

SOCIO-EDUCATIONAL IMPLICATIONS FOR SUSTAINABLE DEVELOPMENT BASED ON MENTAL MODELS OF ENVIRONMENTAL REPRESENTATION

IMPLICACIONES SOCIO-EDUCATIVAS PARA UN DESARROLLO SOSTENIBLE A PARTIR DE MODELOS MENTALES DE REPRESENTACIÓN DEL MEDIO AMBIENTE

IMPLICAÇÕES SOCIO-EDUCACIONAIS PARA O DESENVOLVIMENTO SUSTENTÁVEL A PARTIR DE MODELOS MENTAIS DE REPRESENTAÇÃO AMBIENTAL

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ABSTRACT: This study's overriding aim is to provide an understanding of the models of perception involving the term Environment, with a view to discovering the types of models that exist in people's minds and the nature of the mechanisms required to advance toward sustainability through Environmental Education. An interpretative and inferential analysis has been conducted. Each individual in a total sample of 351 people has used a drawing to depict the concept they have of the term environment. The drawings have been studied to reveal the absence or presence of the features corresponding to 16 categories established through a data collection matrix. The results have provided six representative models. We conclude that for the majority of the population the term environment is mainly biological and includes natural aspects, while for a significantly lower percentage it is a term that incorporates biotic, social and technological aspects. These conclusions suggest that Environmental education should go beyond the ecological and aesthetic aspects and principles specific to an environmentalist and/or naturalist perspective of the environment, seeking also social and cultural approaches, informed by human beings' development and life requirements.

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<p>PALABRAS CLAVE: desarrollo sostenible Educación Ambiental sistemas socioambientales modelos mentales de representación lenguaje pictórico</p>	<p>RESUMEN: El objetivo de este estudio es conocer los modelos mentales de percepción sobre el término “medio ambiente”, para comprobar qué tipo de modelos existen en la mentalidad de los sujetos y cuáles deben ser los mecanismos para avanzar hacia la sostenibilidad a través de la educación ambiental. La metodología seguida ha consistido en un análisis de contenido interpretativo e inferencial. La prueba ha consistido en que cada individuo plasmará en un dibujo el concepto que tiene sobre el término de “medio ambiente”, en una muestra de 351 individuos, verificando la ausencia o presencia de los elementos correspondientes a las 16 categorías establecidas a través de una matriz de recogida de datos. Los resultados arrojan 6 modelos representativos del “medio ambiente”. Las principales conclusiones indican que para la mayoría de la población “medio ambiente” es un término principalmente biológico, que integra aspectos naturales, y para un porcentaje significativamente menor es un término que integra los aspectos biótico, social y tecnológico del mismo. Estas conclusiones sugieren una Educación Ambiental que debe ir más allá de principios y aspectos ecológicos y estéticos propios de una perspectiva ambientalista y/o naturalista del “medio ambiente”, buscando enfoques también sociales y culturales, por imperativo propio del desarrollo y por necesidad vital del ser humano.</p>
<p>PALAVRAS-CHAVE: desenvolvimento sustentável Educação Ambiental sistemas socioambientais modelos mentais de representação linguagem pictórica</p>	<p>RESUMO: O objetivo deste estudo é compreender a percepção modelos do termo “ambiente” para ver que tipo de modelos existem nas mentes dos sujeitos e quais devem ser os mecanismos para se mover em direção à sustentabilidade por meio da educação ambiental. A metodologia seguida consistiu em uma análise de conteúdo interpretativo e inferencial. O teste tem sido a de que cada indivíduo definido no conceito de um desenho do termo “ambiente” em uma amostra de 351 indivíduos, verificando a presença ou ausência de elementos correspondentes aos 16 categorias estabelecidas através de um matriz de coleta de dados. Os resultados mostram 6 modelos representativos do “ambiente”. Os principais resultados indicam que a maioria da população “ambiente” é essencialmente um termo biológico, integrando recursos naturais, e uma porcentagem significativamente menor é um termo que integra aspectos bióticos, sociais e tecnológicas. Estes resultados sugerem uma Educação Ambiental própria deve ir além dos princípios e aspectos ecológicos e estéticos de uma perspectiva ambiental e / ou naturalista “ambiente” também buscando abordagens sociais e culturais, o auto-desenvolvimento necessidade imperiosa e vital ser humano.</p>

1. Introduction

From a perspective that is not only institutional or political but also academic, the concept of Environmental Education has been constantly evolving ever since it first came into being (Galindo, 2015; Morón-Monge & Morón Monge, 2017). Several theories have underpinned this field of knowledge’s move towards a social and educational intervention (Sepúlveda & Úcar, 2018). It is understood not only as a form of education designed to preserve nature, but also as one that changes our way of thinking, interrelating and behaving, driving a model of development based on ecological balance and social equity (Caride, 2017, Gutiérrez Bastida, 2018). It is a concept that has evolved in step with the ongoing destruction of the environment and the advancing crisis in civilization itself (Stables & Bishop, 2010; Bautista-Cerro, Murga-Monoyo, & Novo, 2019), and that provides us, from its inception, with an approach to the environment and Environmental Education based on the paradigm of complexity (Novo, 2017).

The question is, therefore, whether people’s mentality has evolved in line with the trend that knowledge in Environmental Education has taken; that is to say, the collective imaginary around the concept of “environment”, and the environmental issue is correlated with the advances we have

been making in our ways of doing and thinking about Environmental Education; or, by contrast, the concept of “environment” has been evolving very gradually in people’s mindsets and perceptions and, consequently, in their behaviour regarding the deteriorating environment (Huertas & Corraliza, 2017; Casper & Balgopal, 2018; Levy, Orion, & Leshem, 2018).

This research therefore presents the underlying models of perception of the environment to discover the types of paradigms that exists in people’s mindsets, and which one prevails. Based on the results, we have found that the prevailing model is not linked to reality and current environmental issues. These results hint at where we should channel Environmental Educational processes looking for a responsible social and environmental intervention (Olabe, 2016), with the idea of locating Environmental Education not only from an environmental dimension but also from a social dimension (Perales, 2017), and as a field of social education (Esteban and Amador, 2017).

Studies on the concept of “environment” associated with people’s behaviours have mainly involved observing people’s verbal expressions and conduct regarding specific topics, such as biodiversity (Snaddon, Turner, & Foster, 2008; Martínez, García, & García, 2017), astronomy (Türk, Sener, & Kalkan, 2015), tides (Corrochano,

Gómez-Gonçalves, Sevilla, & Pampín-García , 2017), the greenhouse effect (Shepardson, Choi, Niyogi, & Charusombat, 2011), relationships (Neumann & Hopf, 2012), or general considerations about sustainability (Walshe, 2008; Calafell Subirà, Martínez, & Delgado, 2019). Only a few studies have focused on the way in which students conceptualise the whole (Kalvaitis & Monhardt, 2011; Shepardson, Wee, Priddy, & Harbor, 2007). This last study establishes four mental models among subjects regarding the environment: Model 1, the environment as a place where animals and plants live, a natural habitat; Model 2, the environment as somewhere that sustains life; Model 3, the environment as somewhere impacted and modified by human activity; and Model 4, the environment as a place where animals, plants and human beings live. The prevailing mental model in this research was mental model 1.

