TYPES OF INTELLIGENCE. THE ECOLOGICAL INTELLIGENCE AND SUSTAINABILITY

Lucia Ovidia VREJA[1], Sergiu BĂLAN[2]
[1] Ph.D., Associate Professor, The Bucharest University of Economic Studies,
email: lucia.vreja@man.ase.ro,
[2] Ph.D., Associate Professor, The Bucharest University of Economic Studies,
email: sergiu.balan@man.ase.ro

Abstract

The concept of intelligence is strongly debated among theoreticians, one of the main difficulties being that of deciding whether intelligence is a single- or multi-dimensional human ability. Regardless of its specific meaning or content, the concept of intelligence implies the idea of acquiring knowledge and understanding or making sense of what is known in order to solve problems. Among the various type of intelligence, one of the most important in the present world is certainly the naturalistic or ecological intelligence, broadly viewed as the ability to understand the vital connections between humans and nature, to become aware of the human impacts on the environment and their consequences, as well as to find solutions for preserving both humans and nature in a harmonious relationship. Reviewing the relevant literature regarding the scientific definitions and meaning of intelligence, the current paper argues that ecological intelligence is essential for sustainability.

Keywords: Sustainability, intelligence, naturalistic intelligence, ecological intelligence, ecological thinking, ecological literacy.

Introduction

The American developmental psychologist Howard Gardner tried in his 1983 book, *Frames of Mind: The Theory of Multiple Intelligences* to find out if general intelligence is a single, unique and undivided human ability, or if there are many different intelligences. Gardener's answer was his now famous 'theory of multiple intelligences', where he included no less than seven, and later, eight types: linguistic, logical-mathematical, musical, spatial, bodily/kinesthetic, interpersonal, intrapersonal, and naturalistic intelligence. The last one, the naturalistic or, as psychologist Daniel Goleman calls it, the ecological intelligence, is of interest for our discussion, as it constitutes the main premise for building a more conscious and sustainability-oriented human thinking and way of life.

The current paper is an attempt to define ecological intelligence and identify its role in promoting a responsible and sustainable way of life. Starting from the premise that sustainability or the goal of becoming sustainable cannot be achieved in the absence of a certain type of attitude towards the environment, including here a cognitive, an emotional and a behavioural dimension, the paper begins by identifying the specific content of the ecological intelligence and continues with exposing its importance in sharpening the understanding of the human-nature relation, as well as the role of education in promoting this type of intelligence.

1. Theoretical Framework

Human intelligence and its measurement became one of the central problems of psychology ever since the publication in 1869 of Francis Galton's work *Hereditary Genius*. In this book, Galton, who was no other than Charles Darwin's cousin, based on some rather unconvincing experimental evidence, attempted to prove that people's natural intellectual abilities differ notably. According to the historians of psychometrics, the first successful attempt to devise a working test for intelligence assessment belongs to the French psychologist Alfred Binet, who needed a method of selecting those children from elementary school who needed special education. Together with his collaborator Theodore Simon, he advanced in an article published in 1908, *Le développement de l'intelligence chez les enfants*, the idea of the intelligence quotient, or IQ, defined as a number resulted from the division of mental age to the chronological age (Mackintosh, 2011, pp. 4-5).

If for Binet intelligence seemed to involve some more or less separate and independent faculties, the English psychologist Charles Edward Spearman argued against the division of the mind into distinct and individual functions, such as memory, attention, learning and so on. He believed that we should study mind's operations as a whole, and therefore advanced his "Two Factor" theory, namely that each test of a separate mental ability measures both that specific factor for which it was designed, but also, more or less, a general intelligence factor that must be somehow underlining all the particular abilities tested. This was the birth of the famous G-Factor, the concept used thereafter for arguing that all forms of intellectual achievement have their source in this monolithic and general ability. According to Spearman, the G-Factor "means a particular quantity derived from statistical operations. Under certain conditions the score of a person at a mental test can be divided into two factors, one of which is always the same in all tests, whereas the other varies from one test to another; the former is called the general factor or G, while the other is called the specific factor" (Deary et al., 2008).

