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## Phytoremediation and Training in Agro-environmental Values

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### Abstract

The objective of the article is to contribute to the training of future agricultural professionals from the teaching-learning process, for this, theoretical, empirical and statistical methods are used according to the research, it deals with phytoremediation as a way to recover agricultural soils contaminated by oil production, the need for cultural and educational development of the population to achieve the harmonious integration of all the actors involved in the process. It indicates as a fundamental way to achieve the necessary higher social conscience, the formation in values, for this, it analyzes the different definitions of this category and determines ways to follow to form the values required in society. Makes a methodological proposal through the teaching-learning process of the content on phytoremediation in the "Agronomy" career to contribute to the training of professionals fully committed to the sustainability of this activity and human development.

### Introduction

Oil activity continues to be in a very important economic sphere, despite efforts to change the energy matrix and the environmental damage that this causes, and this trend seems to continue for at least the next 40 years, which is why Coordinating all possible efforts to minimize the effects polluting and damage environmental caused by the production of hydrocarbons is defining even in the conservation of life on earth.

Within the contents object of studies related to the mitigation of environmental damage and recovery of contaminated soils, which are received by agricultural engineers in

training, is phytoremediation, very in tune with the situation of eastern Ecuador, a region is that its main the economic line is the export of oil and at the same time it focuses its efforts on the development of its agriculture as an important source of employment and the construction of a more just and equitable society.

But environmental recovery is usually a slow process and does not reverse completely the damage caused, which is why it is necessary to work on the causes that originated the problem to avoid their recurrence and thus preserve conditions optimal that allow the flowering of life on the planet.

For the above, scientific-technical knowledge is not enough, it is necessary to change consciences, promote values, a deep educational work that turns students into environmental activists and convinced defenders of nature, so that once they graduate to act in the solution from pollution already created, become guardians and defenders of nature-friendly procedures. When teaching these contents, the teacher must carefully plan the training in values of their students, not leaving it to spontaneity

## **Materials and methods**

Desktop research (QuestionPro, 2020) is applied, as the research method that implies the use of data already existing in different bibliographic bases, reports and similar documents that are available in public libraries, websites, in addition to inductive-deductive to be able to reach concrete results regarding information related to the search for agri-environmental values, also theoretical methods were used, empirical and statistical.

## **Analysis and discussion of the results**

### **Phytoremediation of soils contaminated by oil production**

Contamination of soils by spills or improper disposal of oil is a global environmental problem, particularly the pollution produced by heavy and extra heavy oil, which although they are less toxic than light and medium oils, their remediation is more difficult and expensive (Infante and Morales 2012).

Within the techniques for soil decontamination, phytoremediation is attractive because of its low cost, because it improves soil conditions, because it is aesthetically pleasing and environmentally friendly (Pilon, 2005), (Yavari et al. 2015). Phytoremediation is based on the use of plants and their associated microbiota to remove, retain or reduce pollutants present in the environment and can operate through various mechanisms that involve different parts of the plants (Chávez-Maldonado et al. 2010), (Khan. & Tradit, 2013). Among the mechanisms associated with phytoremediation, we can mention phytoextraction, phytostabilization, phytovolatilization and rhizodegradation, the latter being recognized as the main responsible for the reduction of petroleum hydrocarbons in the soil (Yavari et al. 2015). Rhizodegradation is based on promoting the microbial activity associated with the rhizosphere to degrade the carbon compounds found in it. Notably, root exudates contain amino acids, organic acids, carbohydrates, growth factors, and soluble proteins that increase microbial activity in the rhizosphere (Miya and Firestone 2001).

The contribution of plants and microorganisms in the phytoremediation of oil-contaminated soils can be evaluated through indicators of the soil's microbiological activity, such as basal respiration, the activity of the dehydrogenase enzyme and the microbial carbon biomass. Since these indicators are related to the use, by microorganisms, of carbon compounds in the soil under aerobic conditions (Mager and Hernández-Valencia, 2013). It is based on the premise that the addition of hydrocarbons to the soil will increase microbial activity by counting microorganisms with a source of carbon and energy in oil. Additionally, the microbial activity, as well as the degradation of hydrocarbons, will be even higher in soils with plants due to the presence of a rhizosphere that stimulates this activity.

