

Traditional agricultural knowledge as an academic program

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Abstract: in the framework of the social and environmental crises of the third millennium it is necessary to rethink university, its paradigms, the concept of education and its educational model to impact on the construction of the new society. Traditional agricultural knowledge (*saberes agrícolas tradicionales*, SAT), contribute with basic conceptual elements to implement and develop a sustainable society. From this rescue the systematization of SAT and the SAT-science intercultural dialogue, it is proposed to incorporate traditional agricultural knowledge as academic program in the Institutions of agricultural Teaching and Learning in the Superior Level.

Key words: education, agriculture, knowledge, rescue.

Resumen: En el marco de las crisis social y ambiental del tercer milenio, se hace necesario repensar la universidad, sus paradigmas, el concepto de educación y su modelo educativo para impactar en la construcción de la nueva sociedad. Los *Saberes Agrícolas Tradicionales* (SAT) aportan elementos conceptuales básicos para la implementación y desarrollo de una sociedad sustentable. A partir del rescate, la sistematización de los SAT y el diálogo intercultural SAT-ciencia, se propone incorporar los *Saberes Agrícolas Tradicionales* como programa académico en las Instituciones de Enseñanza y Aprendizaje Agrícola del nivel Superior (IEAS).

Palabras clave: educación, agricultura, saberes, rescate.

Introduction

The planet faces an environmental crisis, product of economic and technologic policies under a mechanistic vision, which finds in *the machine* its best metaphor (De Souza, 2002: 6), and that is expressed in a production-market-based logic; this is because in universities and, especially, in higher agricultural educational institutions, it is necessary to rethink university, educational models, redefine the conception of education, its mission and vision, so as to build a new society: the sustainable society.

The dawn of third millennium is characterized by frantic changes in all of the spheres of human activity; by the crisis and vulnerability of the prevailing ideas and paradigms in the industrialism era; by the struggle of the three visions of the world (industrial, economic and holistic) that seek to prevail in the new epoch, and which have their genesis in the technologic, economic and socio-cultural revolutions generated in the 1960's decade (De Souza, 2002: 6-8).

In the early third millennium, characterized by a social and environmental crisis, sustainability is build as a paradigm, opposed to the predatory model ruling in the industrial age, nowadays in complete decline (Torres, 2003: 23-28). In this context, Traditional Agricultural Knowledge (TAK) becomes a protagonist in the construction of sustainable agriculture because of its alternative approach, focused on the care and preservation of natural resources.

It is presumed that the new millennium agriculture will have two approaches: that of the *high-precision agriculture* supported upon biotechnology and cybernetics, and that of the *sustainable agriculture* under a conservation-based model, originated from the awareness of a species that promotes coexistence and solidarity with the similar (living and non-living) under a planetary survival ethics (Toledo, 2003).

On the other side, *pertinence* becomes a criterion of quality of the programs of study to train professionals in agricultural sciences, so incorporating TAK into the curricula of the Institutions of Advanced Agricultural Teaching and Learning (IAATL) will contribute to the social and environmental pertinence of agricultural education.

In this context, it is identified as a problem the fact that, while in the campesino *milpas* in Mexico *traditional agricultural knowledge* is practiced to survive by means of producing maize and associated cultivations such as bean, amaranth, gourd, et cetera (*milpa*), in IAATL's with a mechanist and entropic vision, a great deal of scientific and technologic baggage of productive systems based on external supplies is taught, centered on the exploitation of nature and high yields through the knowledge of the laws of physics and chemistry, with a production-, market-based logic, disregarding the traditional agricultural knowledge accumulated along five millennia.

In the context of the environmental crisis and the pertinence of IAATL, it is proposed to take *traditional agricultural knowledge* to the academic space, answering for this some questions:

How to organize TAK in order to be studied in the context of occidental science?

How to take to the academic space this knowledge system generated in a manner different from the traditional scientific model?

The first question is answered through a proposal of systematization of TAK in the framework of the Kantian conception of organization, as a cognitive instrument of science. Organization as a cognitive instrument becomes evident in *The Transcendental Analytics of the work Critique of Pure Reason*, where Kant builds the concept of categories (Kant, 2003: 75-102).

To answer the second question, it was necessary to locate an educational model congruent with the principles of integral development and formation implicit in TAK, paying attention to do so to the educational models centered on learning and conceived under the paradigm of constructivism as a summary of the cognitive, humanist and historical-critical models that contemplate the formation of the individual in an integral way.

