

## Epistemological Fundamentals of Agriculture Education in Cuba

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### ABSTRACT

The epistemological fundamentals of agricultural education are presented in this paper. Several theoretical referents are included as epistemological fundamentals on agricultural education: Martí's ideas about agriculture and instruction, the axes agriculture-education-politics; practical instruction in agriculture; instruction-technological innovation-agricultural extension; and projection-sustainability; agroecology as a science, with levels of complexity and relationships that make possible to tackle the complexities of reality from various epistemological approaches, and their participatory approach of social movements, and transforming reality based on knowledge discussion, struggle for equity, self-determination, and social justice; the agrosemiotic vision of training; and the integration of ecosystem service potentials of agrobiodiversity. Education in agriculture (EA) is defined as a complex, dynamic, hermeneutic, and dialogical process of empowering agricultural activities oriented to sustainability.

**KEY WORDS/:** education in agriculture; agroecology; agroecosystem; agrobiodiversity; agrosemiotic

### INTRODUCTION

Today's context is characterized by climate change, world crises (economy, society, finances, food, and environment), and particularly, the Cuban context (economic blockade, population decrease and aging), are leading to changes of perspective in agriculture education, in the search of sustainable food safety and sovereignty.

Cuban agriculture is part of the national identity and ethnogenesis, since the aboriginal, European, African, and Haitian cultures melt in different ethnic and ethnocultural processes. The shaping (ethnogenesis) of the Cuban ethnosocial system integrated different ethnic and multiethnic backgrounds that gave rise to a new nation: aboriginal, mainly from the Arawak islanders branch who were farmers and ceramists; Spaniards from the Canary Islands, Galicia,

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Catalonia, Basque country (Guanche, 2013), and the peninsula; Africans from different ethnic groups, mainly Sub-Saharan regions, especially the Bantu and Yoruba groups; the French; French-Haitians; and the Chinese. Training as a pedagogical category has been studied by different authors with varied perspectives (Honoré, Para una Teoría de la Formación Dinámica de la Formatividad, 1980), (Honoré, Vers l'oeuvre de formation! L'ouverture à l'existence, 1992); environmental education (Leff, Saber ambiental, sustentabilidad, racionalidad, complejidad, poder, 1998), (Molano Niño & Herrera Romero, 2014) ; competences of the environmental educator (Loret de Mola López, Méndez Santos, & Rivero, 2013), (Figuroa Hernández, 1995); research education (Sánchez Lima, 2008). (Yurén Camarena M. T., 2000) and (Yurén Camarena M. , 1999) and (Sánchez Lima, 2008). Some of the first referents of environmental education are Leff (1996), Leff (1995), Leff (1998), and García (2006), in the field of complexity; and Parrado Alvarez, Méndez Santos, Ricardo Marrero, Cejas Yanes, Díaz Fernández, and Torres Zamora (2011), in the field of educational environmental projects.<sup>4</sup>

The National Program of Environmental Education for Sustainable Development (CITMA, 2015) identified the deficiencies in environmental education (insufficient interdisciplinarity in environmental education of syllabus and curricula in the national education system, and initial and permanent training of professionals). Accordingly, its goal was to improve the environmental culture of the people, through new knowledge, skills, attitudes, conduct and behavioral changes that encourage humans to better their relationship to the environment, and capacity to create a sustainable society.

One of the causes of the occurrence of fragmented environmental education is the absence of a complex systemic vision of an unfinished process, like education and local development. Particularly, food production has little use of the production and value chains approach (Bárceñas, Prado, Rosales, & Pérez, R, 2014) and (Vinci, *et al.*, 2014), as a way to achieve permanent education of human resources in general, especially college and university professionals.<sup>5</sup>

The Communist Party's Guidelines of the Economic and Social Policies for the 2016-2021 period (14, 117, 118, 121, 122, 157, 158) (Communist Party of Cuba, 2017) are coherent and emphatic concerning the need to create skilled labor force in agriculture (technicians and engineers), as well as the objectives of the National Plan of Economic and Social Development for 2030. It

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<sup>4</sup> Jesús Guanche considered 10 ethnical processes: ethnic assimilation (forced) Hispanic-aborigin (1510-1799); Hispanic interethnic integration (1510-1799); ethnic assimilation (natural) afro-aborigin (1525-1560; African interethnic integration (1515-(1868-1878)); ethnogenetic mixture (natural) Hispanic - African (1515-(1868-1878)); ethnic assimilation ( natural) Canary-aborigin (1550 - 1650); Canary-Hispanic-peninsular-African ethnogenetic mixture (1515-(1868-1878)); ethnic assimilation (natural) Creole- Hispanic -French (1790-(1868-1878)); interethnic integration French Haitiano-African (1790- (1868-1878)); ethnic assimilation (natural) Creole-Hispanic-Afro-Chinese (1847-(1868-1878), and five ethocultural processes: ethnic assimilation (forced) Hispanic aborigin, and interethnic assimilation Hispánico; ethnic assimilation (natural) Afro-aborigin, interethnic assimilation African, and ethnogenetic mixture Hispanic-African; ethnic assimilation (natural) Canary-aborigin, and ethnogenetic mixture Canary-Hispanic peninsular-African; ethnic assimilation (natural) Creole-Hispanic French, and interethnic integration French Haitian-African; ethnic assimilation (natural) Creole-Hispanic-Afro-Chinese.

<sup>5</sup> "Then we go back to the pressing need to suggest, live, learn, and teach a complex thinking, that can interweave disciplines as a possibility of a complete mankind; only like that, the eternal limitation and fragmentation of the subject separated from himself in the search of knowledge would be overcome." (Nicolescu, Basarab (1996): Transdisciplinarity. Manifiesto. Ediciones Du Rocher

includes the nation's perspective, axes, and strategic sectors, which call for integration in environmental education to professional training within the Cuban context.<sup>6</sup>

The above includes professional education in agriculture-related specialties in four of the nine strategic axes: transformation of production and international insertion, human potential, science, technology and innovation, natural resources and the environment, and human development, equity and justice. Particularly, the concept of Cuban Social and Economic Model of Socialist Development to 2030 has a special significance.

Accordingly, education in agriculture is particularly important in Cuba, where agriculture has been at school since colonial times, saving chronological differences, and without the necessary links to the current scenarios. In a predominantly agricultural country, it is fundamental to tackle agriculture, especially when the world deals with a financial, ecological, economic, and food crisis amidst climate change. The goal is to make a contribution to food sovereignty and safety from the school, through practical contexts that help interpret agricultural processes, and therefore, improve the relationships of humans with the environment.

In that sense, this paper is an approximation to the epistemological fundamentals of education in agriculture, based on a comprehensive perspective for application at different educational levels, accordingly. Critical review of national and foreign references, and their learning, including agroecology and ecosemiotics, and their development are important tools in the process. The authors also used analysis and synthesis, and the historical-logical method to state the epistemological fundamentals of education in agriculture and its conceptualization.

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<sup>6</sup> 14. To prioritize and advance into the whole production cycle through networks among production, service, science, technology, and innovation organizations, all the universities should guarantee fast and efficient development of new products and services, using appropriate quality standards that include the results of scientific research and technological innovation, and integrate inner and outer sales management. 117. To continue to increase the quality and rigor of the teaching-learning process, and strengthening of the role of teachers in the class. To increase the efficiency of the school cycle, rank permanent upgrading, motivate the teaching staff, to improve the working conditions, and to optimize the role of the family in the education of children, adolescents, and young students. 118. To train the teaching staff with required quality levels in every province and municipality, to meet the needs of education in other schools. 121. To make possible that classes in different specialties and degrees correspond to the development of the Cuban economy and society; to increase the number of students in agricultural, pedagogical, technological, and basic science degrees. To guarantee vocational training and professional orientation since primary school, in concert with production and service organizations, political, student, and people organizations, along with the families. To further encourage the work of technicians and skilled workers. 122. To consolidate the responsibility of organizations, entities, administration boards, and other economic actors in training and developing skilled workers. To update university training and research based on development needs, the Cuban social and economic model, and the incorporation of new technologies. 157. To grant top priority to preservation, protection and improvement of natural resources (soil, water, animals and plants). To recover quality seed production, animal and plant genetics, and the use of national biologicals. 158. To maintain and develop integrated research projects to protect, preserve, and rehabilitate the environment, evaluate social and economic impacts of extreme events, and adapt the environmental policy to the prospects of the social and economic environment. To carry out programs for preservation, rehabilitation, and rational use of natural resources. To promote environmental education with the inclusion of all the actors of society.

