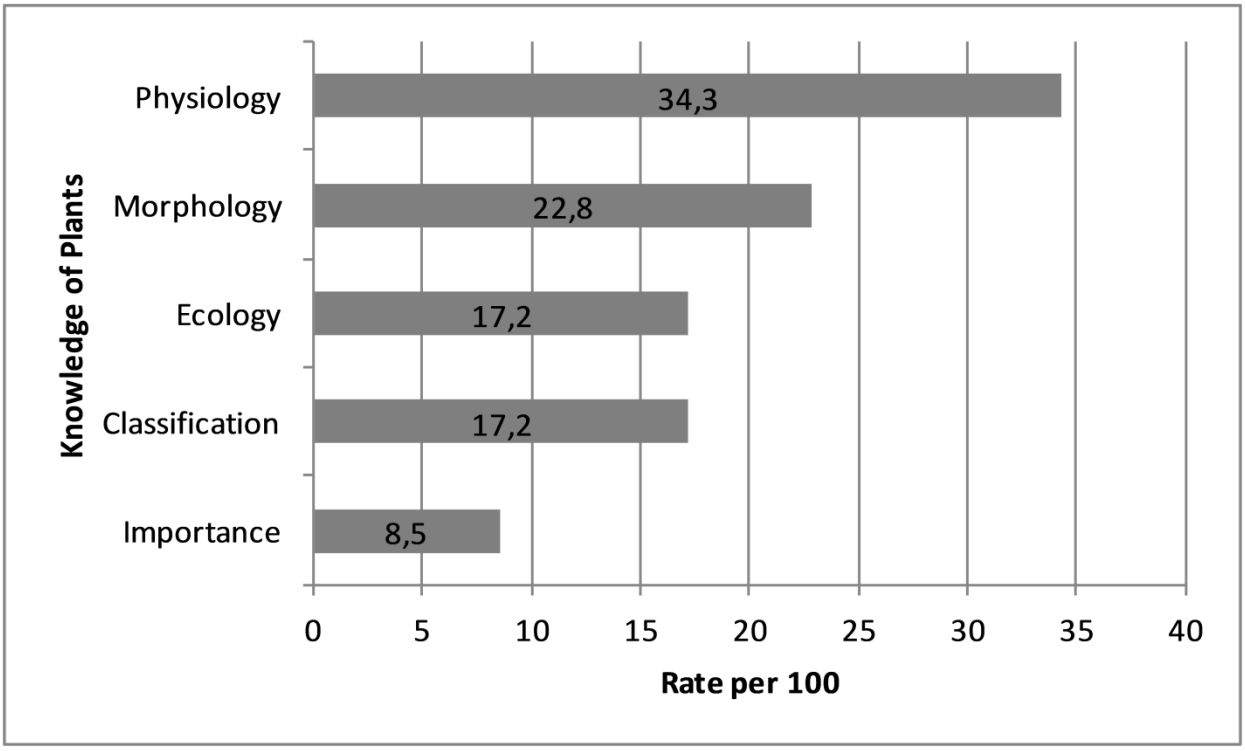

Figure 1. Proportions of learning outcome categories regarding plant knowledge in Greek primary school curriculum.

Furthermore, it is noteworthy to determine the distribution of these categories in each of the three school subjects that offer insight to plant life. As shown in the Table 2, "Study of the Environment" includes references to all five categories. Learning outcomes regarding plant physiology and plant morphology are equally included (17.15%), as it happens for ecology and classification (8.57%). Plants' importance percentage is limited, but still higher than that of the other two school subjects. In the "Geography" curriculum, there are no references to physiology and classification while learning outcomes related to morphology, ecology and importance are restricted (2.86%). Moving on to "Science", it is impressive that physiology percentage is 22,85%, showing that this subject is more dedicated to the fundamental processes of plant functioning. Learning outcomes related to plants' importance are absent from the "Science" subject.

Table 2. Categories of plant knowledge in the Greek primary school subjects.

	Study of the Environment	Geography	Science	In all three subjects
	Percentage of learning outcomes per category			
Physiology	17.15%	0.0%	22.85%	40%
Morphology	17.15%	2.86%	0.0%	20.01%
Ecology	8.57%	2.86%	5.71%	17.14%
Classification	8.57%	0.0%	5.71%	14.28%
Importance	5.71%	2.86%	0.0%	8.57%
Total	57.15%	8.58%	34.27%	100%

3. **Discussion**

Based on the results, Greek primary school curriculum appears to be deficient in plant knowledge. Even though the amount of offered knowledge about animals is not greater than that of plant knowledge, the opportunities for Greek students to study and learn about flora are not plentiful. Among twelve school subjects in total, only three include references to plant life. "Study of the Environment" is a considerable source of knowledge about plants but this subject is present until fourth grade. "Science" and "Geography" enter the curriculum during fifth grade in order to replace study of the environment, but their plant knowledge content is not equivalent to that of their precursor. However, it is important to underline, that these quantitative data give us only an overview about the limited presence of plant knowledge in the Greek curriculum. We cannot be critical and absolute about the curriculum's appropriate amount of plant knowledge, for this is something that relates to scientific literacy and to the percentage of every other subject. Determining the level of scientific literacy is a matter of debate, as there are studies that suggest redefining and lowering it in order to be more functional (Abrahams, Constantinou, Fotou, & Potterton, 2017). On the other hand, regardless of how small or large the proportion of plant knowledge in the curriculum is, we would like to criticize the type of knowledge that can be found in it.