Phytoremediation only allows the recovery of agricultural soils partially and in the long term, it is appropriate to exploit agricultural soils with methods and techniques that allow the conservation and care of natural resources, this is only possible through systematic educational work that allow future to form values professionals and the general population.

### **Agriculture, culture and education**

Agricultural development requires fully trained human resources, which not only make it possible to obtain the resources necessary for human survival, but also the conservation of the natural conditions that allow agricultural exploitation. This not only depends on technical knowledge, but also on having sensitivity and values that regulate the actions and behavior of professionals during their actions in all spheres of life.

A profound educational influence is needed on the entire society, an education contextualized to the specific conditions of each locality and based on the principle that educating is preparing for life, an education that does not remain in the instructive plane, but capable of penetrating into the deepest essence of the human being, forming convictions and modifying behaviors, that is, forming values.

Fabelo (2003) points out: by value, it is generally understood, the capacity that certain objects and phenomena of objective reality possess to satisfy some human need, that is, the social determination of these objects and phenomena, consists of their function of serving the practical activity of man.

So from the philosophical point of view, values are understood as a complex formation of personality, contained not only in the cognitive structure, but fundamentally in the deep processes of social and cultural life and in the conception of the world by man. , closely related to social consciousness and depending on the type of society in which the individual develops.

From the point of view of this conception, it is necessary to understand this category from three types of analysis.

- The objective system of values (seen as a constitutive part of reality itself and of the social significance attributed to it by the subject it values).
- Subjective or consciousness values (Way in which social significance is reflected in individual consciousness).
- Institutionalized value systems (they show the way of organization and functioning of the society in which the subject develops).

The formation in values initially rests on the knowledge of reality, obtained through instruction, but it should not stop here, it should penetrate the field of feelings to form a superior personality.

The Philosophical Dictionary explains that values do not reflect only certain reality, they not only constitute knowledge about something, but also guide the activity of men, that is, they have a practical nature (Wikipedia, 2020).

The Grijalbo Encyclopedic Dictionary defines values as a quality of things for which they are desirable or undesirable.

When analyzing these definitions, it may appear that values and social significance refer to the same concept. Clearly what is valuable is significant, but not all social significance constitutes a value, by this it is understood, the formation of that which plays a more role in the development of society and, therefore, is directly or indirectly related to progress. Social. It is considered that the definition expressed by the Philosophical Dictionary is sufficiently comprehensive in terms of values, since it emits an exhaustive assessment, both negative and positive, of the personality.

Starting from the philosophical definition of values, social consciousness depends on the social being in the last instance: say, ideas, concepts, norms, principles, constitute values of the personality and therefore of society in the different spheres of this, this leads us to reflect that the attitudes and convictions required at the social level for the development of sustainable agriculture can be developed through activities aimed at turning them into an ethical-moral norm. Activities that must be in accordance with the characteristics of the different age and cultural groups of society, in addition, these activities must also be aimed at tourists and exploit the educational potential of this activity. It is about creating, enhancing the development of the appropriate social being that, ultimately, will lead to the expected social consciousness.

These activities must take place within a framework that meets a set of positive conditions, among which are:

- Take into consideration the needs, aspirations and interests of those to whom they are directed.
- Respect the dignity of all participants.
- Establish relationships with adequate communication.
- Promote creativity and the direct role of the participants.

The work to be carried out must be systemic and involve all economic, cultural and educational actors in society, so that they coordinate efforts in achieving this supreme goal, government institutions must be the ones that direct the work and bring together the other participants, the Schools, because they are centers of pedagogical knowledge, should act as methodological advisers, but not without first carrying out a deep internal analysis to determine if the required attempts are being made in the teaching-learning process, so that the act of teaching is not left alone in the instructive and gain in educational intentionality, so that when knowledge and skills are taught, the process also has the emotional charge necessary to touch the deepest sensitivity of the human being, it is about analyzing and exploiting the educational potentialities, the potentialities for training in values of the contents of the different subjects.