## DEVELOPMENT

Recent reports of FAO (2016), noted that adaptation to climatic change will be the only way to achieve food safety for all and eradicate hunger, malnutrition and poverty. From 2030 on, the impact of climate change on crop yields, livestock raising, fishing, and forestry will be more severe worldwide. A drop in production levels will bring serious consequences to food safety. The shortages of foodstuffs will increase prices dramatically; the more variable the climate, the more volatile the prices will be.

Being an island, Cuba is vulnerable to climate change. On top of it, the risks will increase with growing urbanization, population reduction, and aging. By 2050, urbanization in Cuba will be 80%, causing a decrease of the rural population along with women's preference to settle in urban areas. Aging occurs more intensely in urban areas. In 20 years from now, 31% of the Cuban population will be 60 years or more; four years later, the figure will be 34%, the country with the largest number of elders in Latin America and the Caribbean (Center for Population and Development Studies, 2015).

Since colonial times, agriculture in Cuba was dealt with at different educational levels: in colonial times (Pezuela, 1863), Sagarra, 1964), (Fernández, 1868), (Pruna, 1882), (Cadenas, 1894), (Riera and Tortosa, 1896); in neo-colonial times (García S., 1926 a), (García, 1926 b), (García, 1926 c), (Quesada, 1943) (Vicente & Peralta, 1942); and in the revolutionary period (Castro, F., 1975), (Castro F., 1964 ) (Castro, F., 1967a) (Castro, F., 1968b) (Castro, F., 1969), (Castro, F., 1966), (Castro, F., 1968a), (Castro, F., 1967b); Program of Education in Agriculture (Santos I., Medina, Machado, & Martín, 2011) and (Parrado, O., Gutiérrez, Z., Hernández, M., & Godínez, A., 2014); education in agriculture for teachers, and work training in agriculture for junior high school (Leyva, Santos, & López, 2015).

Agriculture is present in the educational systems of countries, such as, Spain (CEIDA, 1998), Nicaragua (MINED, 2009), the Dominican Republic (SEE, 2009), the United States of America (Wells, Matthews, Caudle, Lunceford, Clement, & Anderson, The Infusion of Inquiry-based Learning into School-based Agricultural Education: A Review of Literature, 2015), (Chumbley, Haynes, & Stofer, 2015) (Roberts & Edwards, 2015), (Martin & Kitchell, 2015), Sudáfrica (Kidane & Worth, 2014), and China (Penghui & Tormoehlen, 2007); and in the African continent (Riedmiller, 2002).

The epistemological fundament and conceptualization of education in agriculture stems from José Martí's concept of agriculture and education; the state of the art of education in agriculture in the world and Cuba; historical and systemic assessment of food production to identify the common features in the relationship culture-nature that has led to environmental issues along the history of mankind, based on a Marxist perspective; the epistemological positioning of transdisciplinarity; and the theoretical bases of agroecology, which provides an agrosemiotic vision of education in agriculture.

### **José Martí's ideas as the groundwork of education in agriculture**

The keys to Martí's vision of education in agriculture are synthesized in the following axes, agriculture-education-politics; educational processes-technological innovation-agrarian extension; predictability-sustainability.

### **Agriculture-education-politics**

Martí's work is extensive to the need of thorough and harmonious training of individuals for life. His words are still present in relation to the Cuban economic model update. He also deepened on the urgent need to till the land to solve Cuba's problems. The relationship of agriculture with instruction is thoroughly dealt with, because education in agriculture has a potential to teach values, and to teach peoples to govern.<sup>78910</sup>

That is why agriculture is so important for the Latin American countries, especially in times of economic, financial, food, and environmental crisis. In Cuba, agriculture is being developed near the cities, based on an agroecological perspective of urban and suburban agriculture, along with the lease of idle lands, and optimization of food production, as stated in the Communist Party Guidelines for Social and Economic Development.

A professional should be permanently aware of new technological breakthroughs and innovation. Accordingly, a school of agriculture must be part of the surrounding context: outstanding farmers, farmer-farmer agroecological movement, and so on. A school of agriculture should never be separated from food production, which is the basis of professional training.

### **Education-technological innovation-agricultural extension**

The pedagogical routine can lead to lack of creativity by teachers and students, mediated by agricultural practices, the dichotomy between the affective and cognitive, and the significance of learning. Martí stressed on the role of humans as a part of nature, and therefore, nature should not be harmed by their actions. He stated the link of creativity to nature, foreseeing the current bioethical conceptions. Martí also talked about the need for teachers to develop extension actions with farmers, in order to raise their spirit, incorporate them to society with knowledge about the government, and help them improve their relationship with the land they cultivate. Martí (1884) positioned himself against school based on the pen and ink, or by modern-day extension, digital agriculture, and all the variants that denied practice as the basis and end of knowledge, which harm the training of agriculture students.

Additionally, he noted the need of technological update and its contextualization, with the introduction of the best agricultural practices, and their relationship with professional training. He

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<sup>7</sup> Education should go along with life. It is pointless for education to use man's only training time in not providing training. Education should provide the means to address the problems that life brings. The greatest human problems are the preservation of existence, and finding the means to make life pleasant and peaceful. Cfr: Martí, José "Fragmentos", O. C. tomo 22, p. 308

<sup>8</sup> "Every man should learn to provide for their own sustenance, to work available jobs, for their own sake, and for the sake of their homeland. The rest is wisdom of names and lists, which will not help lift the tiniest things from the soil, it will only produce pretentious scientists, as there were once pretentious theologians" Cfr: Martí, José "Carta de los Estados Unidos", El Partido Liberal, México, 20 y 21 de junio de 1890; Otras Crónicas de Nueva York, 2da edición, Ed. Ciencias Sociales, 1983, p.142

<sup>9</sup> "Broad is the uncultivated Cuban soil, and clear is the justice to whomever can use it, it must be hidden from those who do not want to put it to good use. Having a good soil system, easy to start a plentiful country, Cuba will have room for all the good men, and a balance for the social problems, and a root for a republic which above all disputes and nomenclatures, must embrace entrepreneurship and hard labor. " Cfr: Martí, José. "El Partido Revolucionario a Cuba". Patria, Nueva York, 27 de mayo de 1893. O.C. Tomo 2 p. 346)

<sup>10</sup> Martí, J. (1884). "La próxima Exposición de New Orleans. A los gobiernos, municipios, Escuelas de Agricultura y hacendados de la América Latina". *La América*, Nueva York, mayo de 1884, La Habana: 1975, 2da ed. Ciencias Sociales, O.C. tomo 8, p. 369

emphasized the role of schools of agriculture. Very interesting and recurrent is his idea in several of his articles about predictions, which is useful for any area of human activity. Martí (1881, 1883) also pointed to the need that farmers should not apply their knowledge mechanically, since agricultural activities are very diverse.

### **Prediction-sustainability**

Agricultural practices have demonstrated over and over that the lack of prediction is the cause of failure. The dynamics of agriculture demands different variants, like a chess game, in face of diverse scenarios. His criterion of responsible consumption, and its relation to sustainability were advanced for his time, and coherent (Martí 1875, 1883, 1884), coinciding with Ramón de La Sagra:

The current level of maturity reached by mankind, supported by the scientific breakthroughs, and enlightened by the companies, for the moral sentiment, belongs to a period when the surface of the planet we inhabit should be exploited in the most useful and convenient way, not only for the present generation, but for the generations to come. It will never be accomplished again if the personal, ephemeral, and transient interests of some are not abandoned for the sake of the general and eternal interests of the entire human species. (Sagra, 1860)

These ideas must materialize in agricultural education, using a transforming vision of the reality, based on participation and protagonism of the training environmental educators, teachers, engineers, technicians, and skilled workers. Hence, Martí's ideas are a guide to permanent action, a tool for continuous systematization of training in agriculture.