Our study's originality is that we focus on the value of pictorial language as a link with the subjects' mental models. We follow the approach adopted by Judson (2011), who contends that mental models are an important way of evaluating students' understanding of a specific system and its component parts when they are represented through a drawing. The study of the mental models of the "environment" through drawings enables us to understand how people conceptualise it as a system, how they understand nature, the interactions between objects, their components, factors, critical issues, and even causal links (Liu & Lin, 2014). In turn, we adopt the approaches of the New Ecological Paradigm and the New Ecological Paradigm Scale for Children -NEP- (Corraliza, Collado, & Bethelmy, 2013; Collado et. al. 2015). We go beyond interpersonal language as a working tool, mediated by the word, which we have generally used to explore human beings' personal and collective imaginary, and we use pictorial language, conscious that little research has been conducted from this perspective (Moseley, Desjean-Perrotta, & Utley, 2010).

All this enables us to bring into play new dialogical rules between human beings and the "environment", contributing the communicational capability that the "environment" itself has, emerging from an individual's creativity when making a drawing (Vivaldi & Salsa, 2017). A drawing, as creative pictorial language, allows including elements of attachment that are evaluative and communicational (Scareli & Da Silva, 2016). This is the best way of reaching conclusions that enable us to overcome the traditional confrontation between nature and culture that has informed the human condition.

2. Theoretical underpinnings

It is widely accepted that people create internal representations, mental models of external reality to give meaning to the world in which they live (Johnson, 1983; Greca & Moreira, 2000). Mental models act as an objective's structural analogue, and enable individuals to form explanations and predictions about that objective. They thus mediate in our reasonings, decision-making, and attitudes towards tasks and related issues (Jones et al., 2011). In other words, reality and knowledge of that reality are closely related processes, internalising reality through a social process.

This study encompasses the basic processes that people develop from the moment they observe the environment through to the way they depict it in a drawing. These processes lead us to people's identity-related, and therefore educational, nature. We analyse the process of perception (imaginary)-signification (meaning/sign)-communication (language), based on the environment's non-objectivity or immutability, as it responds to significant and communicative perceptive conditioners that the individual evaluates, experiences, and encodes (Page, 2016).

Perceiving the environment involves responding to a twin dimensionality. On the one hand, the real, existing, objective environment that everyone sees and is scientifically explained; and on the other, the subjective view, which arises from each individual's perception. It is the environment that is experienced, which gives rise to the existential bases that provide the platform for the organisation of the relationships of awareness with the phenomena perceived. Although the individuals in this sample are not drawing something they can see at that very moment, the resulting image is the outcome of prior perceptive acts that have involved the senses, whose stimuli stored in the imaginary are restated and portrayed in the drawing, selected and defined according to cultural and personal guidelines, with the result being the construction that each individual makes of their own subjective take on the environment (Mattingly, Lutkehaus, & Throop, 2008; Collins, 2016).

A process of a social nature that exceeds a merely psychological treatment, whose capturing of symbols is the result of socialization, thereby involving a social activity, in line with the social nature of human beings (Rickenmann, 2016; Litzner Ordóñez & Rieß, 2019). It is a constructive process of integration, where the social and cultural context has an influence, with it being almost impossible to delimit between what is perceived, the imaginary created, the experience accumulated, and the act of drawing, and therein lies its educational

potential. It implies a process of social construction of reality from the complexity of human beings, from a systemic and integral understanding of their development. The issue lies in establishing the interrelationships between those parts; the solution, the drawing.

It is a complex and dynamic process, in other words, an active one, whose results mediate the action of drawing. Initially, the concept of environment, which is to be found in an individual's imaginary, provides information conveyed by patterns of signals that are not in themselves specific for particular sensorial channels (Beery & Jørgensen, 2018). That concept then illuminates and envelops people, forcing the individual to explore the concept of environment perceived and which persists. Finally, the individual selects or discriminates among all the information in their possession, choosing according to its relevance and validity, which in the majority of cases involves attachments and emotions, a key aspect of this research. The drawing is a metaphor of personal and emotional experiences, according to emerging pedagogical methodology (Montanero, 2019), in which there are aspects that can be analysed, such as their aesthetic and technical nature, colour, the shapes and lines translated and fixed in people's minds, improving the capacity for introspection, and combining cognitive, motor and emotional processes (Sammut et al., 2015).

The drawing, therefore, not only has dimensions that express features or components of the environment, but also dimensions that characterize the emotional experience, which explain how the environment is experienced and the impact that an environmental setting or its more salient facets have on an individual's emotions expressed in a drawing, which are the basis of their development (Galindo & Corraliza, 2012).

Perception and the ensuing imaginary are followed by signification, the meaning. Each one of us in our own imaginaries always has different areas for gardens, fields, skies, landscapes, factories, village squares, and paths through which we perceive numerous settings. There is room for objects, subjects, places and times associated with the environment that we have perceived beforehand and still perceive, which we use and occupy in our everyday lives. It is precisely the meanings we assign to those areas that act as bridge between the imaginary and language, between perception and communication, between development and behaviour. The environment does not exist in absolute terms, but instead possesses the qualities and meanings that people confer upon it, and which may and should be translated into Environmental Educational terms (Garrido, 2014).

We do not therefore accept a single sense or meaning for the environment, as it has been shown that not everyone living in the same place within an analogous setting experiences the same feelings, nor does so with the same intensity toward their shared environment and in which they develop (Bethelmy, 2012). Further still, the environment and the meanings it conjures up are not isolated processes, but instead they are related to others, not always controlled, nor even perceived, but which have a significant bearing on people's lives, and therefore on the Environmental Educational approaches we want to make (Cosette, 2015). We therefore understand the environment to be a complex system of symbols and meanings. The fact the environment represents realities that people have culturized and imbued with signification means that the acts of receiving and transmitting meanings, the respective contextual sources and the individuals themselves, are part of a logic of meaning, and may therefore be investigated through drawing. (Valsiner 2014).

Today's reality is the outcome of a time in which symbols, charged with history, which give full meaning to the environment, are defined by a swiftness that makes them pass by in quick succession before people's lives, without having the time to reveal their meaning. We need language, communication, to understand it in all its expression. We have to make way for the language provided by drawing to move from the background to the forefront in the perception we have of the environment and mediates our development (Aparicio, 2015).