These ideas were the main basis for the later developments during the behaviourist and psychometric eras in the twentieth century psychology, when the common-sense and self-evident beliefs were that intelligence is unitary, undivided and mostly inherited. At the same time, it was considered that humans are born without any mental contents (the 'blank-slate' theory, originated back in Aristotle's work *De Anima* and reformulated as the 'white-paper' theory by John Locke in his book from 1690, *An Essay Concerning Human Understanding*) and can be made, trough appropriate conceived training, to learn and do anything. Nowadays however, the tide has reversed, and the majority of psychologists no longer take the G-Factor hypothesis as granted, but believe that: the mind is not a blank slate at birth, but 'pre-wired', i.e. has some innate content; there are various or a multitude of intelligences, each one with its own strengths and weaknesses and quite independent of each other; it is extremely difficult to teach ideas and behaviours that contradict the innate contents of the mind.

2. Different Types of Intelligence

All the spectacular developments in defining intelligence have one of their main sources in the life and work of American developmental psychologist and Professor of Cognition and Education at Harvard University, Howard Gardner, considered to be a real paradigm-shifter in psychology. Gardner challenged the main ideas of the dominant view on human intelligence: he argued against Piaget's model of cognitive development in successive separate stages and against the idea of intelligence as a single, indivisible ability that has as

source a single G-factor which can be straightforwardly measured using standardized IQ tests, and instead proposed his now famous multiple intelligences theory (Smith, 2002).

As Gardner himself recollects in his 1999 book *Intelligence Reframed: Multiple Intelligences for the 21st Century,* the source of inspiration for his original pluralistic theory were many years of research he was involved in, starting from the end of the 1960s, in two projects: University of Harvard's 'Project Zero', where the objective was to study the cognitive development of children and Boston University's Aphasia Research Center, where he worked with stroke victims who suffered from aphasia (Gardner, 1999, pp. 29-30). The most important consequence of these years was the understanding of the fact that individuals who were studied in the two projects proved to have remarkable achievements in diverse fields, as sports, music, entrepreneurship, chess, politics, and therefore were thought to have special intellectual capacities relevant in these domains that should be considered as separate in the attempt to understand intelligence. In other words, as Gardner put it, "the human mind is better thought of as a series of relatively separate faculties, with only loose and nonpredictable relations with one another, than as a single, all-purpose machine that performs steadily at a certain horsepower, independent of content and context. On an intuitive level, I had embraced the view of the human brain and the human mind that is now called modularity: the view that, over hundreds of thousands of years, the human mind/brain has evolved a number of separate organs or information-processing devices" (Gardner, 1999, p. 32).

Gardner treats intelligence in instrumental terms, believing that it is much more than some static potential, measured with IQ test: it must manifest itself in action as the ability of real problem solving, or otherwise we cannot call it properly intelligence. In his 1983 book *Frames of Mind: The theory of Multiple Intelligences*, he states that intelligence, or in other words, "human intellectual competence must entail a set of skills of problem solving – enabling the individual to *resolve genuine problems or difficulties* that he encounters and, when appropriate, to create an effective product – and must also entail the potential for *finding or creating problems* – thereby laying the groundwork for the acquisition of new knowledge" (Gardner, 2011, pp. 64-65). Two decades later, he offered a more concise and refined definition, including not only the instrumental, but also a cultural point of view: "I now conceptualize an intelligence as a *biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture*" (Gardner, 1999, p. 34). The change of accent is important, because now he admits that intelligence is not something that must be necessarily seen or manifested, but instead it is a potential, that can be activated or not, that will manifest itself or not, depending on a lot of factors and circumstances: opportunities available, personal decisions, cultural values and norms and so on.

On the basis of this definition, Gardner identified several kinds of intelligence, initially seven, and later added a few more. But in order to be able to decide if a certain mental capacity can be considered some separate and autonomous form of intelligence, he had to formulate a system of criteria to be met by any candidate mental faculty. The criteria to be considered when evaluating a 'candidate intelligence' (Gardner, 1999, pp. 36-41; Davis et. al., 2011, p. 487) are the following:

> (1) The potential for isolation. This condition means that a certain mental ability should be visible in some degree of isolation in exceptional groups of people, such as autistic savants, brain damage victims, or prodigies, where individuals should present very high or very low levels of that particular capacity, as compared to their other capacities.

(2) A distinct neural substrate. This means that the neural structure and function of a mental faculty should be different and distinguishable from the others.

(3) A specific trajectory of development, i.e. the different capacities should develop on different paths and at different rates.

(4) A basis in evolutive history, i.e. any specific faculty must have previous variants in ancestor or close relative species and a visible survival value.