### **Education in agriculture in Cuba and the world**

In the review of historical backgrounds in Cuba and internationally, the terms used were education in agriculture, and school-based education in agriculture, with different connotations often focused on youth training for the labor market.

Agriculture is present in the educational systems of countries, such as, Spain (CEIDA, 1998), Nicaragua (MINED, 2009), The Dominican Republic (SEE, 2009), the United States of America (Wells, Matthews, Caudle, Lunceford, Clement, & Anderson, *The Infusion of Inquiry-based Learning into School-based Agricultural Education: A Review of Literature*, 2015), (Chumbley, Haynes, & Stofer, 2015) (Roberts & Edwards, 2015), (Martin & Kitchell, 2015), Sudáfrica (Kidane & Worth, 2014) and China (Penghui & Tormoehlen, 2007); and in continents, like Africa (Riedmiller, 2002).

Internationally, experiences of agriculture at schools are varied. A study made by Riedmiller (2002) in 30 African countries revealed different approaches based on their goals: educational (centered on providing knowledge and skills to students to improve agricultural practices, favor natural sciences learning, as a practical dimension of sustainability in environmental education programs, and to favor attitudes and motivations to agriculture and rural life); economic (reduce the costs of education, foster local agricultural development); social-political (train young and teen-age girls for agricultural activities, with a minimum professional background that allow them to increase their personal incomes, improve the nutrition of school children, and motivate children to take schools by tackling relevant topics in their contexts).

Moreover, Temu, Per Rudebjer & Chakeredza (2010) called for an integrated approach to agriculture in schools. In Argentina and other countries, education in agriculture comprises a system of agricultural schools, like in Cuba until the mid-60s of the twentieth century (rural

homes and rural mid schools), that were a source of income for school farms and technical colleges.

In the US, school-based agricultural education began in 1917, and focused on the needs of the labor market. Its mission was to train students for a successful career in world agricultural systems, food, fibers, and natural resources. It was conceptualized as a systematic program of instruction for students who wanted to learn sciences, business, plant production technology, environmental systems, and natural resources. By means of education in agriculture, students create opportunities to develop leadership capacities, personal growth, and professional success. It was based on problem-solving and research learning, which emphasized on cognitive development of critical thinking and intellectual development of mid school students (Wells, Matthews, Caudle, Lunceford, Clement, & Anderson, 2015).

In China, Penghui & Tormoehlen (2007), in absence of a system of education in agriculture, recommended to include it in the existing syllabus.

In Cuba, the syllabi and curricula were reviewed at different times (Pezuela, 1863), (Sagarra, 1864), (Fernández, 1868), (Pruna Santa Cruz, 1882), (Riera & Tortosa Picón, 1896); neocolonial times (García Spring S. , 1926 a), (García Spring S. , 1926 b), (García Spring S. , 1926 c), (Quesada, 1943) (Vicente & Peralta Reyes, 1942), and in the revolutionary period (Castro Ruz F. , 1975) Program of Education in Agriculture (Santos Abreu I., Medina Morales, Machado Muros, & Martín Santos, 2011) and (Parrado Alvarez, O., Gutiérrez Lastra, Z., Hernández González, M., & Godínez Do-Val, A. , 2014).

This study evidenced that agriculture in Cuba has been in the schools since colonial times, going through neo-colonial times, to the revolutionary period. An important referent is the ideas stated by Fidel Castro Ruz in the 1959-1973 period, when new ideas were laid out to make agriculture the productive support for the application of the studying-working principles at the schools in the countryside (Castro Ruz F., 1975), (Castro Ruz F., 1964 ) (Castro Ruz F., 1967a) (Castro Ruz F., 1968b) (Castro Ruz F., 1969), (Castro Ruz F., 1966), (Castro Ruz F., 1968a), (Castro Ruz F., 1967b), which supports continuous training of technicians and professionals in agricultural studies, as well as the association of training centers with production, considering the particular differences created over time.

Recently, (Santos Abreu I., Medina Morales, Machado Muros, & Martín Santos, 2011) compiled a course book and recommended to include it in the basic curriculum (Santos Abreu I., Medina Morales, Martín Santos, & Machado Muro, 2012) to deal with teacher training in agriculture education. In Cuba there are favorable conditions to promote agriculture studies from within general education, and for teachers to meet the school's goals, using an interdisciplinary and inter-value-based approach.

The introduction of agricultural education for teachers (Santos Abreu I., Medina Morales, Martín Santos, & Machado Muro, 2012) provides a broader and more comprehensive perspective. This curriculum has been optimized (Parrado Alvarez, O., Gutiérrez Lastra, Z., Hernández González, M., & Godínez Do-Val, A., 2014), bringing agriculture in a more cultural dimension, which is highly complex in today's scenario, not only due to the multiplicity of entries, meanings, and definitions that lead to a more theoretical view, but also because of the appreciation as a multidimensional phenomenon inserted in society, which is revealed by its practical significance.

In spite of the conditions created in Cuba, in comparison to other countries, there are still quite a few choices for deeper and more thorough treatment of agriculture, as a specific content dealt with at different education levels. Its particular environmental, cultural, economic, political, and social characteristics, and the pressing need to accomplish food sovereignty and safety as a matter of national security to foster prosper and sustainable socialism.

### **Transdisciplinarity and agroecology**

To integrate education and praxis, it is important and essential to explain the concepts of pluridisciplinarity (the study of an object of one discipline by several other disciplines at the same time); interdisciplinarity (the transference of methods from one discipline to another); transdisciplinarity (the study of what is part of the disciplines at the same time, through the disciplines, and beyond the disciplines). Its end is to understand the world, and knowledge as one of the urgent needs of today (Nicolescu, 1996).

According to the Charter of Transdisciplinarity (1994), the appropriation of transdisciplinarity in education implies a transdisciplinary attitude and vision: rigor of arguments to analyze reality; acceptance to the unknown, unexpected, and unforeseen; and the tolerance required to acknowledge opposing ideas and truths. Authentic education should not favor abstraction of knowledge. It should teach how to put information into context, be more concrete, and globalize. The transdisciplinary education re-evaluates the role of intuition, the imagination, sensitivity, and body when knowledge is transmitted.<sup>11</sup>

Accordingly, transdisciplinarity is important for agricultural training processes (Francis, Breland, Østergaard, Lieblein, & Morse, 2013); experience learning in agroecology (Alvarez Salas, Polanco-Echeverry, & Ríos Osorio, 2014), and for epistemological aspects of agroecology as a complex science, with a transdisciplinary and systemic character, oriented to providing solutions to agroecosystem issues. Hence, the object of study recommended is socioecology resilience and agroecology, as the object of agroecosystem knowledge. Gliessman (2013), and Méndez, Bacon, & Cohen (2013) stressed on transdisciplinary agroecology, participation, and transforming actions.

Agroecology is the epistemological pillar of sustainable agricultural education; its efficacy will depend largely on how much the epistemological conception has been acquired by the environmental educator.

Education in agriculture will also require a great deal of attention to system conceptualization (agroecosystems), by defining limits, elements, structures, and intervening interconnected processes at different scales (global), and their time and space dimensions, for which some dichotomies of the Cartesian approach must be overcome (culture-nature, society-nature, subject-object).