On the one hand, every educational process is a communicational process and on the other hand, the meanings concealed behind the concept of environment acquire their ultimate sense in the communicational link established between the individual and the environment through drawing (Milstein, Pileggi & Morgan, 2017). From the moment in which we use meaning as a bridge between perception and communication, we break with the traditional understanding of language as being exclusively verbal, and we propose a broader universe of communication, following the model of the Palo Alto School (Rizo, 2011).

Drawing is a system of representation that uses a non-grammatical artistic-visual language. Yet it is not a distorted image, but instead an individual's communicative expression regarding a perceptive and significative framework on the environment. What matters in this case is to decode the communicative process or assemblage, as behind it lies knowledge, because the drawing, as a means of expression and language, enables us to position ourselves in a certain way toward the

environment. Drawing is, in a word, a discourse, over and above its linguistic connotation, and located in the enclaves of visual grammar associated with more anthropological and educational knowledge than literary, which is learnt from everyday experience, superseding a normative grammar (Decuyper & Simons, 2016). They involve a connotational discourse and a language, with an extremely interesting educational richness, through the contribution the semiology of drawing and visual language makes to the construction of identity (Acaso, 2012).

Drawing is, therefore, discourse; it is language, identity and education. The environment, depicted in drawings, and over and above its functional, informative, persuasive, and grandiloquent expression, is language and education. Beyond communication considered in an instrumental manner as an interpersonal relationship, insufficient for an Environmental Education, and disproportionate for the inclusion of a sustainable culture (Jordan & Kristjánsson, 2017), we defend that communicational premise contained in the drawing, based on its internal symbolism and iconology, which permits expressing, more holistically and realistically, an individual's identifying features from their understanding of the environment. The drawing allows overcoming the mere relationship between the individual and the environment and incorporating the link that may or may not have been established, as there is a shift from meaning to statement, and from the latter to language (Otxotorena, 2016).

In short, beyond the exclusively didactic approaches of Environmental Education, where drawing is simply a supplementary material, we present a semiotic-communicative-educational correlation in which drawing is a social outcome. Together with the material, we integrate the social, providing scope for meanings, emotions, language, communication and, above all, values.

3. Method

3.1. Objective

This study's overriding interest seeks, on the one hand, to identify models of mental representation that bring together common perceptive patterns on the term 'Environment' over the past 20 years, as well as the majority view, and on the other, to explore the different perceptions of the concept among the study's target population. This will enable us to discover whether that social imaginary coincides with the issues and demands of the complex movement of Environmental Education.

3.2. Sample

The cohort consists of 351 Spanish individuals. By age groups, it contains 227 pupils from compulsory secondary education (aged 12-16) (62%), and 124 adults who attended to environmental training activities (aged 18-59) (38%). By sexes, the pupils record a more balanced distribution, whereas there is an overrepresentation of women among the adults. Concerning the geographical variable, the pupils come from several Spanish regions, with 70% living in rural areas and 30% in urban areas (according to rurality criteria of Spanish Institute of Statistics), while the provenance among the adults is more disperse, hailing from all over Spain.

Non-probability convenience sampling has been used because of its operational ease and low cost. This involved contacting several schools, as well as organisations and associations that provide instruction in environmental matters. In the case of students, the criterion of inclusion, sample, time, condition of students, theme, inclusion, interest, environmental issues, materialized through the completion of training courses.

3.3. Research design

It is a naturalistic design for gathering graphic information on the perception a group of individuals have of the concept 'Environment' of the concept "environment" of the selected sample to perform a subsequent content analysis. Each member of the cohort was required to do so on an individual basis, with no conferring to avoid contaminations and influences, thereby safeguarding each participant's own particular vision. The venues for the assay were different classrooms used for teaching purposes; in no case did they involve natural settings. The test of instruction was the same for the two age groups and took place over 20 years: between 1998 and 2017. The process followed is similar to the protocol to analyse drawings on ecosystems described in Dentzau and Martínez (2016), also directed at the improvement of Environmental Education.

The decision was made to limit the assay to free drawing, considered a psychopedagogical index revealing aspects such as the evaluation of mental level, of the relationships established with the environment, and because of its possibilities as a means of communication.

No time limit was set for the assay, so as to enable each individual to express themselves fully in their own personal way. The working atmosphere was peaceful and relaxed in rooms set aside for the purpose. Despite the fact there was no time

limit, none of the assays held lasted more than 17 minutes.

This interpretive and inferential study has involved a series of data collection phases to determine and analyse the mental models under study.

a. Definition of types and categories of analysis

The initial phase involved a first direct perusal of all the drawings presented in order to gather preliminary information on the material to be analysed, followed by successive and more systemized analyses to identify each and every one of the expressive devices used. In view of their considerable number, they were grouped and agreed into categories and coders to facilitate their subsequent analysis and representation, at the same time as a distribution was made among the three components of Environment: Biotic, Technological and Sociological, as shown in table 1. The research team, in successive phases, dined, on one hand what was included in each category, as well as each typology (validity); and, on the other hand, it was controlled the frequency of how consistently do equally-trained coders classify the data in similar ways (reliability).

Table 1. Conceptual classification	
COMPONENT	CATEGORIES
BIOTIC	Trees
	Mountains
	Water
	Flora: Bushes Grass Pastures
	Fauna: Mammals Birds Reptiles Fish Amphibia Insects Other invertebrates
	Sun
	Clouds
	Biospheres
TECHNOLOGICAL	People working in the countryside
	Vehicles
	Livestock: Cattle Poultry Sheep Horses Household pets
	Contamination: Atmospheric Water Waste
	Renewable energies: Solar Wind
SOCIOLOGICAL	Leisure: Hiking Biking Other sports
	Constructions
	Skips: Paper Glass Plastic Rubbish Bins

Source: prepared by the authors.

All the drawings presented enabled us to identify six models that correspond to the different ways of mental models of environment: Scenic, Bucolic, Metaphoric, Contrastive, Conceptual and Biospheric. Each one of them shares similar meanings (Montiel, 2016), and a series of descriptive criteria were defined within each one in order to subsequently classify the 351 drawings and ensure some degree of uniformity within each category that would differentiate it from the others (Guerrero et al., 2016). The results section includes the description of each of them.

b. Quantification of frequencies.

A data collection matrix was used to verify the absence or presence of all the features corresponding to the 16 categories established. In addition, the data were broken down according to the two age groups involved, with the aim being to infer the potential existence of significant relationships between the two age groups and the six types of work (mental models), as well as other possible correlations.

c. Data processing and interpretation.

Given the nature of the data obtained, a twin analysis has been conducted that combines a qualitative and quantitative methodology. The

quantitative approach has involved a descriptive-correlational analysis using SPSS 24.0 statistical software.