(5) Susceptibility to encoding in a symbol system, such as language or pictographic symbols, that encode culturally meaningful information, because the human brain seems to have evolved to work efficiently with such systems.

(6) It should be supported by data from experimental psychometric tests of intelligence.

(7) It should be experimentally distinguishable from other forms of mental ability, in the context of specific tests.

(8) It should be associated with some specific, identifiable mental processes that manage information related to each form of intelligence.

According to these eight criteria, Gardner proposed in his aforementioned book from 1983, *Frames of Mind* seven separate forms of human intelligence: linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal and intrapersonal (Gardner, 2011, pp. 77-292).

The first two of them, linguistic and logical-mathematical, are the abilities usually searched for and valued in school, and therefore have a great contribution to high performance in traditional educational environment and to high scores in classical IQ measurements or other achievement tests. Linguistic intelligence is the ability to use different types of language, written or spoken, with the purpose to express ideas, remember and communicate information or achieve other practical goals. It involves competence in analysing information, decoding the messages and constructing linguistic structures, such as speech acts or written texts, in order to convey own messages or to accomplish other goals that involve communication. Typically, writers, actors, lawyers, politicians, teachers are people with high scores in linguistic intelligence (Gardner, 2011, pp. 77-104; Gardner, 1999, p. 41; Davis et. al., 2011, p. 488).

Logical-mathematical intelligence consist of the ability to detect patterns and relations, analyse problems logically, reason inductively and deductively, find and evaluate proofs, make assessments and calculations, successfully solve mathematical operations and abstract problems and scientifically investigate diverse questions. Usually, scientists, mathematicians and logicians have superior logical-mathematical intelligence (Gardner, 2011, pp. 77-104; Gardner, 1999, p. 42; Davis et. al., 2011, p. 488).

The next three types of intelligence (spatial, musical, bodily-kinesthetic) are also connected to one another, and manifest themselves especially in people involved in the world of arts. Gardner believes that it would not be legitimate to treat linguistic competence as a form of intelligence, but musical ability for example rather as a talent. Musical intelligence, which is believed to be very similar to the linguistic one, consists of the ability in production, remembering, performance, making sense of and appreciation of musical creations understood as patterns of sounds involving qualities such as pitches, tones, rhythms. We should expect to find high scores of this form of intelligence in musicians, performers and composers. Bodily-kinesthetic intelligence represents the potential of using the body or some parts of the body, like the hands, to create products and objects or to solve practical problems.

We should expect to identify a high level of this kind of intelligence in athletes, dancers, actors, but also in craftsmen, mechanics, surgeons, technicians. Spatial intelligence concerns the ability to recognize and operate with patterns and images of spatial relationship, both of wide exterior spaces (important for aircraft pilots, navigators, topographers), but also of confined, restricted, small spaces (specific for architects, sculptors, artists, watchmakers, chess players, designers). Gardner observes that in different cultures spatial intelligence is used in extremely different ways, proving how a single generic biopsychological potential can be employed in domains that have evolved for a spectacular variety of purposes (Gardner, 2011, pp. 105-134, pp. 179-250; Gardner, 1999, pp. 42-43; Davis et. al., 2011, p. 488).

The last two forms of intelligence, interpersonal and intrapersonal, were treated initially by Gardner together, as a single capability, the personal intelligence with its two forms. Afterwards he separated them, mainly because the more recent discoveries in evolutionary psychology proved that interpersonal intelligence has a very long history being found also in other species, while intrapersonal intelligence is a more recent form, specific mainly for human consciousness. Interpersonal intelligence consists of an individual's abilities to comprehend other people's moods, feelings, thoughts, intentions, motivations, desires, and consequently to be able to cooperate effectively with others. It is specific for religious leaders, doctors, psychologists, political leaders, actors, salesmen, teachers and so on and its origins are connected with the person's affective and emotional life. Intrapersonal intelligence, on the other hand, refers to the capacity of self-understanding, to recognize and understand one's own moods, feelings, thoughts, intentions, motivations, desires, and to construct a working model of oneself in order to use it for regulating one's own life (Gardner, 2011, pp. 251-292; Gardner, 1999, p. 43; Davis et. al., 2011, p. 488).