The expected broad and complex vision of agroecology, according to León (2012) as the science that studies the structure and function of agroecosystems based on their ecological and cultural interrelations is foreseen. When agroecology is visualized as a transdiscipline (Álvarez-Salas, Polanco-Echeverry, & Ríos Osorio, 2014), the existence of complexity and interrelation levels is assumed, which facilitates tackling the complexity of the reality from different epistemological approaches, and their participatory conception of social movements, and as transforming the reality, considering knowledge exchange, the struggle for equity, self-determination, and social justice (Méndez, Bacon, & Cohen, 2013), based on coherent policies that allow for pertinent

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<sup>11</sup> Arrábida Agreement (1994). Drafting Committee: Lima Freitas, Edgar Morin and Basarab Nicolescu. Retrieved on October 19, 2013, from <http://www.filosofia.org/cod/c1994tra.htm>



changes of food systems. In that sense, political agroecology is appropriate (González de Molina, 2013).

Overcoming the society-nature dichotomy in agroecology demands a change in the social agricultural thought about education in agriculture (Sevilla Guzmán & Woodgate, 2013). The role of social movements (Vía Campesina (VC)) in agroecology to achieve social changes, presenting their social, cultural, and political goals as a response of neo-liberal globalization policies is recent. It goes beyond the scope of agroecology as a science that explains the function of agroecosystems or the principles that support ecologically productive practices. (Rosset & Martínez Torres, 2012).

In Cuba, agroecology has gained strength among farmers (Farmer-to-Farmer Cuban Agroecological Movement (MACAC)), led by the National Association of Small Farmers (ANAP), which implements second degree hermeneutics efficiently and intuitively in production practices.

The political side of agroecology is particularly relevant to transform reality; to the environmental educator, it is not only the science that identifies the physical factors of agroecosystems, but also a method to suggest ways to implement indispensable changes. Without a political will to implement agroecological practices in urban, suburban, and family agriculture, very little would have been achieved in Cuba to change the food system paradigms. It can contribute to broader knowledge of socioecological dynamics of agroecosystems, which helps understand their resilience. This vision also helps overcome the underlying Cartesian approaches to agroecology that hinder agricultural training.

### **Agrosemiotic approach of education in agriculture**

In his works on the origin of higher psychic functions, Vygotsky stated a distinctive human feature: it is mediated by tools (instruments and technical artifacts), and signs. Vygotsky thought that in the same way tools allowed external manipulation and transformation of the environment, signs facilitated internal manipulation and transformation. The invention and use of signs as auxiliary means to solve any psychological problem faced by individuals (to remember, compare, communicate, choose, etc.) is psychologically analogous to inventing and using tools (Vygotsky, 1995).

The incorporation of what has previously belonged to the interaction between the environment and the individuals to the personal and intrapsychological side, is one of the key concepts of Vygotsky's theory, known as "internalization". In terms of social interaction and signs, the different semiotic systems perform an essential role: first, they are in charge of communication; then, they are an instrument for organization and control of the individual's behavior.

The dynamics of the relationship between spontaneous empirical knowledge and nature is explained by the role of symbols in human practice, by Ilienkov E. V.:

[...] nature is in man's mind not only part of it, which he produces directly and reproduces or consumes for some useful purpose. Without constant idealization of the real objects that renew human vitality, and without its transformation into something idealistic, and without symbols, man cannot be an active part of social production. (Ilienkov, 1984)

The idealistic part is directly realized in the symbol and through the symbol; i.e., by means of the body of the outer word, which is perceptible by the senses, it is visible and

audible. But this body, in itself, is at the same time another being in another body, and as such, due to its ideal, its meaning is completely different from its body shape, directly perceptible through the ears and eyes. The word as a sign, like a name, has nothing in common to what it is a sign. This commonness is uniquely revealed in the transformation action of a word into practice and through practice, into a thing (then otherwise), it is revealed in the practice and symbolization of the results (Ilienkov,1984).

Soviet psychologist Leontief explained the role of meanings in man's practical activities.

That way, meanings refract the world from man's consciousness. Although language is the carrier of meanings, language is not the demiurge of meanings. Modes (operations) are hidden behind linguistic meaning; they are socially created from action, along which men change and know objective reality. In other words, meaning embodies the idealistic form (transformed and turned into language matter) of the existence of an object world, its properties, links, and relations, unveiled by all social practice. Therefore, meanings themselves; i.e., in abstraction of their function in an individual's consciousness, are little "psychological", as the socially known reality behind them (Leontiev,1972)<sup>12</sup>

The permanent processes of reading, dialogue, interpretation, and decision making explain why some farmers are successful and other are not under similar ecological conditions. It also has a repercussion on professional training when it moves away from performance, particularly in agriculture. In that sense, the scientific explanation and the epistemological bases of the process are associated with semiotics, in general; ecosemiotics, in particular; and agroecosemiotics, in singular. Human activity cannot be conceived in isolation from nature; work, language and communication allowed humans to develop differently from the other animals.

Since its beginning, the human species has faced a continuous process of interpretation of nature, in order to adapt to the conditions of its existence. The appearance of agriculture was a landmark for human development and their ever-growing distancing from nature, to present. At some point, elementary forms of relationships coexisted, as in the case of hunters-gatherers with precision agriculture.

This process is based on the interaction of systems with two material or idealistic systems, where reflection, as a component of matter, content, structure, particularity (system that is reproduced in a different way in another system), and consequently, the comprehension of reflection, is linked to the correspondence and identification of two systems resulting from their mutual interaction, when the assumption of reflectivity is accomplished.

Reflectivity considers that a system is made of the reciprocal interference between the activity of the object system and the objectivizing activity of the subject, and that the object is not just definable in its relation with the subject in two levels: epistemological and self-reflective.

The epistemological level is manifested when a naturally ontogenic system (a living being) that produces life, is managed. Interference is produced between the objective activity of subjects and the limited objective activity of the object, among other interpretations of the environment which are operated by the subject and object.

The self-reflective level is present in the case of speaking systems that exert their objective activity or sense production at the same level of the subject. Interference is produced between the objective activities of the subject and object, by reciprocal reflectivity.

The emergence of semiotics as a science has given rise to further developments (Maran, Mimicry: Towards a Semiotic Understanding of Nature. Sign Systems Studies, 2001), (Maran, Towards an Integrated Methodology of Ecosemiotics: The concept of Nature-text, 2007), like the contributions of Noth (2001) to ecosemiotics, who considered ecosystems from a communicative perspective, and studied the role of perceptions and conceptual categories in design, construction and transformation of environmental structures.

From a cultural sociosemiotic standpoint (Cruz Doimeadiós, 2012), the decisions that subjects make in their relationship with nature are closely related to the meanings that each social group assigns to nature. These are based on the previously built symbols, through symbolic construction of nature, defined by the above author as a special process of interpretation and symbolic elaboration that corresponds to the granting of meanings, using a sign-value system from which cultural practices are arranged to facilitate social appropriation and transformation of nature.

Generally, ecosemiotics is in charge of studying perceptions and conceptual characterization of design, construction, and transformation of environmental structures. It provides conceptual tools to describe the role of signs and communication within the dynamics of physical environment (Maran & Kull, 2014). They also establish the key principles of ecosemiotics that apply to agroecosystems, where anthropic influence is vital.

The approximations of particular sciences in semiotics have gone from cultural geography with emphasis on landscapes (Lindström, Kul, & Palang, 2011), and agriculture (Pânzaru, 2011). Moreover, the assimilation of the semiotic view in training processes derived from the curricular arrangement for agroindustrial engineering (Gualdrón de Aceros, Barbosa Chacón, & Vásquez Cardozo, 2010). Recently, E.Nugis (2011) suggested his approach on agrosemiotics, as part of biosemiotics, including zoosemiotics, phytosemiotics, and mycosemiotics. Furthermore, he suggested the term pedosemiotics to deal with meanings related to soil properties.

The previous leads to a contextual hermeneutics position, with emphasis on relationships, subject-object interaction, both as a part of a whole producing reciprocal influences. In this position, the role of the object or subject is not diminished; instead, there is an interchangeable dialogical complementation. The subject is repetitively considered the active side (agent, constituting), or the passive side (patient, constituted). In turn, the object is repetitively a conditioning and constituting, or conditioned and constituted part.