In parallel, the information recorded was converted for processing in the Gephi 0.9.1 software program, which generates figures that display the frequency of each category (or node), highlighting those with the greatest weight. The lines graphically depict the unions of pairs of categories, showing the intensity of the relationships between them, and their colour is the age group to which they belong (blue: overall population; purple: secondary pupils, and orange: adult population). In other words, they reflect the frequency of subjects that when they refer to one category also refer to the other. The thickness and intensity of the colour indicate the greater or lesser repetition of that correlation (previously recorded in the corresponding data matrices). In turn, each category's node has the colour of the component to which it belongs (biotic, sociological or technological), which shows the weight each one of them has for each one of the categories and ages analysed.

4. Results

In an initial approach to the study purpose, Graph 1 shows the distribution of the 351 drawings analysed in the six types identified.

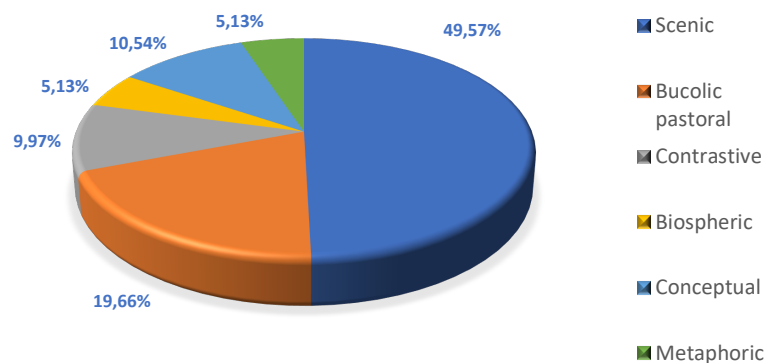


Figure 1. Distribution by types of environment.

The data show that almost half the sample presents a drawing that follows the Scenic model, followed by 19% that opt for the Bucolic-pastoral approach. Both models present an image of idyllic, natural settings, with no human intervention in the Scenic case, but with it in the Bucolic depictions, yet always in a responsible manner and integrated with nature. These are followed in terms of frequency by the Conceptual and Contrastive models, with each one accounting for around 10% of the total sample; and finally, there are the Biospheric and Metaphoric models, recording an identical share of just over 5% each.

This initial overall snapshot contextualizes and inflates the natural features associated with idyllic images when depicting the concept of Environment, in detriment to other types.

By age groups, (figure 2) adults record a more equative distribution among the different models, and one that is therefore less stereotyped and restricted, whereas the secondary pupils (Graph 3) clearly reveal a preference for the Scenic and Bucolic-pastoral models, which taken together for this group account for 81.94% of the total, and reinforce the notion of an idealized image associated with nature and free from human intervention.

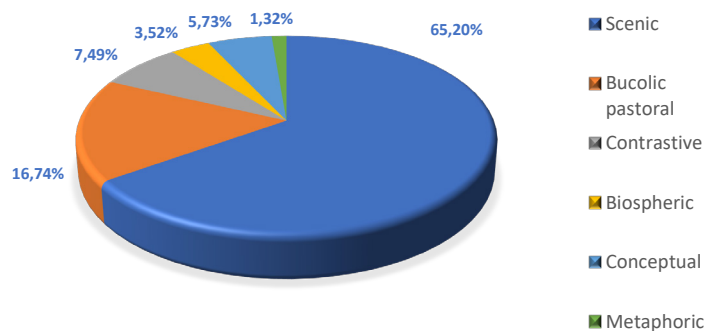


Figure 2. Distribution by types. Secondary pupils.

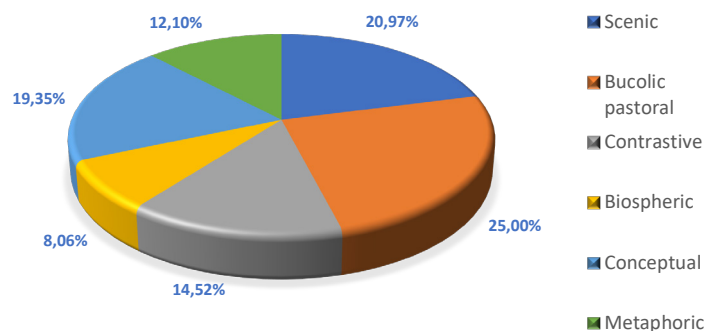


Figure 3. Distribution by types. Adult population.

There now follows a separate analysis of each mental model, defining their descriptors, the criteria for the inclusion of the drawings in each of them and the results obtained for the two age groups studied.

4.1. Scenic model

This model groups drawings in which the entire picture shows a landscape, with the bulk of its features being of natural origin. The most repeated patterns fall into three categories: Mountains, Water and Flora in an idyllic view of natural landscapes, their good state of conservation and the absence of any traces of human activity and its consequences.



Image 1. Drawing classified as Scenic.

In short, these are depictions of nature in its purest state, with extremely well-preserved landscapes and no traces of human activity. For almost half the study sample, environment does not involve sociological or technological factors.

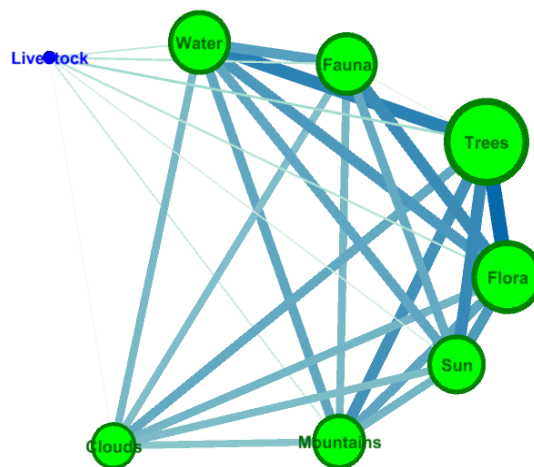


Figure 4. Scenic model. Total population.

The graphic depiction of the components of the Scenic model, as well as the size of their nodes, provide a highly convincing image of the link between this type and natural features. Of the eight categories that appear in this model, seven are biotic. The sociological component is completely absent, and the technological one has only one exponent, namely, livestock, albeit with a much lower frequency. In terms of natural

features, Trees is the most repeated category, and figure 1 shows that this category is closely correlated to the other features that follow it in terms of frequency: Flora, Water, Sun and Mountains. They are all classic features that correspond to the first pictures of the landscape that children tend to draw. With the exception of Livestock, all the other features are closely interconnected with one another. The image also shows that there is a fairly uniform view in which all the categories of the biotic component (except the biospheres that in themselves constitute a model) appear in most of the drawings and, what's more, they do so with a very strong interrelationship.

The secondary pupils lean more towards this type. The relationships among the adult population are more evenly balanced between the sunny elements and have stronger interrelationships.