As it was mentioned above, physiology and morphology seem to be considerably analyzed in the curriculum. On the contrary, there are no sufficient references to ecology, classification and especially to the importance of plant life, as this importance is determined in the context of biodiversity. Since plants are the backbone of all life on Earth, disregarding their importance can be a major deficit in a school curriculum. Especially during the last two years of primary school that "Geography" and "Science" class takes place, the references to plant knowledge are more scientific oriented. Hence, the educational approach to plant life for senior Greek students of primary school seems to be rather inadequate.

A growing body of literature has investigated the plant blindness phenomenon but there are no studies that examine the curriculum in regard to this issue. Thus, it is not possible to examine whether other researchers' findings concur well with ours. However, in order to evaluate even more meaningfully the Greek curriculum and determine a more comprehensive educational context for teaching about plants, we compare it to the multiple perspective educational approach for sustainable development and biodiversity of UNESCO (2014). This approach is a complete educational proposal in order the students to comprehend biodiversity in various ways and understand thoroughly how this concept can be embedded in our social context. The main reason that led us to this comparison is that plants are a major component of biodiversity. As described in the Figure 2, the UNESCO's educational approach to biodiversity is definitely more comprehensive than the approach to plant life in the Greek curriculum. The only common perspectives in these two educational approaches are the scientific and the geographic. The values perspective is not fully integrated in the Greek curriculum, as the few references to plants' importance that have been found in the curriculum, can be related only to the Utilitarian values context. It is remarkable that all the other UNESCO's perspectives are absent from the primary school curriculum, while it would be mostly beneficial to integrate them. For example, regarding the cultural diversity perspective, there are unnumbered stories, songs, poetry, and other forms of Greek cultural expressions that are based or have references to typical Greek plants. Greek aromatic plants are an important group of the Greek native flora as the soil and the climate of Greece are ideal for the flourish of many and exceptional species (Koutsos, 2006). Owing to that fact, aromatic plants are considered as an excellent choice for intensive agriculture in Greece and a great environmental resource for this country towards the direction of sustainable development. Offering an in depth knowledge through all these perspectives can help students learn more about certain plant species while simultaneously, flora's impact to the culture of their homeland would be brought into light holistically. Examining the important interconnection between physical environment and the culture of a land, can be an exceptional way to enhance scientific literacy.