From that conception, contextual truth is built by intersubjective consensus about one or another interobjectivity studied in the context of cognitive praxis of the subjects that build it. As a result, these interpretations are supposed to be contrasted to everyday practice of real and concrete men and women. The outcome may then be fertile or sterile for humans \_and the standard fundamentals they attach to\_ who will then rule out one or the other. <sup>13</sup>

This paper defines agrosemiotic as the semiotics of agroecosystems, particular ecosystems with permanent dialogue between nature and culture in a process of reading, interpretation, and decision making, based on the interaction of their cultural, social, economic, political, demographic, and natural dimensions, to ensure food sovereignty and safety toward

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<sup>13</sup> Sotolongo Codina, P. L. & Delgado Díaz C. J (2006). La epistemología hermenéutica de segundo orden en Red de Bibliotecas Virtuales de Ciencias Sociales de América Latina y el Caribe de la red CLACSO  
<http://www.clacso.org.ar/biblioteca> - biblioteca@clacso.edu.ar

sustainability. Agrosemiotics is the basis of agricultural professional training, because the farther it moves from the key link, the poorer the professional training will be.

Thus, the potential of education in agriculture considering the ecosystemic standpoint is appealing.

### **Agrobiodiversity and education in agriculture**

The Cuban framework legislation for the environment says that "Every state body or organization, and natural and legal individuals must adopt the actions and necessary measures within their respective competences, to secure preservation of national biological diversity and sustainable use of their components." <sup>14</sup>

Agrobiodiversity comprises communities, species, and organisms that make up all the genetic variability used in agriculture, including wild species that live and grow naturally, in contact with domesticated species; and the cultural diversity that is generated through human relationships in their appropriation of nature. It refers to the variety and variability of animals, plants, and microorganisms, which are deemed important for agriculture and nutrition. In a wider sense, it not only comprises the genetic resources of cultivated species, but also all the biological diversity needed to back up key functions of the agroecosystem, preserve its structure and processes, contribute to produce goods and offer services (ecosystemic services), to ensure nutrition and promote sustainable agricultural development.

So, it reveals its potential to integrate contents within education in agriculture in the form of ecosystemic services (ES): support (ecosystemic, soil formation, transportation, human habitat, biodiversity, biodiversity maintenance, nutritional cycle processes, etc.), supply (food, water, genetic resources, fiber, wood, biofuels, medicines, etc.), regulation (climate, gas emissions, water quality and quantity, erosion, pollution, nutrient recycling, pollination, diseases, etc.), and cultural (cultural identity, recreation, tourism, esthetic and spiritual benefits, science, education, etc.), that either in their conceptualization or classification have been dealt with in the literature (De Groot, Wilson, & Boumans, 2002), (Montes & Salas, 2007), (Costanza, 2008), (Camacho Valdéz & Ruiz Luna, 2012), (Zaccagnini, 2014). They are the direct or indirect benefits that society inherits from the ecosystem's components and functions, which according to a complex Morinian approach, the ecosystem can be perceived as a complex system of many and varied events that become signs and signals to the different living beings, creating network myriads that lead to poly-grids with information and instructions arriving from all directions, explaining the objective and subjective of the culture-nature relationship.

Education in agriculture that promotes these services and processes into sustainability makes possible the integration of key environmental issues that affect production.

### **Education in agriculture and its conceptualization**

Training, as a pedagogical category has been studied by different authors (Honoré, 1980), (Honoré, 1992), who defined it in the interiority-exteriority dynamics, the training related to creating a culture, the selection of a field of research and practice to share with others the discovery of new means, elaborate new rules, and manufacture new models.

The capacity of training is only revealed as the condition of doing what is possible, not as an obligation. Intention, project, and sense take shape and strength to transform the accepted meanings; researcher training (Yurén Camarena M. T., 2000) and (Yurén Camarena M. , 1999) (Sánchez Lima, 2008); and environmental education (Figueroa Hernández, 1995), as organic and

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<sup>14</sup> Cfr. República de Cuba. Ley 81 (Sobre medio ambiente). Capítulo 2.Art. 84

reflective processes of knowledge arrangement, and of the society building new capacities to understand and intervene in the transformation of the world.

A review of environmental education made by Molano Niño & Herrera Romero (2014) noted that there are enriching experiences directed to curricular innovation, many are the processes that tend to make a segmented vision of reality, with syllabi similar to curricula, and environmental education centered on the disciplines. In conclusion, they recommended alternative university environmental education.

To make professional education a sustainable activity, it is important to have an integrated, systemic, and complex vision of education, which should not focus on isolated environmental elements.

This problem arises mostly from the conception of the human-environment relationship assumed in the educational and productive practices, where the incorporation of different components of the environment is limited and leads to a reductionist approach. Hence, the opportunities offered by the actors, contexts, and didactic styles are lost.

### **Practical context of education in agriculture**

To achieve thorough understanding of praxis, some theoretical remarks must be implemented in order to overcome the reductionist approaches of life, and trophic pyramids, which can be embodied in the reticular conception of the plot, as a grid used where the agricultural education of an environmental teacher includes the intersubjectivities of all the actors of the process, and the interobjectivities of the objects, all mediated by praxis in a reciprocal and interactional process to transform praxis itself. The practical context has several dimensions: space, time, economic, legal, political, demographic, cultural, ethical, environmental, and natural.

Education in agriculture implies knowing the causes of environmental problems to work on them by associating theory and practice in the production scenarios, using a participatory approach by all the actors involved in food production, which must promote a closer relationship between farmers and consumers. Education in agriculture would not be possible if it overlooked the current situation of mankind, in danger of extinction due to the endless thirst of profit accumulation by capitalism, whose wealth is in fewer hands. Therefore, it deepens the study of these causes based on the Marxist theory, Martí's thoughts of man-nature interaction, and Fidel Castro's conception about the environment.

The ecological model of Bronfenbrenner (1977) and its further development (Neal & Neal, 2013) are necessary to set up the theoretical groundwork that contributes to improved education in agriculture, through permanent realization of the context, from a complex ecological vision.

Bronfenbrenner defined development as "the process through which a developing individual acquires a broader, different and valid conception of the ecological environment, that encourages the person to carry out activities that unveil the properties of that environment, restructure it, and support it. In terms of form and content, such levels go from equal to greater", but Bronfenbrenner's novel contribution was the way to understand systems or contexts.

To explain the relationships established between different systems, Bronfenbrenner used the concept of ecological transitions, that makes reference to role or environmental changes that take place in a lifetime. In short, the author said that an "ecological transition is produced when the

position of a person in the ecological environment is altered as a consequence of role or environmental changes, or both at the same time".

In that sense, it is important to point out that ecological transitions are appealing to psychology, because they assume risk situations to developing individuals; that are both origin and consequence of change processes.

This model contributes to assessment of subject development, and their relations with different systems that effect on agricultural education, and their sustainability as part of continuous training. All of it implies the existence of an intention and motive for an individual to perform certain activities.

So that education in agriculture becomes efficient, a systemic training approach must be implemented, which includes food production. The strengths to achieve it are based on currently undergoing research on integration of production and value chains. The integration of human resources training, in general, and technicians and professionals, in particular should be included in that vision too (Vinci *et al.*, 2014), (Bárceñas, Prado, Rosales, & Pérez, R, 2014), and school knowledge on agriculture is not put aside.

Landini (2010) analyzed the dynamics of local school knowledge, particularly, its improvement and reconfiguration, using advances in technology and scientific knowledge. He studied the process of invention, circulation, and consolidation of local knowledge from a historical perspective, with the support of conceptual frameworks of social psychology. Additionally, he conceptualized the dynamics implied, and suggested a comprehensive model aimed to describing and explaining community processes of knowledge creation, and the relationship between local knowledge and scientific knowledge.

Traditional knowledge is also treated at the university (García Lobo & Anido Rivas, 2016), in its relationship with competences and university functions. Psychology and semiotics have contributed to an explanation of the need of strengthening the link between spontaneous empirical knowledge and scientific knowledge, as an expression of the existing bond between theory and practice.