As Gardner himself explicitly stated, this list should be seen from the beginning as a provisional one, and other forms of intelligence were added to it later, as was the case with spiritual intelligence, existential intelligence, and the one that is of special interest to us here, the naturalist (or naturalistic) intelligence. For him, a person with a high score of naturalist intelligence is someone "who demonstrates expertise in recognition and classification of the numerous species – the flora and fauna – of her or his environment" (Gardner, 1998, p. 115; Gardner, 1999, p. 48). In every culture such people are held in high esteem, because they can recognize plants or animals that are notably valuable or extremely dangerous. In the context of cultures which lack formal science, they are the keepers of 'folk taxonomy' and 'folk biology', whereas in literate and scientifically oriented cultures, they become the recognized biologists and taxonomists. One such case is that of the Western culture, where we associate naturalist intelligence with people like naturalists Charles Darwin, Louis Agassiz, Ernst Mayr, Stephen Jay Gould, Edward O. Wilson but also with environmentalists like Rachel Carson. Gardner argues that he came to think about this new kind of intelligence because such individuals cannot be readily classified using the first seven intelligences, and maintains that all the eight criteria aforementioned are successfully met by this new intellectual faculty.

Thus, there are: (1) cases of individuals who are especially gifted in recognizing naturalistic patterns, while others are impaired in this respect; (2) real perspectives of identifying the neural networks of species recognition (not done yet, but definitely possible, because human naturalistic capacity seems very similar to those of other species, and thus it would be possible to confirm which brain regions are active in naturalistic perception); (3) arguments for the existence of a developmental course of the specific abilities on a scale starting from novice and culminating with experts; (4) arguments from evolutionary history of primates and other species for the importance for survival of the ability of an organism to discriminate

among species, to avoid predators and identify its own prey; (5) the various systems of classification of living organisms that exist in every culture and are solid proof of naturalistic intelligence's susceptibility to encoding in a symbol system; (6), (7) experimental tests, such as those of Eleanor Rosch on categorization, that suggested the existence of special and distinct mechanisms of identifying 'natural kinds' by comparison with prototypes; (8) some identifiable mental capacities, such as to understand biological individuals as members of some groups or species, to distinguish between related species and to chart relations among species (Gardner, 1999, pp. 49-52).

However, naturalist intelligence is not limited to taxonomic abilities, as is also make the people who have high scores in this respect to manifest high levels of enthusiasm for being always in close contact with nature, to have high abilities of natural phenomena observation, to show interest in learning about nature and living species, to show theoretical and emotional concern about those kinds of phenomena that affect the ecosystems, such as pollution, deforestation, changes of weather, global warming and so on, and to be interested in finding solutions for the problem of sustainability and sustainable development (Kelly, 2018).

As Gardner himself anticipated, he was not the only one who would try to identify and introduce in classifications new kinds of human intelligence. One of the best-known psychologists who proposed additional intelligences (ranging from moral intelligence to humour intelligence or cooking intelligence) was Daniel Goleman. Though he is best known for his theory concerning emotional intelligence, we are here interested in another form of mental ability directly connected to naturalist intelligence, that Goleman talked about in his book aptly named *The Ecological Intelligence*.

3. Ecological Intelligence and its Role in Sustainability
Ecological intelligence, as defined by the American psychologist Daniel Goleman, refers to the human "ability to adapt to our ecological niche" (Goleman, 2009, p. 93), which implies both the understanding of the organic relation between organisms and their environments or ecosystems, as well as the capacity to acquire cultural information, to learn from experience and to adapt to the environment without harming it. This type of intelligence, different from all the other types of intelligence, deals with the capability of humans to understand that they are part of nature, that their activities influence and even change ecosystems and that survival on the long run means leaving sustainably. Ecological intelligence also implies an "ecological literacy", defined as the ability to "read" and interpret the current environmental concerns and the connections between humans and nature (McCallum, 2008).

Simply speaking, ecological intelligence means, among other things, becoming aware of the fact that our current affluent material world, characterized by a plentiful supply of goods, has not only benefits, but also costs too. At the same time, ecological intelligence means knowing that our daily actions, including what we produce, buy, consume, use and dispose of – the so-called "cradle-to-grave" cycle of a product – have a serious impact on the planet and its inhabitants, an impact that is much beyond our immediate reach (Goleman, 2009, pp. 8-9).