Values are transmitted, but not necessarily orally, through speech. The value is transmitted, in being a model for who interacts with you González (1990).

The role of the example in the formation of values is clearly evident. “The example creates virtues”, consider in this the personal example, but also the example and the institutional action, it cannot be formed in love of nature, in respect of ethnic and cultural diversity, to name a few examples, when as a rule general and intentional, nature is destroyed, racial or cultural discrimination is practiced, national and regional policy must be aimed at integration and mutual recognition.

Many specialists and scholars of the value category consider that these constitute a general guide to conduct, they are the result of individual experience and personal fulfillment, giving meaning to life and promoting its quality, therefore training in values constitutes the right path to achieve great social changes and human development. They can also be defined as spiritual determinations that designate the positive meaning of things, facts, phenomena, relationships and subjects, for an individual, a group, social class or society as a whole.

The teaching-learning process developed in educational institutions, because it has an already established level of organization, meets all the necessary conditions to become the starting point of the expected social transformations for the achievement of sustainable agriculture.

### **Teaching-learning process and training in values**

It is common to define the teaching-learning process as the procedure by which special or general knowledge is transmitted and acquired on a subject, from this point of view, no attention is paid to the educational role of said in the process, not all the potentialities of the teaching work are used to form conscience and feelings according to social needs, that is, it is not taken into account that at the same time that knowledge is taught, values must also be formed.

The education in values during the teaching-learning process can be carried out through the following forms, which are grouped within the traditional approach or the innovative approach.

#### **Traditional approach**

The attitudinal contents comprise the attitudes, values and norms and, appear in all the blocks of contents in which the curricular areas are structured with the purpose that they are programmed and developed together with the teaching of the conceptual and procedural contents Parra (2003). In this modality, it is important that the formation in values be considered during the process of elaboration of the curriculum that will govern the teaching work in the different levels of education.

**Cross-cutting themes**, so called because they intervene in the school curriculum in its different areas of knowledge, are configured in the form of interdisciplinary thematic contents of great social significance and whose learning is considered essential for the comprehensive training of citizens. They are moral and civic education, education for peace, education for health, education for equality between the sexes, environmental education, sexual education, consumer education and road safety education. Parra (2003). Here the creativity of the teacher is important to decide which values to form and through which activities, although it is much more profitable to plan jointly and in a coordinated way the objectives and procedures to achieve better results.

The workeducational for the formation in values is governed by the different approaches that are assumed in educational matters.

**Traditional approach:** Under the common name of traditional approach, a series of values education strategies are collected whose theoretical assumptions have been formulated by behaviorist theory (strategies based on positive or negative reinforcement), social learning theory (learning through model imitation) and communication theory (persuasive communication). Parra (2003). This approach is based on the assumption of the existence of objective values that are accepted by all, which can be formed through teaching and acquired through exercise and habit. These methods have always been present in education, among the most prominent are.

**The instruction.** Moral teaching through lyric, prose or theater in an exemplary way of life of the great heroes of classical mythology or of the great historical figures, was always present as a teaching method for the transmission of values to the youth in classical Greece and Rome. Precisely the qualifier "didactic" applied to these literary genres came to bear witness to their moralizing character. Medieval fables and apologists persisted in this purpose of moralizing the customs of the time. Parra (2003).

**Positive or negative reinforcers.** Positive reinforcement, such as rewards and praise, are used with the intention of producing the desired response, that is, promoting said behavior. Negative reinforcements, such as punishment and censorship, are intended to decrease the frequency of unwanted behavior. Parra (2003). Both the family and the school have widely used these reinforcements to guarantee respect for social norms, that is, to change existing attitudes and make other desired ones appear.

**Learning through the imitation of models.** It is produced by the tendency of individuals to reproduce the actions, attitudes or emotional responses that different real or symbolic models present. Sarabia (1992).

Man learns through social interaction with his peers by imitating attitudes and behavior of people who are significant to him, such as parents, teachers and colleagues, hence the important role that personal example plays in the formation of values, It is not about telling the student what their actions should be in different situations, it is about leading by example, who does not possess said values cannot form values in values.