Hence, it is important to materialize education in agriculture as a complex, dynamic, hermeneutical, and dialogical process of appropriation of agricultural activities oriented to sustainability. It stems from thorough comprehension of praxis and its dimensions (space, time, economic, legal, political, demographic, cultural, ethical, environmental, and natural).

Education in agriculture moves toward a treatment of rural contexts in its cultural dimension. It exists in the countryside and the cities, as a result of migration to urban areas, which takes place in Cuba, with almost 80% of the population in urban areas, despite improvements of the living standards (education, healthcare, housing, infrastructure) in rural areas, and the existence of urban and suburban agriculture. Hence, an operational definition of rural context is the condition occurring as a result of agriculture as part of culture and nature, either through the use of natural services and resources for production, or their use in other activities (recreation, tourism, education, and housing). This definition makes the space dimension more flexible, and it contributes to the extension of praxis in the context of training technicians and teachers for agriculture-related specialties.

The context of praxis for education in agriculture is at the productive basis of urban agriculture, suburban agriculture, and family agriculture, UBPC, CPA, and other institutions in the community which schools can access, along with the social, environmental, economic, political, and cultural contexts, in permanent interaction with IPAs and research centers.

## Education in agriculture

After broadening the scope of Martí's ideas about agriculture and instruction and its axes (agriculture-education-politics; practical agriculture teaching; training process-technological innovation-agriculture extension; and prediction-sustainability, agroecology as a whole, with complexities and interaction levels make possible to tackle the complexity of reality from different epistemological approaches. Also part of this study is the participatory conception of social movements, which can transform reality based on dialogue, the struggle for equity, self-determination, and social justice. The agrosemiotic vision of the training process, and the integration of all the potential brought by the ecosystemic services of agrobiodiversity that define education in agriculture as a complex, dynamic, hermeneutic, and dialogical process of appropriation of agriculture. It is based on cultural, social, economic, political, demographic, and natural dimensions to ensure food sovereignty and safety toward sustainability. To achieve thorough understanding of praxis, some theoretical remarks must be implemented in order to overcome the reductionist approaches of life and trophic pyramids, which can be embodied in the reticular conception of the plot, as a network where the agricultural education of an environmental teacher includes the intersubjectivities of all the actors of the process, and the interobjectivities of the objects, all mediated by praxis in a reciprocal and interactional process to transform praxis itself.

The application of such conceptions provides a more intentional orientation of training processes at different levels of the educational system in Cuba, and of institutions associated with agriculture.

## CONCLUSIONS

Agriculture is an essential activity for human survival that requires the implementation of a training system that meets the needs of food sovereignty and safety. For that purpose, education in agriculture should overcome the barriers of disciplines, and the already established conceptions for graduate and post graduate education in agriculture, now based on alienation of productive contexts. Instead, it must be part of the context of praxis so that the new trained professionals can be oriented toward sustainability, through permanent reading, dialogue, interpretation, and decision making.

A generalization of theoretical referents are included as epistemological fundamentals on agricultural education: Martí's ideas about agriculture and instruction, the axes, agriculture-education-politics; practical education in agriculture; instruction-technological innovation-agricultural extension; and projection-sustainability; agroecology as a science, with levels of complexity and relationships that make possible to focus on the complexities of reality from various epistemological approaches, and their participatory approach of social movements, and transforming reality based on knowledge discussion, struggle for equity, self-determination, and social justice; the agrosemiotic vision of training; and the integration of ecosystem service potentials of agrobiodiversity, as an expression of the relationship culture-nature oriented to sustainability.

## REFERENCES

- Alvarez Salas, L. M., Polanco-Echeverry, D. N., & Ríos Osorio, L. (2014). Reflexiones acerca de los aspectos epistemológicos de la agroecología. Cuadernos de Desarrollo Rural, 11(74), 55-74.
- Bárceñas, A., Prado, A., Rosales, O., & Pérez, R. (2014). Integración regional: hacia una estrategia de cadenas de valor inclusivas. Santiago de Chile: CEPAL.
- Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, 32, 513-531.
- Camacho Valdéz, V., & Ruiz Luna, A. (2012). Marco conceptual y clasificación de los servicios ecosistémicos. *Revista Bio Ciencias*, 1(4 Año 2), 3-15.
- Castro Ruz, F. (1964). Discurso pronunciado en el acto de Fin de Curso del Instituto Tecnológico de la Caña "Alvaro Reynoso", Ateneo de Matanzas, el día 13 de noviembre de 1964.
- Castro Ruz, F. (1966). Discurso pronunciado en el acto de graduación de los primeros 425 técnicos del Consejo del Plan de Enseñanza Tecnológica de Suelos, Fertilizantes y Ganadería, en la escalinata de la Universidad de La Habana, efectuado el 18 de diciembre de 1966.
- Castro Ruz, F. (1967a). Discurso pronunciado en el Instituto Tecnológico Obrero de Suelos, Fertilizantes y Alimentación del Ganado "Rubén Martínez Villena", el 30 de enero de 1967.
- Castro Ruz, F. (1967b). Discurso pronunciado en la Clausura del III Congreso Nacional de la ANAP, en el Instituto Tecnológico "Rubén Martínez Villena", el 18 de mayo de 1967.
- Castro Ruz, F. (1968a). Discurso pronunciado en el acto de graduación del Instituto Tecnológico de la Caña, celebrado en Matanzas, el 6 de octubre de 1968.
- Castro Ruz, F. (1968b). Discurso pronunciado en el Instituto Tecnológico "Rubén Martínez Villena" con motivo de graduarse alumnos de este Instituto Tecnológico y de la escuela "Ilya Ivanov", el 10 de junio de 1968.
- Castro Ruz, F. (1969). Discurso pronunciado en el acto de Graduación del Curso de Estudiantes de Agronomía y de Técnicos de Nivel Medio de los Institutos Tecnológicos Agropecuarios, celebrado en la Universidad Central, en Santa Clara, el 18 de octubre de 1969.
- Chumbley, S., Haynes, J. C., & Stofer, K. A. (2015). A Measure of Students' Motivation to Learn Science through Agricultural STEM Emphasis. *Journal of Agricultural Education*, 56(4), 107-122, doi: 10.5032/jae.2015.04107.
- CITMA. (2015). Programa Nacional de Educación Ambiental para el Desarrollo Sostenible. La Habana.
- Costanza, R. (2008). Ecosystem services: multiple classification systems are needed. *Biological Conservation*(141), 350-352.
- Crutzen, P. J., & Stoermer, E. F F (2000). The Anthropocene. *IGBP Newsletter*, 41(17), 17-18.
- Cruz Doimeadios, R. (2012). La concepción sociosemiótica de la cultura aplicada al estudio de la naturaleza, *Santiago*, 127:47-60
- De Groot, R., Wilson, M. A., & Boumans, R. M (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economics* 2002; 41: 393-408. *Ecological Economics*(41), 393-408.
- Delgado Díaz, C. (2007). Revolución del saber, cambio social y vida cotidiana. *Temas*, 52, 116-127.
- FAO. (2016). El estado mundial de la agricultura y la alimentación, Roma.
- Figueroa Hernández, A. (1995). Formación ambiental. *Revista Perspectivas Docentes*, 47-56.