4.2. Bucolic-Pastoral model



Image 2. Drawing classified as Bucolic-Pastoral.

As regards the previous model, in some of the drawings in which natural features prevail, human presence appeared as a differentiating aspect, always in a manner that was respectful toward nature through sustainable activities, with livestock involved in extensive grazing or small dwellings integrated within the landscape, among other features.

In this type, therefore, humans do not have any negative impact nor cause environmental damage, being depicted in a positive light and at one with nature. The drawings are associated with rural settings, sustainable development and a biocentric image of society, respectful of the environment and in which humans are just another species within the system.

The following figure reveals differences between the Bucolic and Scenic models.

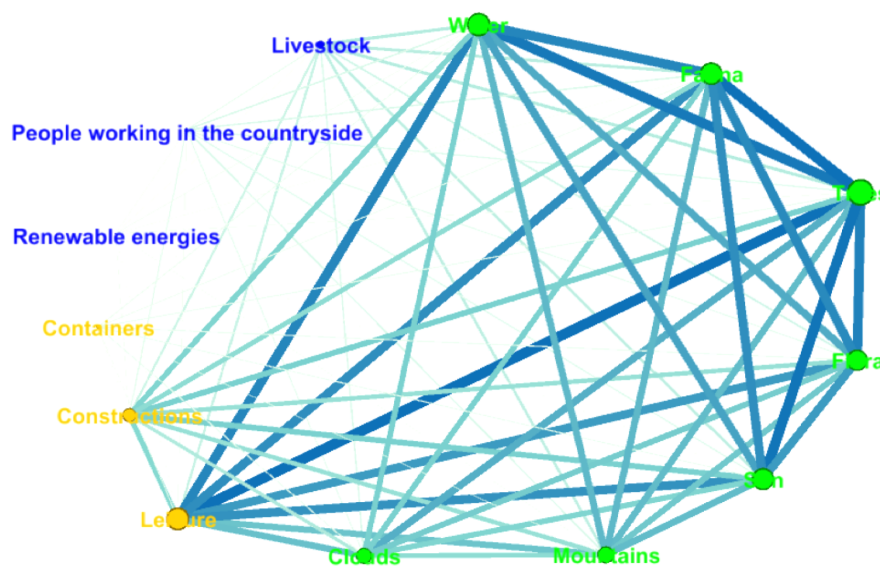


Figure 5. Bucolic-Pastoral model. Total population.

A highlight in this type is the appearance of new categories of the sociological and technological components, providing a more balanced image among these three aspects of the environment. Nevertheless, the biotic categories continue to be more numerous, with the exception of the category of Leisure, which is closely interrelated with the natural categories. Constructions come next in importance within the sociological framework,

and they also correlate more with natural aspects than with economic ones, reinforcing the notion of human activity that respects the environment and is in tune with it. Concerning the Scenic model, we find added categories: Skips, Renewable Energies, and People working in the countryside, with them all sharing the intention of making a sustainable and respectful use of the environment.

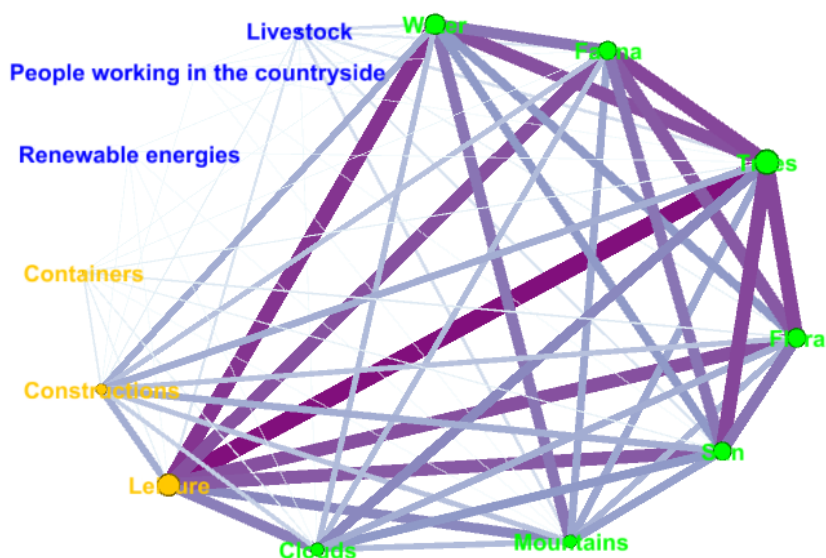


Figure 6. Bucolic-Pastoral model. Secondary pupils.

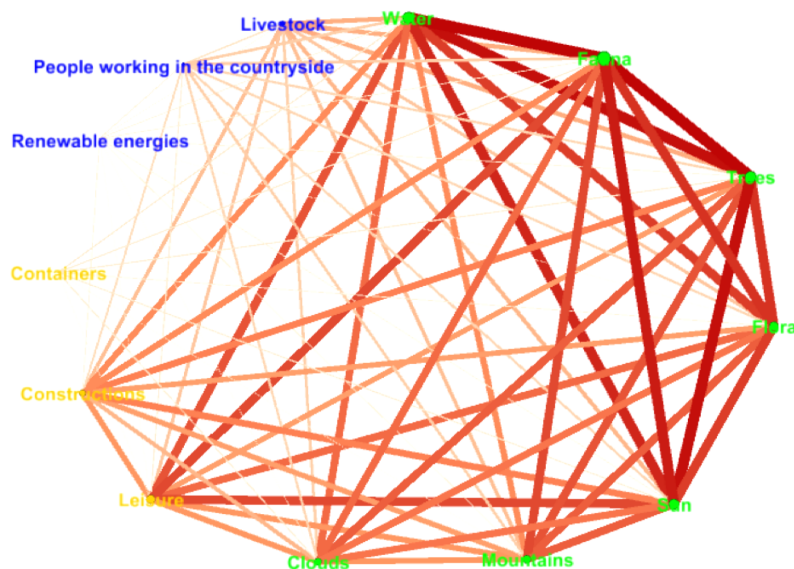


Figure 7. Bucolic-Pastoral model. Adult population.

The categories are the same for each age group, although economic features are more important for the adult population than for the pupils.

Secondary pupils reveal that Leisure is the main category, together with strong relationships

with natural aspects. By contrast, and different to the older age group, Renewable energies and People working in the countryside are far less prominent (even though it is a larger sample group).

In sum, this category has a wider variety of features and a greater presence of Technological and Sociological components, which are almost non-existent in the Scenic model. The adult population has a more rounded graph with greater balance across the features, while the pupils polarize this model between Leisure and the natural categories.