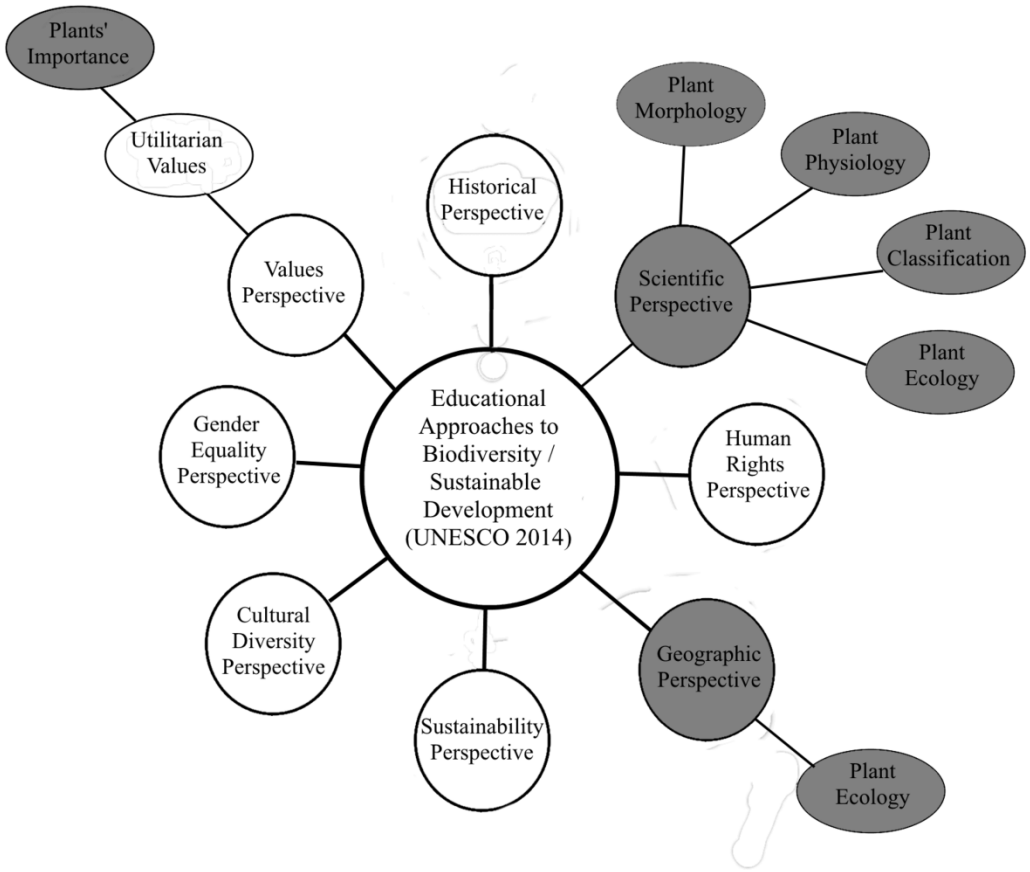

Figure 1. Perspectives found in the Greek Primary School Curriculum regarding Plant Sciences corresponding to UNESCO perspectives. Eclipses Grey filled represent Greek Curriculum categories included in this perspective.

It is important to remark that the suggested educational approach of UNESCO is only one pathway we can choose to expand, to broaden the education for plants. There can be other options to expand the curriculum towards this direction, as well. The rich context of environmental education could be such an option, as it is well known for changing effectively knowledge and attitudes of students worldwide the past decades. This option can also elucidate the sustainability perspective and the important concept of biodiversity.

The protection of biodiversity is an essential goal towards the sustainable development direction. Students of economically advanced countries do not demonstrate strong commitment to protect biodiversity (Menzel & Bögeholz, 2010) and consequently, it is essential to educate them about the value and the existence of all organisms. Ignoring plants can undoubtedly impede such educational innovations and therefore, plant blindness can be considered as a phenomenon that opposes the conservation of biodiversity. The findings of

our study enhance the general concern about the reduced emphasis on plant life in educational systems worldwide. Deficiencies in plant knowledge have already been recorded by other researchers. Tunnicliffe (2001) suggests that school is not a source of plant knowledge for primary school students. Furthermore, Link-Perez, Dollo, Weber and Schussler (2009) concluded that elementary textbooks are poor concerning plant names and images, which in turn has broad implications for students' ability to process new plant information. Even environmental education receives criticism during the last years (Saito, 2013) because of its' lack in science knowledge. Without a doubt, the sufficient level of science literacy is a keenly debated topic. However, knowledge of at least the common organisms is vital if we want our students to be responsible and to care about their environment as future citizens (Bebbington, 2005). Therefore, revising the content and the main directions of the environmental education could possibly improve its effectiveness and contribute to plant blindness' limitation.

Plant blindness can be a grown phenomenon as long as researchers report such deficiencies. If we want to prevent the consequences of this phenomenon, we need to create a new learning direction regarding plant life. Education is a dynamic process that can and should adapt to changes. The importance of plants as well as the whole context of biodiversity should be top priorities and every curriculum worldwide should conform to this "green" framework. Even though the role of every teacher is essential, the curriculum is still the main determining factor of the students' cognitive development. As long as educational interventions can enhance people's interest in plants (Fančovičová & Prokop 2011; Frisch, Unwin, & Saunders, 2010; Strgar, 2007), a thought out integration of such activities in the curriculum can have a positive effect on students. Putting generally the environment at the heart of every curriculum is not enough, as long as this integration is not configured by the recent academic research reports. When it comes to educational policy, a clear focus and a strategic framework is indispensable in order to reach results.

4. Conclusions

The phenomenon of plant blindness can be considered as a great challenge that prevents children and adults from understanding the natural world around them. It also can be considered as an impediment to environmental citizenship. According to the definitions of environmental citizenship, people are being informed, assess a situation and take action in order to protect their environment (Dobson & Bell, 2006; Gabrielson & Cawley, 2010). Hence, it is not about action without understanding, but more about finding value of something through knowledge and acting by an existing or a new belief. In this context, awareness of the plants that exist on Earth along with knowledge about their role in the conservation of our ecosystems, can point out a group of organisms that deserve our attention. According to the literature, high levels of ecological

literacy correlate significantly with volunteer activities (Pitman, Daniels, & Sutton, 2017). A person's ecological behavior depends upon a manifold approach to environmental knowledge (Kaiser & Fuhrer, 2003). For example, motivation alone or specific information on solving problems like pollution, cannot define comprehensively a person that consciously seeks to protect the environment and minimize the negative impact on the natural world. Enhancing the education for plant life in schools worldwide can complement and nurture the concept of environmental citizenship. This can be a safer path to enhancing and establishing environmental awareness.

Plant blindness cannot be cured instantly or through a single educational intervention (Kissi & Dreesman, 2017). A set of well-organized, long-term, intended educational activities can constitute a possible solution to this issue. This education plan should be integrated in an appropriately designed curriculum. An enriched literature and further research can help the educational community to face such emerging challenges and suggest appropriate changes in a curriculum. There is no doubt that more studies are required in order to draw complementary conclusions about the primary curriculum of other countries. In a broader context, educational resources worldwide should be further examined by future inquires so we can clarify, whether they promote underestimation of plants and contribute to phenomena such as the plant blindness. The results of all these studies can be a solid, comprehensive guide for writing new course books and reconstructing curriculum if needed.

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