- Francis, C., Breland, A., Østergaard, E., Lieblein, G., & Morse, S. (2013). Phenomenon-Based Learning in Agroecology: A Prerequisite for Transdisciplinarity and Responsible Action. *Agroecology & Sustainable Food Systems*, 37(1), 60-75.
- García Lobo, L. N., & Anido Rivas, J. D. (2016). Las funciones universitarias como fundamento para generar competencias orientadas hacia la codificación del conocimiento agrícola local. *Acta Agronómica*, 65(1), 58-64. doi:10.15446/acag.v65n1.47515
- García Spring, S. (1926 a). Materias enseñadas en las Escuelas Públicas de Cuba. *Revista Bimestre Cubana*, XXI(3), 411-429.
- García Spring, S. (1926 b). Materias enseñadas en las Escuelas Públicas de Cuba. *Revista Bimestre Cubana*, XXI(4), 590-600.
- García Spring, S. (1926 c). Materias enseñadas en las Escuelas Públicas de Cuba. *Revista Bimestre Cubana*, XXI(6), 706-722.
- García, R. (2006). *Sistemas complejos. Conceptos, método y fundamentación epistemológica de la investigación interdisciplinaria*. Barcelona: Gedisa S.A.
- Gliessman, S. (2013). Agroecology, Transdisciplinarity, and Climate Change (Editorial). *Agroecology & Sustainable Food Systems*, 37, 1101-1102.
- González de Molina, M. (2013). Agroecology and Politics. How To Get. *Agroecology and Sustainable Food Systems Sustainability? About the Necessity for a Political Agroecology*, 37, 45-59. doi:10.1080/10801001.2012.705810
- Gonzalez de Molina, M. (2013). Agroecology and Politics. How To Get Sustainability? About the Necessity for a Political Agroecology. *Agroecology & Sustainable Food Systems*, 37:45-59, doi: 10.1080/10440046.2012.705810
- Gualdrón de Aceros, L., Barbosa Chacón, J. W., & Vásquez Cardozo, C. A. (2010). La perspectiva semiótica como base para la construcción curricular. Una apuesta de la UIS hacia la Formación Regional en Agroindustria. *Revista de Pedagogía*, 31(89), 277-306.
- Guanche, J. (2013). España en la savia de Cuba. Los componentes hispánicos en el etnos cubano. Ed. revisada y aumentada. La Habana: CIDMUC, Centro de Investigación y Desarrollo de la Música Cubana, 385 p.
- Honoré, B. (1980). *Para una Teoría de la Formación. Dinámica de la Formatividad*. Madrid: Narcea.
- Honoré, B. (1992). *Vers l'oeuvre de formation! L'ouverture à l'existence*. París: Editions L'Harmattan.
- Ilienkov, E. V. (1984). *Lógica dialéctica. Ensayos sobre historia y teoría*. La Habana: Ciencias Sociales.
- Kidane, T. T., & Worth, S. H. (2014). Student Perceptions of Agricultural Education Programme Processes at Selected High Schools in KwaZulu-Natal Province, South Africa. *The Journal of Agricultural Education and Extension*, 20(4), 381-396
- Kul, K. (2001). Biodemiotics and the problem of intrinsic value of nature. *Sign Systems Studies*, 29(1), 353.
- Landini, F. (2010). La dinámica de los saberes locales y el proceso de localización del saber científico. Aportes desde un estudio de caso. *Cuadernos de Desarrollo Rural*, 7(65), 19-40.
- Leff, E. (1996). Las universidades y la formación ambiental. *Revista de Ciências Humanas*, 14(20), 103-124.

- Leff, E. (1998). Saber ambiental, sustentabilidad, racionalidad , complejidad, poder. México: Siglo XXI.
- León, T. (2012). Agroecología: la ciencia de los agroecosistemas. La perspectiva ambiental. Bogotá, Colombia: Instituto de Estudios Ambientales/Universidad Nacional de Colombia.
- Leontiev. A.N. (1972). Actividad y conciencia”, *Voprosii filosofii*, N° 12., p. 134.
- Leyva Carbonell, R. A., Santos Abreu, I. & Lopez Toranzo, J. (2015). Consideraciones teórico– metodológicas para la formación laboral agropecuaria en la educación secundaria básica. *Revista Didasc@lia: Didáctica y Educación*, 6(2):2015-226
- Lindström, K., Kul , K. & Palang, H. (2011). Semiotic study of landscapes: An overview from semiology to ecosemiotics , *Sign Systems Studies* 39(2/4), 201
- López Cedeño, F. (2014). Semiosfera: Pliegue entre mundo y lenguaje. *Themata Revista de Filosofía*, 49(1), 185-202.
- Loret de Mola López, E., Méndez Santos, I., & Rivero Rivero, M. (2013). La evaluación del desempeño profesional del educador ambiental. *Transformación*, 9(2), 29-44.
- Maran, T. (2001). Mimicry: Towards a semiotic understanding of nature. *Sign Systems Studies*, 29(1), 325.
- Maran, T. (2007). Towards an integrated methodology of ecosemiotics: The concept of nature-text. *SIGN SYSTEMS STUDIES*, 35((1-2)), 269-294.
- Maran, T., & Kull, K. (2014). Ecosemiotics: main principles and current developments. *Geografiska Annaler: Series B, Human Geography*, 96(1), 41-50.
- Martí, J. (1875). México. *Revista Universal*, 14 de agosto de 1875, La Habana: 1975, 2da Ed. Ciencias Sociales, O.C. tomo 8, p. 310
- Martí, J. (1881). “Aprender en las Haciendas” . *La América*, Nueva York, junio de 1881, La Habana: 1975, 2da Ed. Ciencias Sociales, O.C. tomo 8, p.275-277.
- Martí, J. (1883). “Abono. – La sangre es buen abono”. *La América*, Nueva York, agosto de 1883, La Habana: 1975, 2da Ed. Ciencias Sociales, O.C. tomo 8, p. 298
- Martí, J. (1884). “Escuela de Artes y Oficios de Honduras. Necesidad de escuelas y estaciones agrícolas y de maestros ambulantes”. *La América*, Nueva York, junio de 1884, La Habana: 1975, 2da ed. Ciencias Sociales, O.C. tomo 8, p.15
- Martí, J. (1884). “La próxima Exposición de New Orleans. A los gobiernos, municipios, Escuelas de Agricultura y hacendados de la América Latina”. *La América*, Nueva York, mayo de 1884, La Habana: 1975, 2da ed. Ciencias Sociales, O.C. tomo 8, p. 369
- Martí, J. (1884). Escuela de Artes y Oficios de Honduras. Necesidad de escuelas y estaciones agrícolas y de maestros ambulantes. *La América*, Nueva York, junio de 1884, La Habana: 1975, 2da Ed. Ciencias Sociales, O.C. tomo 8, p.15
- Martí, José “Carta de los Estados Unidos”, *El Partido Liberal*, México, 20 y 21 de junio de 1890; *Otras Crónicas de Nueva York*, 2da edición, Ed. Ciencias Sociales , 1983, p.142
- Martí, José “Fragmentos”, O. C. tomo 22, p. 308
- Martí, José. “El Partido Revolucionario a Cuba”. *Patria*, Nueva York, 27 de mayo de 1893. O.C. Tomo 2 p. 346)
- Martin, M. J., & Kitchell, T. (2015). Critical Theory View of the National FFA Convention. *Journal of Agricultural Education*, 56(2), 122-137. doi: 10.5032/jae.2015.02122.
- Méndez, V. E., Bacon, C. M., & Cohen, R. (2013). Agroecology as a Transdisciplinary, Participatory, and Action-Oriented Approach. *Agroecology and Sustainable Food Systems*, 37:3-18, 2013, 3, 3-18. doi:10.1080/10440046.2012.736926