**Persuasive communication.** Persuasive communication theory starts from the assumption that the formation and change of opinion and attitude are learning processes in which persuasive communication manages to induce other people to accept an opinion and act accordingly. As a result of the change of opinion, the new attitude to the object or situation on which the change has occurred arises Parra (2003).

Attitudes are therefore linked to the beliefs or opinions that the subject forms about reality, in such a way that the change of opinion, due to new information received by persuasive communication, causes beliefs and attitudes to change Llopis and Ballester (2001), Rodríguez (1989) distinguishes five types of persuasive communication shown in figure 1.

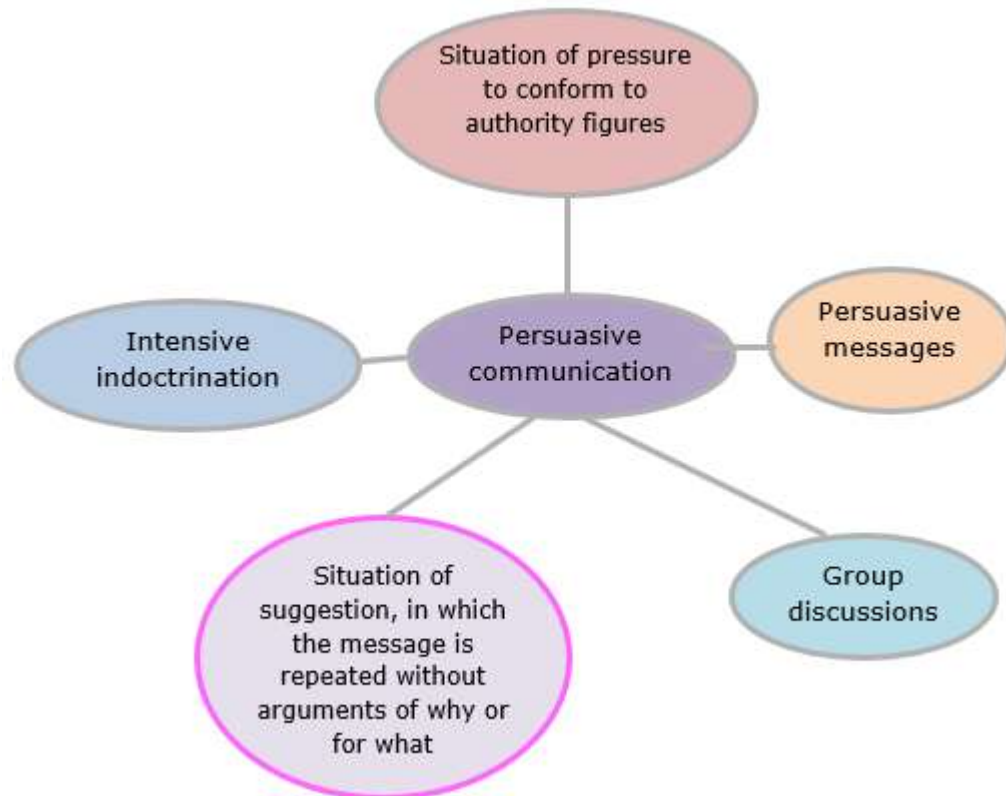


Figure 1. Types of persuasive communication

Source: Rodríguez (1989)

Of the five previous classifications, only group discussion and persuasive messages are considered educational. The main limitations of the traditional approach lie in; imposing on the student a value scheme devoid of significance for him, by not taking into account his aspirations and feelings, focuses more attention on the results of the educational process than on the methods to achieve them, inability to involve everyone in the assessment process. The personality of the subject, both its cognitive, affective, and behavioral instances, instills universal and absolute values, hence, denies the historical-social character of values and their subjectivism, it does not focus on processes of conviction and reasoning on the part of the individual. student, rules fundamentally through imposition.