4.3. Contrastive model

The drawings of almost 10% of the sample have contrasted two aspects of the environment. On the one hand, once again a scenic depiction; on the other, an urban landscape dominated by the environmental damage caused by human activity. In most cases, it involves the contamination caused by the atmospheric emission of gases from means of transport, central heating and industry. The scenic part is full of bright colours, whereas shades of grey colour the urban landscape. Both visions tend to occupy the same amount of space within each drawing.



Image 3. Drawing classified as Contrastive.

This way of interpreting the environment therefore comprises the social factor, addressing today's environmental issues and the biotic factor, reflecting the idealism of working toward a sustainable and healthy world.

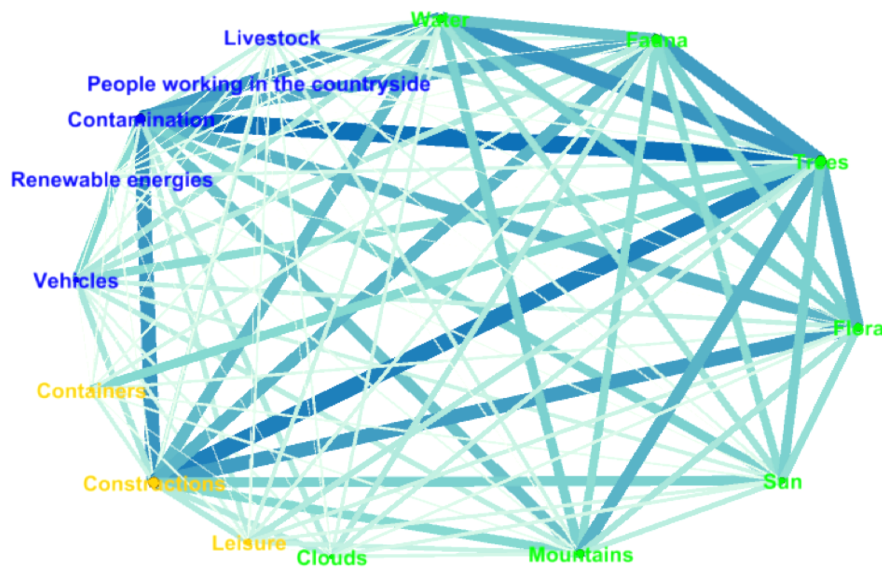


Figure 8. Contrastive model. Total population.

Figure 8 reveals significant differences with the two previous models. For the first time, natural features are displaced by the appearance of Constructions (sociological field) and Contamination (technological field). Indeed, a triangle appears that is formed by the darker coloured lines that encompass the vertices of Contamination, Trees and Constructions (with the inclusion of the three spheres of the environment). It is therefore a more complete type, which reflects a greater

level of depth and understanding of the environment as a complex setting.

In terms of age groups, fewer pupils have chosen this model compared to the adult population, and when they have done so, they provide a more polarized conceptual view, with fewer interrelations across the different features. Constructions stand out among the adult population as a more significant feature, and one linked to Contamination, and Vehicles.

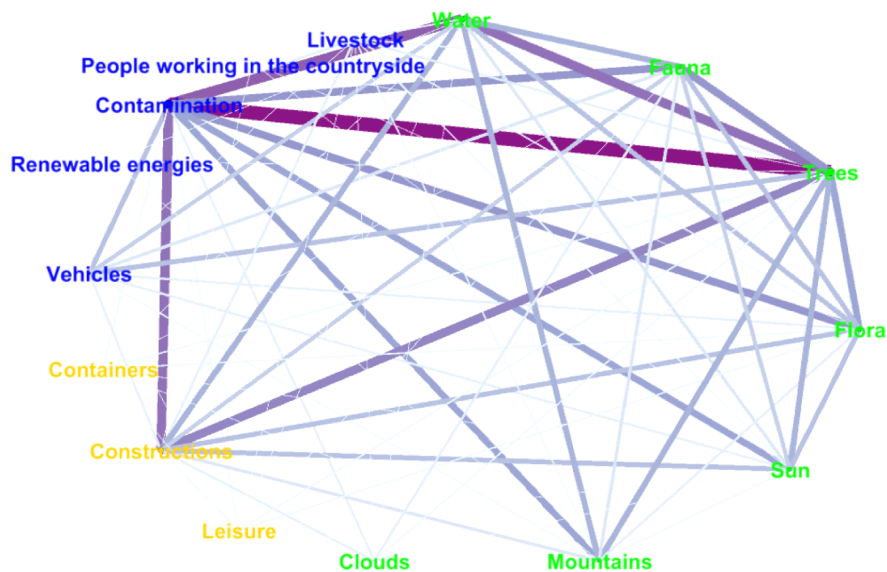


Figure 9. Contrastive model. Secondary pupils

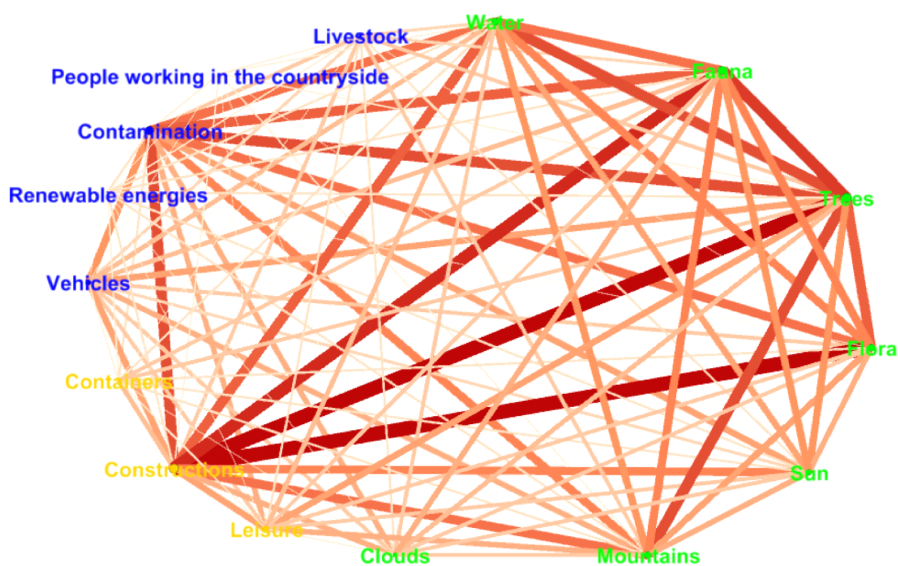


Figure 10. Contrastive model. Adult population.

4.4. Conceptual model

This category consists of the drawings that include natural features, human activity (of a positive and/or negative nature) and biospheres. Nevertheless, they are not presented in isolation, but instead interconnected with arrows or explanatory indicators with the appearance of some symbols and text. They are generally drawn in black and white, with long, bold strokes, with a range of geometrical shapes, albeit with a prevalence of arrows, squares and circles.