Numerous examples from all over the world are informative proofs that various populations, in different periods of time, have managed to understand the laws of nature, as well as their bonds with the environment and to ensure their sustainable existence by wisely exploiting the natural resources and finding solutions to the challenges of survival. One of the most known examples of ecological intelligence is the way the Indian population has managed to preserve its ecosystem and, implicitly, their means of survival by instituting the interdiction

of eating cow meat more than a millennium ago. Although at a first sight it might seem that spiritual and religious values are more important than the life itself in India (Harris, 1974, p. 11), the interdiction should be understood in terms of costs and benefits in relation to the environmental, demographic, technological and economic conditions of the population. Cow worship and the interdiction to consume cow meat are neither irrational nor unexplainable, but a clear example of an ecologically intelligent behaviour, a rational response to the ecological and economic conditions of rural life in India, manifested through the depletion of natural resources and the increase in population density. For an agricultural population whose subsistence depended on the dimension of arable land and the size of agricultural crops, cattle were the only species that could not be eliminated, as they were the only means of pulling a plough. The slaughter of cattle for meat, especially in difficult periods of famine, would have posed a threat to the whole cycle of food production (Harris, 1978, p. 162). In addition to their absolutely essential role in agriculture, cattle perform many other vital economic functions (such as a provider of fertilizers, construction materials, or secondary food products) without which the survival of the population, especially the poor individuals, would have been challenged. Although in times of crisis cattle might be the only source of food in a household, sacrificing them and consuming meat to overcome immediate difficulties would jeopardize long-term survival (Sanderson, 2014, p. 88). Nevertheless, the temptation of meat consumption, especially in times of famine and extreme drought, could not easily be overcome, so the Hinduists set up a complex mechanism, promoted in the form of a religious taboo that made meat consumption sacrilegious.

Another, more general illustration of the ecological intelligence of humans refers to the tendency of our ancestors in all societies to impose restrictions or "supernatural sanctions" when the relation between the benefits of the community and the costs associated with the consumption of certain species of meat becomes unbalanced. Throughout the world, one could easily observe that abundant species that can be maintained without high costs and whose meat can be consumed without endangering the ecosystem "rarely become the target of supernatural prohibitions" (Harris, 1978, pp. 145-146). On the contrary, supernatural bans or food taboos are imposed on species whose consumption, for various reasons, become more expensive at a certain time or, more importantly, endanger the existing way of subsistence.

Such instances are long-term adaptive responses to certain ecological conditions caused by population growth and environmental pressures, most probably emerged unconsciously and unintentionally, through trial and error. Moreover, they became part of the local culture, in the form of valuable knowledge, transmitted from generation to generation and from individual to individual. For numerous populations, cumulative cultural evolution has generated adaptive responses to the environment, allowing them to accumulate features, techniques, practices, norms, institutions that have allowed them to survive and thrive.

The wisdom to use natural resources in a sustainable manner is part and parcel of all the human populations that thrived and managed to overcome difficulties, sometimes in extreme environments, yet it is now acknowledged that modern humans, at least in certain parts of the world, especially in developed societies, have lost the abilities to anticipate the consequences of their actions on the environment, the sensibility to detect and respond to potential dangers and the intelligence to find solutions to current environmental problems of global reach (Goleman, 2009, p. 92).

In terms of loosing our vigilance to detect threats to our survival, it is worth mentioning here the so-called "mismatch hypothesis" (Hagen & Hammerstein, 2006, pp. 341-343) or the "Savanna Principle" (Kanazawa, 2012, p. 25), which mainly refers to the fact that our brain

was developed in a different environment, called the Environment of Evolutionary Adaptedness (Franks, 2005; Volk & Atkinson, 2013) that is the natural hunter-gatherers-style habitat to which human beings were originally adapted and in which they spent more than 99% of their evolutionary history (Rosano, 2013). As a result, the humans were well-adapted to understand and deal with situations that existed in the ancestral environment, yet they are maladapted to the present environment, which is much more complex and posing different challenges and threats. For examples, most individuals all over the world retain their "ancestral" fear of snakes and spiders, yet they are quite immune to the abundant ecological dangers of today (Goleman, 2009, p. 75), although it is more likely to be harmed by pollution or climatic changes than bitten by a snake, at least in developed societies. Given this situation, experts such as Daniel Goleman (2009, p. 93) are insisting on the necessity for humans to develop and sharpen a "new sensibility" and a new type of intelligence, translated into the capability to identify and understand the hidden interconnections and interdependencies between human activities and ecosystems, that will ultimately trigger necessary and appropriate changes in both "commerce and industry, as well as in our individual actions and behaviours".