- Ministerio de Educación Superior. (2010). Orientaciones metodológicas y de organización de la carrera Licenciatura en Educación Primaria, Plan D.
- Molano Niño, A. C., & Herrera Romero, J. F F (2014). La formación ambiental en la educación superior: una revisión necesaria. *Luna Azul* (39), 186-206.
- Montes, C., & Salas, O. (2007). La Evaluación de los Ecosistemas del Milenio. Las relaciones entre el funcionamiento de los ecosistemas y el bienestar humano. *Revista Ecosistemas*, 16(3), 137-147.
- Neal, J. W., & Neal, Z. P. (2013). Nested or Networked? Future Directions for Ecological Systems Theory. *Social Development* Vol 22 No. 4 722–737 November 2013, 22(4), 722-737, doi:10.1111/sode.12018.
- Nicolescu, B. (1996). *La Transdisciplinariedad. Manifiesto*. Ediciones Du Rocher. Ediciones Du Rocher.
- Noth, W. (2001). Ecosemiotics and the semiotics of nature. *Sign Systems Studies*, 29(1), 71.
- Nugis, E. (2011). Sign systems and agrosemios in agriculture. *Journal of Agricultural*, 25-30.
- Pânzaru, O. (2011). School of semiotics from Tartu: Genesis of semiotics of culture and semiotics of nature. *Agronomy Series of Scientific Research / Lucrari Stiintifice Seria Agronomie*, 54(2), 433-436.
- Parrado Alvarez, O. L., Méndez Santos, Ricardo Marrero, Cejas Yanes, Díaz Fernández, & Torres Zamora (2011). Los proyectos de educación ambiental para el desarrollo sostenible desde la escuela. *Experiencias valiosas. Pedagogía 2011. Curso 36*. La Habana: Pedagogía 2011.
- Parrado Alvarez, O. L. (2014). La sostenibilidad y su tratamiento en la formación de docentes y técnicos medios de las especialidades agropecuarias en la provincia de Camagüey. Informe de resultado de investigación. Proyecto Estrategia integrada de Educación Ambiental orientada al Desarrollo Sostenible en la formación de docentes y técnicos medios de las especialidades agropecuarias en la provincia de Camagüey.
- Parrado Alvarez, O., Gutiérrez Lastra, Z., & Bello Riera, N. Z. (2012). Programa de Educación Agropecuaria. Camagüey: Departamento de Agropecuaria.
- Partido Comunista de Cuba. (2016). Actualización de los Lineamientos para la política económica y social del Partido y la Revolución. VI Congreso del Partido. La Habana.
- Partido Comunista de Cuba. (2016). Proyecto de Conceptualización del Modelo Económico y Social Cubano de Desarrollo Socialista. Plan Nacional de Desarrollo Económico y Social hasta 2030. Propuesta de Visión de la Nación, Ejes y Sectores Estratégicos. La Habana.
- Partido Comunista de Cuba. (2017). Conceptualización del Modelo Económico y Social Cubano de Desarrollo Socialista. Bases del Plan Nacional de Desarrollo Económico y Social hasta el 2030: Visión de la Nación, Ejes y Sectores Estratégicos. La Habana.
- Partido Comunista de Cuba. (2017). Lineamientos para la Política Económica y Social del Partido y la Revolución para el período 2016-2021. La Habana.
- Penghui, D., & Tormoehlen, R. (2007). Rebuild a New Agricultural Education System: Based on the Actuality and Issues of the Agricultural Education in Contemporary China. *AIAEE Proceedings of The 23rd Annual Meeting*, (págs. 83-94).
- Pezuela, J. d. (1863). *Diccionario geográfico, estadístico e histórico de la Isla de Cuba* (Vol. 3). Madrid, España: Imprenta de Mellado.

- Pruna Santa Cruz, M. (1882). Lecciones de Agricultura aplicada á la Isla de Cuba (2da ed.). La Habana: M. Alorda.
- Quesada, C. S. (1943). Elementos de Agricultura. La Habana: Editorial Selecta.
- Riera, B. (1882). Programa oficial para los exámenes de Agricultura Elemental, Teórica y Práctica en el Instituto Central de 2da Enseñanza. La Habana: Imprenta La Nueva Principal.
- Riera, B., & Tortosa Picón, M. (1896). Nociones de agricultura teórico práctica con aplicación al clima, constitución geognóstica y cultivos especiales de las Antillas (3era ed.). Madrid: Establecimiento Tipográfico de A. Avrial.
- Roberts, R., & Edwards, M. C. (2015). Service-learning's ongoing journey as a method of instruction: Implications for school-based agricultural education *Journal of Agricultural Education*, 56(2), 217-233, doi: 10.5032/jae.2015.02217.
- Rosset, P. M., & Martínez Torres, M. E. (2012). Rural social movements and agroecology: context, theory, and process. *Ecology and Society*, 17(3), 17.
- Sagarra, J. B (1864). Breves nociones de Agricultura, industria y comercio. Santiago de Cuba: Imp. de M. A. Martínez.
- Sagra, R. Cuba 1860. La Habana Comisión Nacional de UNESCO. Ed. Nacional de Cuba s/f p.64
- Sánchez Lima, L. (2008). Proceso de formación del investigador en el área tecnológica: El caso de los programas de Postgrado del CENIDET. *Revista de la Educación Superior*, 37(145), 7-23. Retrieved on April 23, 2016, from <http://www.scielo.org.mx>. *Revista de la Educación Superior*, 37(145), 7-23.
- Sánchez Lima, L. (2008). Proceso de formación del investigador en el área tecnológica: El caso de los programas de Postgrado del CENIDET. *Revista de la educación superior*, 37(145), 7-23. Retrieved on April 23, 2016, from <http://www.scielo.org.mx>. *Revista de la Educación Superior*, 37(145), 7-23.
- Santos Abreu, I., Medina Morales , N., Martín Santos, T., & Machado Muro, Y. (2012). Programa para la asignatura La Educación Agropecuaria en la escuela cubana actual. Santa Clara: Universidad de Ciencias Pedagógicas Félix Varela.
- Santos Abreu, I., Medina Morales, N., Machado Muros, Y., & Martín Santos, T. M (2011). La educación agropecuaria en la escuela cubana actual. Santa Clara: CIGEA.
- SEE. (2009). El huerto escolar como recurso de enseñanza-aprendizaje de las asignaturas del currículo de educación básica. Santo Domingo, República Dominicana: FAO.
- Sevilla Guzmán, E., & Woodgate, G. (2013). Agroecology: Foundations in Agrarian Social Thought and Sociological Theory. *Agroecology and Sustainable Food Systems*, 37, 32-44. doi:10.1080/10710046.2012.695763
- Sotolongo Codina, P. L. & Delgado Díaz C. J (2006). La epistemología hermenéutica de segundo orden en Red de Bibliotecas Virtuales de Ciencias Sociales de América Latina y el Caribe de la red CLACSO Retrieved from <http://www.clacso.org.ar/biblioteca - biblioteca@clacso.edu.ar>
- Suárez, J. (2015). Producción integrada de alimentos y energía a escala local en Cuba: bases para un desarrollo sostenible. *Pastos y Forrajes*, 38(1), 3-10.
- Temu, A., Per Rudebjer , G., & Chakeredza, S. (2010). Enhancing integrated approaches in agricultural learning systems using experiences from agroforestry. *Scientific Research and Essays*, 5(16), 2179-2185.
- Vygotsky, L. S. (1995). Historia del desarrollo de las funciones psíquicas superiores. En L. S. Vygotsky, *Obras Escogidas*, vol. III. Madrid: Visor

- Vinci, M., Hernández Morales, A., Mireles, M., Pacheco, M., Landa Saá, Y., Anaya, B., y otros. (2014). Conceptos básicos e instrucciones para realizar el diagnóstico. Marco conceptual-metodológico para la aplicación de un modelo de planificación y gestión con enfoque de cadena en el sector agroalimentario en Cuba. La Habana: Ministerio de la Agricultura de Cuba, PNUD.
- Wells, T., Matthews, J., Caudle, L., Lunceford, C., Clement, B., & Anderson, R. (2015). The Infusion of Inquiry-based Learning into School-based Agricultural Education: A Review of Literature. *Journal of Agricultural Education*, 56(4), 169-181, doi: 10.5032/jae.2015.04170.
- Yurén Camarena, M. (1999). Formación, horizonte al quehacer académico. México: Universidad Pedagógica Nacional.
- Yurén Camarena, M. All concentrations of T. (2000). Formación y puesta a distancia. México: Paidós. México: Paidós.
- Zaccagnini, M. E. (2014). Manual de buenas prácticas para la conservación del suelo, la biodiversidad y sus servicios ecosistémicos. Buenos Aires: Programa de Naciones Unidas para el Desarrollo, PNUD, Secretaría de Ambiente y Desarrollo Sustentable de la Nación INTA.