### **Innovative approach**

As an alternative to traditional models, the strategies that are grouped under the innovative approach stand out, they share as a common feature that they are grounded through constructivism as the basis of the teaching-learning process and educational work, part of the non-existence of universal and absolute values, but considers totally relative values and an individual construction.

Among its best-known methods, the following stand out:

**The values clarification approach:** The purpose of this model is to help students identify their own values and become aware of them, share them with others, and act according to their own choices. According to the authors of this theory, it is unethical to instill in students a rigid and predetermined value system, which is why it is necessary to

consider their personal preferences, provoke reflection on them and for students to assume responsibility for their own choices.

Values are used from an early age acquired by parents fundamentally fulfilling family, social, political or cultural mandates, these are acquired and are reflected in the entire learning process during life (Ponce & Rodríguez, 2020).

According followers this method, the formation process consists of three stages values: selection, and performance estimation, each of which poses certain conditions Rath (1967), shown in Figure 2.

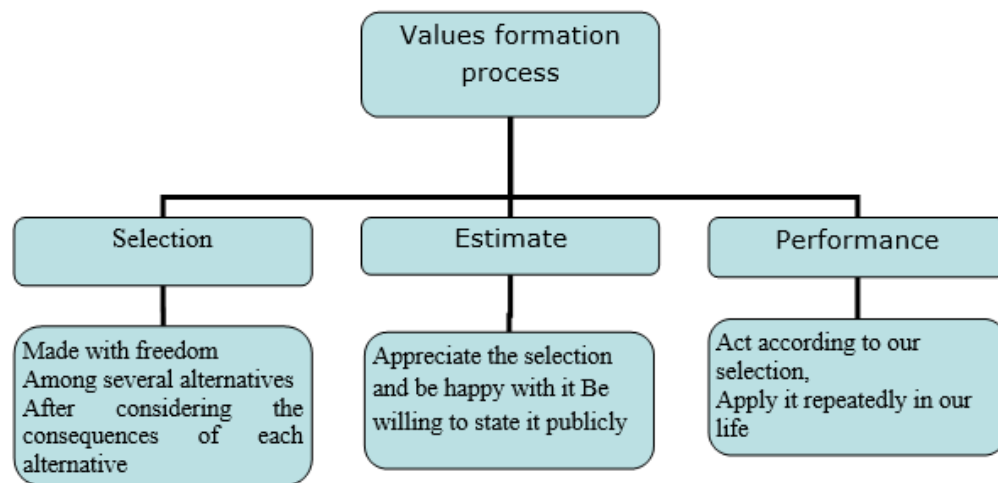


Figure 2. Values formation processes

Source: Rath (1967).

Another method of the innovative approach is the model of moral development, which is based on Piaget's cognitive-evolutionary theory of moral development in children (1932). The development of moral judgment takes place through the dynamic interaction between the organism and the sociocultural context in which the person lives, favoring a process that takes the subject from heteronomy to moral autonomy Parra (2003).

This process consists of three levels: the pre-conventional, the conventional and the post-conventional and a total of six stages that correspond to childhood, pre-adolescence and early adolescence, respectively. The levels and stages of development.

### Level 1 pre-conventional

Stage 1: Heteronomous morality (Obedience to the norms and rules imposed by adults)

Stage 2: Individualism (Orientation towards satisfying the main needs of the self)

### Level 2 Conventional

Stage 3: Reciprocity of personal expectations (Conformity to stereotyped images of good behavior in order to avoid the disapproval of others)

Stage 4: Acceptance of the social system and awareness of it (Orientation towards "law and order" and towards the fixed rules established by the authority)

### Level 3 Post-conventional

Stage 5: Social contract and recognition of human rights (Awareness of the relativism of values and conformity with the norms in which all society agrees)



Stage 6: Internalization of universal ethical principles (Orientation towards values such as justice, equality of human rights, respect for the dignity of the individual).

Within this classification there is also the model **active learning**, which is based on the assumption that values are formed from the interactive process that takes place between the person and society. In effect, values are influenced by society, the individual is encouraged to become an effective agent within it, it is about giving individuals opportunities to exercise their values at an individual and social level, for this the learner is placed in specific situations in which you have to make decisions and act according to your values.