Image 4. Drawing classified as Conceptual.

Within this type, environment is a broad concept, with an integrating view of its three factors: biotic, social and technological, with full

awareness of the planet's social systems and the interrelations between them, as well as of global imbalances.

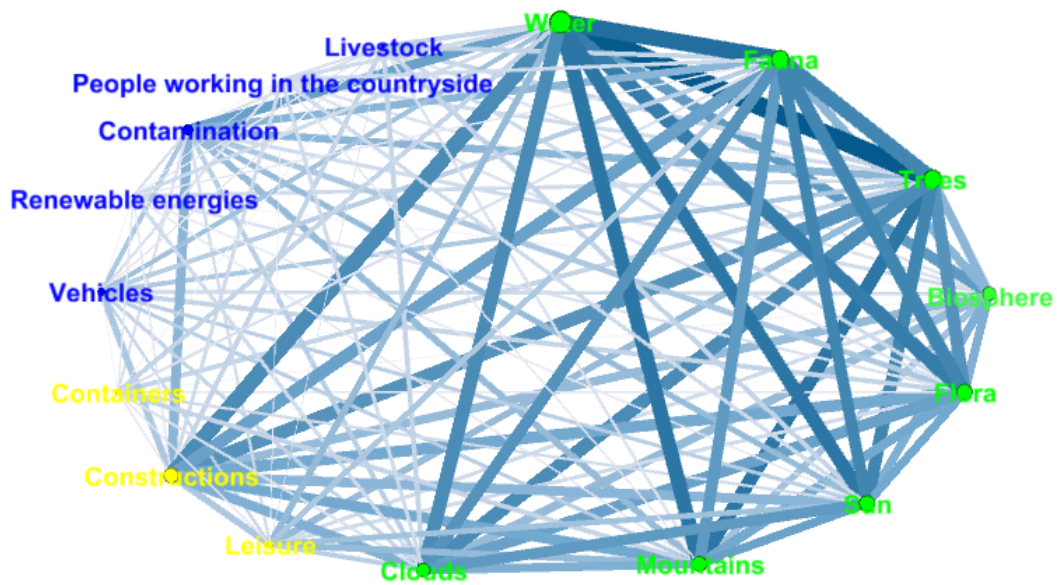


Figure 11. Conceptual model. Total population.

Figure 11 shows how natural components prevail in tandem with Constructions and Contamination. This last category is the one that most

clearly reflects the technological sphere. Another distinctive aspect in this model is the inclusion of Biospheres.

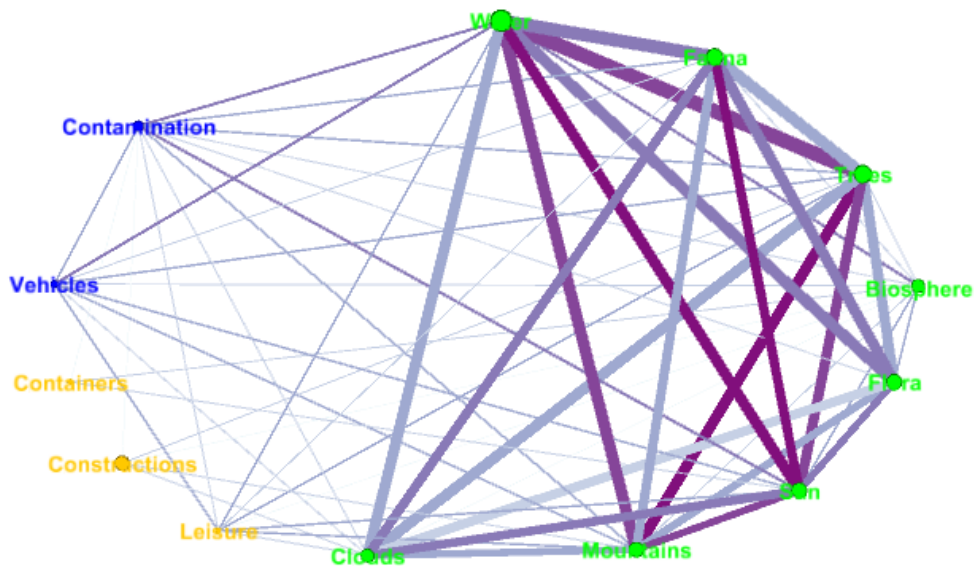


Figure 12. Conceptual model. Secondary pupils.

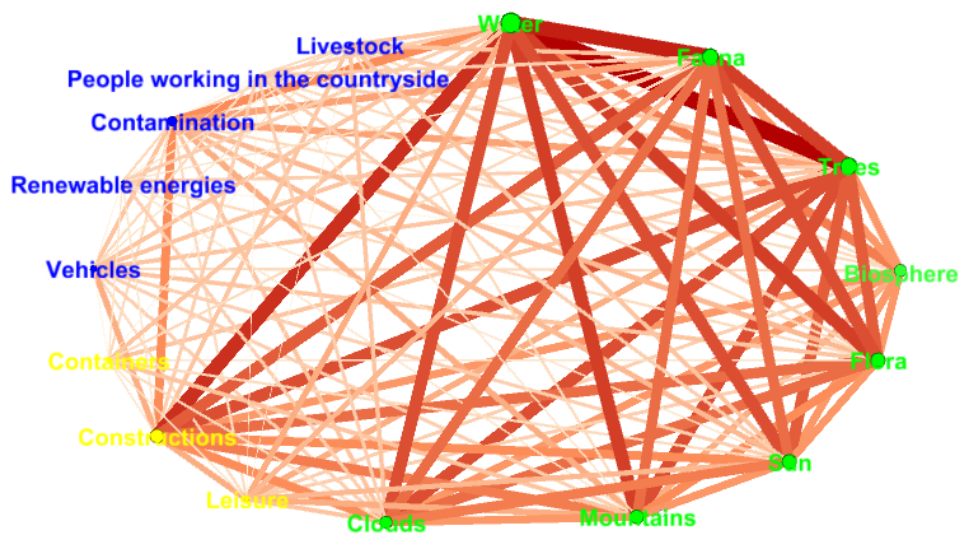


Figure 13. Conceptual model. Adult population.

Figure 11 (total population) is similar to that plotted with the data for the adult population (figure 13), but different to the one for the pupils (figure 12), who do not include technological features such as Livestock, People working in the countryside, and Renewable Energies, giving hardly any importance to Constructions in detriment to Contamination and Vehicles.

A highlight in the case of secondary pupils is the appearance of explanations (76.92%) and catchphrases (38.46%), probably influenced by the awareness campaigns directed at them, as well as by the educational system itself.