The ecological intelligence of the twenty-first century must be extended beyond the basic knowledge and abilities of native populations to adapt to their environments, to include know-how about the multitude of ways man-made systems interact with natural ones with potential impacts on the planet, on the individual and on the society as a whole (Goleman, 2009, pp. 95-96). Nevertheless, neither our senses and inborn neuronal circuits, nor the basic local knowledge of our ancestors are enough for helping us detect the global-scale ecological dangers of our current world and our contribution to the deterioration of the environment. Therefore, we need to rely on our unique ability to learn, and education, in both formal and informal formats, is essential for compensating for "our natural blind spots" (Goleman, 2009, pp. 101-103). Moreover, ecological intelligence requires a collective and collaborative effort, as no single mind is able to grasp all the essential knowledge regarding our ecological footprint and the countless potential impacts of our actions on the environment. For instance, a simple decision to buy a toy should imply an elaborate life-cycle assessment (Kirchain, Gregory & Olivetti, 2017, p. 693) and consider a specialized category and large amount of information from the type of raw materials and potentially harmful chemicals such as lead used in colouring it, to manufacturing techniques and their energy consumption, emission and waste water, to social and economic conditions of the labour force involved in the production process, to the recyclability characteristics or impact after disposal. Although few individuals, if any, would know all these things and easily access them in the process of decision-making, no one would spend the necessary amount of time and energy to process the information for making the optimal decision (Simon,1978).

At present, ecological intelligence seems to be the prerogative of the specialists and experts in the field of ecology-related disciplines, as knowledge regarding the consequences of our daily actions are not easily available to the large public. Therefore, ecological literacy and specific education are absolutely necessary for cultivating and increasing our ecological intelligence, with the ultimate aim of uncovering the hidden ecological impacts and collectively understanding that it is also our responsibility to find solutions to current problems (Goleman, 2009, p. 20). For instance, ecological intelligence might help us understand that being "green" is far from being "sustainable", as many so-called "green" products or activities have actually a bigger impact on the planet or on the people's health. In a recent study published by the Danish Environmental Strategy (Bisinella et al., 2018, p. 16), it is estimated that plastic bags have actually the lowest environmental impacts and are

entirely reusable or recyclable. Moreover, the production of a plastic bag requires less energy and pollutes less water than the production of a paper bag (Goleman, 2009, pp. 47-48), although the plastic-versus-paper debate is far from being conclusively closed.

The main role of ecological education is that of nurturing an equally theoretical and practical ecological intelligence that would enable people to know how to access, understand and process relevant information for their decision-making in terms of their total impact on the environment. Experts agree that, when making decisions, such as what to buy, people usually lack valuable knowledge that would allow them make better choices with a lower impact (Goleman, 2009, pp. 266-267), and in this regard three types of information seem to be crucial: 1) *why* should people care about the environmental impact; 2) *what* aspects are more important for deciding which choice is better; and 3) *how* accessible is the right decision compared to the wrong one. Several globally accessible online platforms, such as GoodGuide and Skin Deep are already addressing the latter two types of information by reviewing and rating various categories of products and services and providing consumer guides, yet the need to know why is important to care, part of the ecological intelligence, is not yet addressed systematically.

Conclusions

Living sustainably and reducing the impacts on the natural environment humans leave in require a special type of intelligence, named either naturalist or ecological intelligence. Broadly speaking, naturalist intelligence refers to the sensitivity and propensity of certain individuals to "read" the signs of nature, to develop a special relation with it and to be aware of its "suffering" and its "healing" necessities. Ecological intelligence, although touching upon the same characteristics, abilities and sensibilities, widens the content by including all the aspects of the complex process of adaptation to the environment. Ecological intelligence refers to the humans' innate and especially learned abilities to understand the organic relation between all the organism that live in a certain environment and between them and the ecosystem itself, and the capacity to learn from experience and find proper solutions to the current environmental problems. More importantly, ecological intelligence has a crucial role in ensuring sustainability by making individuals aware that their activities influence and change ecosystems and that survival on the long run means making these influences as "clean and harmless" as possible. Nevertheless, given the fact that humans are not naturally-born environmentalists, it should be clear that ecologically intelligent abilities are to be acquired through learning by education.

Therefore, it is the role of education, especially formal education in schools and universities, to teach people about the value of nature, the special and essential human-nature relationship and the long-term impact of choices on both nature and humans. Similarly, it should be the aim of education to teach people to abandon the attitude of "now and here" and to accept a larger view of the world, in which what is done at present and in the space we inhabit might have destructive consequences in many other places in the future.