The active learning model is presented as a circular strategy made up of six stages. Parra (2003).

Stage 1: Become aware of a problem or issue.

Stage 2: Understand the problem or issue. Collect and analyze information and take a personal attitude of value on the issue.

Stage 3: Decide whether to act or not. Clarify our own values and make decisions regarding personal participation.

Stage 4: Plan strategies and action steps: Quick discussions, organize possible action steps, provide skills, practice and rehearse beforehand.

Stage 5: Implement the strategies and take action by yourself or with a group.

Stage 6: Reflect on the actions that can be taken.

Due to both the psychological characteristics, intellectual development of the students, as well as the objectives pursued in the training of agricultural professionals, the active learning model constitutes the appropriate method for the development of a methodological proposal that favors the training in values of the students of the Agronomy Career, for the development of the agricultural sector in a sustainable way.

### **Methodological proposal for the training in values in Agronomy students through the contents of phytoremediation**

The profitability of any economic activity, by itself, does not guarantee its permanence over time, it is necessary to preserve the natural and social conditions that make it possible to continue developing, this may be possible in the case of the conservation of agricultural soils, through remediation or what is more feasible, through conscious exploitation that avoids contamination and degradation of the same. In the training of professionals agricultural, only the first possibility is taken into account and it is not considered at all to influence in an educational way to change the way of thinking and acting of man and in this way generate the lasting changes that society demands so much current.

It is necessary to give a systemic approach to the teaching-learning process and link it with the surrounding reality from a multidisciplinary point of view, carry out activities practical where students of Agronomy, Environmental Engineering, Social Communication, Pedagogy and any other specialty required to face a specific problem participate. To be solved, the objective is to study the main factors that influence a given situation, design and propose not only technical solutions but also the educational, communicative and awareness raising work -of the masses to be developed to avoid repetition.

The preparation of the teaching activities must be carried out in a coordinated manner by the teachers of the subjects of each specialty, so that each activity to be developed contributes to the achievement of a supreme objective that will enable the solution of economic and social problems, at the same time as It facilitates the comprehensive

training of the professionals of the future, going beyond field and focusing the educational on education as a tool capable of changing the world.

It is about not only focusing on the achievement of the instructional objectives but also about taking advantage of the educational potential of the teaching - learning process, it is about effectively fulfilling the six stages of the active learning model.

Stage 1: Become aware of a problem or issue, highlighting the main situations or problems that affect the sustainability of agriculture in the context closest to the student body, environmental problems, disappearance of endemic species of plants and animals, current irresponsible entities and the general population. This is achieved through problem solving and exercises where these problems are addressed.

At this stage it is important to coordinate the teaching work between the teachers of the different subjects that students receive and to define work strategies.

In stage 2, discussion and exchange of opinion between students and teachers must be stimulated to ensure understanding of the problem, this discussion must be participatory, under the assumption of respect for the opinion of others and tolerance.

In stage 3, you must determine what values are not met in the specific situation under study, make a first-person analysis to determine if you have those values and what would be the proper act in a similar situation.

In stage 4, strategies are analyzed and proposed to be followed to positively influence the problem in question.

In stage 5, strategies are implemented and personal or group actions are taken, here it is important that current actions and strategies are discussed, that is, what they can currently do as students and citizens and what they could do if they already were practicing as professionals.

In stage 6, reflection and assessment of strategies are promoted, successes, errors and possible corrective actions are shown.

## Conclusions

Agriculture is a decisive economic sphere for the survival and economic and human development of humanity, but it is affected by other economic activities that destroy the optimal conditions for its development, one of these is the oil exploitation that affects the soils by making them useless for crops, among the possible solutions to this problem is phytoremediation, but it is not the final solution to contamination.

A systematic and conscious educational work is necessary, which allows the creation of convictions in all social and economic actors, therefore, in this paper it is only intended to contribute to this objective through university work and its connection with society. Only what has taken root in the soul of the peoples lasts, let us positively change souls and we will achieve the harmony necessary to preserve life.

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