4.5. Metaphoric model

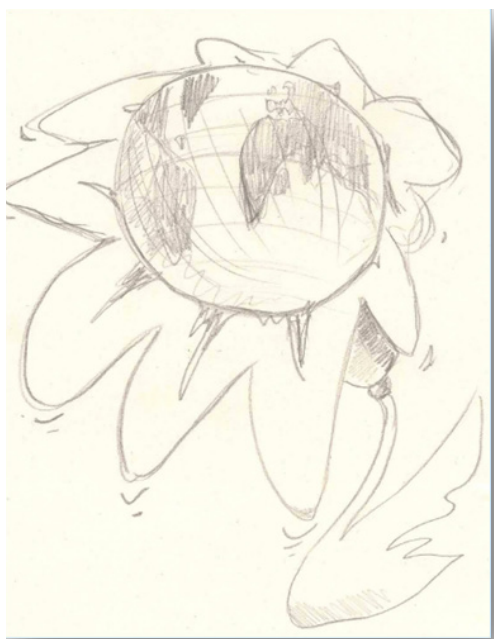


Image 5. Drawing classified as Metaphoric.

This model entails a higher level of complexity and interpretation. It contains both natural and anthropic features. The drawings may not involve a linear reading, but instead prompt a Metaphoric interpretation, revealing greater depth.

Compared to the static nature that prevails in all the other categories, in this case there is a search for movement and a dynamising intent. On this occasion, each drawing is unique and conveys a differentiated idea. In some cases, they could even be seen a logo to be used in environmental outreach programmes.

4.6. Biospheric model

This category includes all the drawings whose core and largest feature is a biosphere. Most of them depict the Earth, with the land-water proportion reflecting reality and showing all the continents. The drawings include concepts such as planet, the North-South socioeconomic divide, but always from a European perspective of the world (Europe in the geographic centre - right). In short, this category provides a holistic and global view, albeit a Eurocentric one.

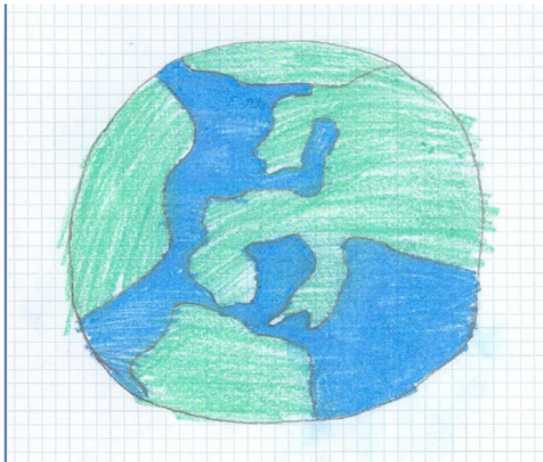


Image 6. Drawing classified as Biospheric.

In this case, there are only three graphic features: Land, Water and Atmosphere. The first two appear in all the drawings in this type, while Atmosphere is depicted by 25% of the pupils, and by 40% of the adult population whose drawings followed this model.

5. Conclusions, limitations and outlook

Based on a study and analysis of the results obtained, it may be concluded that certain mental models are repeated throughout the entire sample that summarize the views on the concept of environment. All the aspects considered beforehand led to the classification, repeated throughout the sample, of six representative models, all with internal consistency, and with greater or lesser sophistication in terms of content, approaches and ideas reflected.

Following the definition of the models, we may likewise conclude that the depiction of the term environment is associated with nature and its presence in a high percentage of cases, prevailing largely among secondary pupils, considering that their way of thinking has not yet reached full maturity for assimilating the broad meaning the concept encapsulates. Adults have a more holistic understanding of the term environment, and their drawings are more complete, with culturally and socially more developed models. This confirms that the age difference between these two study groups is a decisive variable in terms of the knowledge acquired at school and in later life experiences that provide the necessary understanding to develop a view of society and the environment around us.

Furthermore, we find that human beings appear only in a small percentage of the drawings and tend to be depicted in a bucolic manner and enjoying themselves in a manner that respects the

environment (biking, gardening, hiking, etc.). This suggests that human activity is not to blame for the environmental issues our planet currently faces, although it is considered a stakeholder within the medium and the concept of environment. This is a double-edged conclusion: negative when considering that human beings do not connote responsibility toward environmental-social issues, and positive when considering it has a biocentric vision of the medium's model of social-ecological structure. In addition, there is a highly significant economicist vision of the sustainable gain from natural resources, with a greater presence of renewable energies, livestock, agriculture, etc., by the more mature segment of the population.

In short, we may conclude that the concept of environment is not fully assimilated within society with its three component aspects, but instead, and on a general basis, the population considers only the Scenic-biological aspect, whereby a very low percentage of the population consider social and technological aspects to be part of the term environment. This clearly points to the need for those responsible for educating younger minds to provide an Environmental Education that not only considers the medium's natural and biotic aspects, but also the social and environmental issues involved in everyday habits and the systems society develops, such as the generation of waste in daily life, the types of contamination that affect the medium, globalized systems that are causing climate change, etc.

The study has some limitations. Convenience sampling implies that the data provide an approach to the reality studied that is not representative, and therefore no statistical assertions may be made. On the other hand, the sample group of the adult population is too large a group in age issues and, for future replicas of the study, it would be convenient to define its inclusion criteria in more detail. It would be really interesting in future research to compare the environmental perceptions between people living on the coast and those inland, those on plains and in the mountains, as well as other variables (living in rural or urban habitats, level of education, different countries). Moreover, the use of inter-rater codes implies data are subjectively classified into categories.

Another limitation is that the drawings have been compiled over a very long period, two decades, with no evolution between the beginning of the investigation and the final stage. However, no systematic analysis has been conducted to determine whether, however minimal, there has been an evolution of mental conceptions and/or their distribution in the two age groups analysed.

The data obtained and the conclusions, are necessary for creating future tools that will further the process of awareness and education, geared toward sustainable development. Conclusions that lead us to call for an Environmental Education that overcomes its understanding as simply and exclusively a resource, content or ethical code. Environmental Education should go beyond the ecological and aesthetic aspects and principles specific to an environmentalist and/or naturalist perspective of the environment, seeking also social and cultural approaches, informed by human

beings' development and life requirements. We will thus improve the way people perceive the environment and undertake thought processes and educational-environmental actions that are more consistent with the vision we have of it. An Environmental Education explained through social praxis and configured through the conjunction of knowledge, thought and action, giving the environment the importance it requires, insofar as an agent of education. It is not a question of inventing anything new, but instead of reinterpreting the educational capital that is present in the environment itself.

Note

- ¹ The decision has been made not to include trees within the category of Flora, and give them their own category, as the drawings clearly distinguish between wooded areas and patches shaded in green to depict pastures, sometimes with small bushes. Likewise, Livestock was separated from all the other categories under Fauna because its meaning in the drawings was clearly economic and not natural.

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