References
1. Bisinella, V., Albizzati, P.F., Astrup, T.F., Damgaard, A. (Eds.). (2018). *Life Cycle Assessment of Grocery Carrier Bags*. Environmental Project no. 1985, The Danish Environmental Protection Agency.

2. Davis K., Christodoulou J.A., Seider S. & Gardner H. (2011). *The Theory of Multiple Intelligences*. In Sternberg, R.J., Kaufman, S.B. (Eds.). *The Cambridge Handbook of Intelligence*. New York: Cambridge University Press, pp. 485-503.

3. Deary, I.J., Lawn, M. & Bartholomew, D.J. (2008). "A conversation between Charles Spearman, Godfrey Thomson, and Edward L. Thorndike: The International Examinations Inquiry Meetings 1931-1938: Correction to Deary, Lawn, and Bartholomew (2008)". *History of Psychology,* 11(3): 163.

4. Franks, B. (2005). "The role of 'the environment' in cognitive and evolutionary psychology". *Philosophical Psychology*, 18:1, 59-82.

5. Gardner, H. (1998). *Are there Additional intelligences? The Case for Naturalist, Spiritual, and Existential Intelligences*. In Kane, J. (Ed.). *Education, information, and transformation*. Upper Saddle River, NJ: Merrill-Prentice Hall, pp. 111-131.

6. Gardner, H. (1999). *Intelligence Reframed: Multiple Intelligences for the 21st century*. New York: Basic Books.

7. Gardner, H. (2011), *Frames of Mind: The theory of Multiple Intelligences*, New York, Basic Books (first published: 1983).

8. Goleman, D. (2009). *Ecological Intelligence. How Knowing the Hidden Impacts of What We Buy Can Change Everything.* New York: Broadway Books.

9. Hagen, E.H. & Hammerstein, P. (2006). "Game Theory and Human Evolution: A Critique of Some Recent Interpretations of Experimental Games". *Theoretical Population Biology*, 69: 339-348.

10. Harris, M. (1974). *Cows, Pigs, Wars, and Witches: The Riddles of Culture*. New York: Random House.

11. Harris, M. (1978). *Cannibals and Kings. The Origins of Culture*. Fontana: Collins.

12. Kanazawa, S. (2012). *The Intelligence Paradox. Why the Intelligent Choice Isn't Always the Smart One*. New Jersey: John Wiley & Sons, Inc.

13. Kelly, M. (2018). *Teaching Students Who Have a Naturalist Intelligence*. Available on-line at: https://www.thoughtco.com/naturalist-intelligence-8098.

14. Kirchain, R.E. Jr., Gregory, J.R. & Olivetti, E.A. (2017). "Environmental life-cycle assessment". *Nature Materials*, 16: 693–697.

15. Mackintosh, N.J. (2011). *History of Theories and Measurement of Intelligence*. In Sternberg, R.J., Kaufman, S.B. (Eds.). *The Cambridge Handbook of Intelligence*. New York: Cambridge University Press, pp. 3-19.

16. McCallum, I. (2008). *Ecological Intelligence. Rediscovering Ourselves in Nature*, E-book Edition. Golden, Colorado: Fulcrum.

17. Rosano, M. (2013). "Environment of Evolutionary Adaptedness (EEA)". In Runehov A.L.C., Oviedo L. (Eds.), *Encyclopedia of Sciences and Religions*, E-book Edition. Dordrecht: Springer.

18. Sanderson, S.K. (2014). *Human Nature and the Evolution of Society*. Boulder: Westview Press.

19. Simon, H.A. (1978). "Rational Decision-Making in Business Organizations". Nobel Memorial Lecture, *Economic Sciences*, 1978, pp. 344-371. Available online at: https://core.ac.uk/download/pdf/6322096.pdf.

20. Smith M.K. (2002). *Howard Gardner, multiple intelligences and education*. Available on-line at: http://infed.org/mobi/howard-gardner-multiple-intelligences-and-education/.

21. Sternberg, R.J., Kaufman, S.B. (Eds.). (2011). *The Cambridge Handbook of Intelligence*. New York: Cambridge University Press.

22. Volk, A.A. & Atkinson, J.A. (2013). "Infant and child death in the human environment of evolutionary adaptation". *Evolution and Human Behavior*, 34:3, 182-192.