It is also necessary to pay attention to an alternative proposal to the disciplinary one, the trans-disciplinary proposal, or better expressed as hybrid disciplines (Victorino, 2003: 299-301).

With this background, and having as a substratum the work by Gómez (2004b) on the theoretical framework of TAK, its recovery, systematization and the TAK-Science intercultural dialogue, we propose the general instrumentation of an academic program on the *Traditional Agricultural Knowl-*

edge considering objectives, contents, methods, techniques and evaluation forms.

Conceptual elements

On the concept of education-formation

De Souza (2002: 15-17) states there are multiple sorts of education, depending on the type of pedagogy practiced, which at the time, depends on the values, ideologies and visions, which decide the nature and direction of education. So in each historic epoch there is a dominant pedagogy (Castells *et al.*: 1999); understanding pedagogy as the way of intervention in the formation of citizens in the values and relevant premises and commitments of a society (Godotti, 2001).

Hence, the plurality of concepts on education; in this work education is assumed as a process of intervention with intentionality, which tries to perfect the subject by means of a gradual, integral, active and permanent process (Yzunza, 2000), in coincidence with Edgar Morin (1999) when he asseverates that *human condition, must be the essential object of any education*. Nevertheless, it is also accepted that the purpose of education is referred to the perpetuation of an established tradition and the possibility of a different future (Ardoino, 1980).

On the other side, it is recognized that education must occur as a whole, in an interrelation with the objective and the subjective (Díaz, 1997). This concept coincides with the so called *populist formation* by Ornelas (1994), since this does not only respond to a single reproductive and conservative function, but it becomes an instrument for the development of society. From this perspective, social responsibility, the satisfaction of the prioritized needs, awareness of social and environmental solidarity are developed in the students, as well as making them critical, reflective and nationalist citizens.

Even though there is another perspective, the one called modernist formation (Ornelas, 1994). The modernist conception relates higher education with productive functions for economic development in relation to enterprises; its quality takes place with greater connection with productive processes.

In Higher Education Institutions (HEI) there is a tendency toward professional formation that essentially responds to the requirements of the productive apparatus (Feinberg, 1992); so *modernist* conception is that which prevails in higher education in Mexico, under the influence of the production-based approach as a guidance for the educational activity (Ysunza, 2000).

Education for sustainable development

As an agreement of the UN General Assembly, from the recommendations of the World Summit on Sustainable Development in Johannesburg, South Africa (2002), UNESCO proposes four pillars to reach sustainable development through education:

1. Recognition of the challenge (learning to recognize)
2. Collective responsibility and constructive society (learning to live together)
3. Acting with determination (learning to make and do)
4. The indivisibility of human dignity (learning to be)

The pillars proposed to reach sustainable development and the objectives of education (in parentheses) by UNESCO are corresponded and complemented. These principles send us back, at the time, to the goals and areas of action that are attempted to be assisted in the Decade of UN of Education for Sustainable development:

1. Poverty eradication
2. Gender equality
3. Health promotion
4. Environmental conservation and protection
5. Rural transformation
6. Human rights
7. Intercultural understanding and peace
8. Sustainable production and consumption
9. Cultural diversity
10. Information and communication technologies

In education for sustainable development, as a strategy, it is suggested working in an integrated manner in these areas of action for the 2005-2014 decade. Here it is where its conceptual richness and pedagogical intervention resides. Hence, for instance, the articulation *poverty and environment* gives an

account of meanings qualitative different from the two terms seen on their own; if cultural diversity is added, the construct acquires more complexity (González, 2000).

In the congress in Johannesburg (2002), it is reaffirmed that education is the base for sustainable development. Despite that in chapter 36 of the Rio Declaration it is accepted that there is not a universal model of education for sustainable development, there are differences in the local plan in function of the context, priorities and methods; priorities and processes are defined in order to satisfy the local environmental and social conditions.

In this context, quality education is a prior condition for sustainable development, assuming as objectives *the learning of learning, the learning of being, the learning of making and doing and the learning of coexisting*, giving education a new integral and interdisciplinary vision (UNESCO, 2004).

Among UNESCO's priorities *cultural diversity* is to be found: "our rich diversity makes our collective force", it is underscored in the Declaration of Johannesburg (2002). The Setting of the Plan of Action of the Decade has as an objective the protection of biodiversity as an essential element and as an indicator of sustainable development, in broadened entry of cultural diversity. One of the keys of this diversity is the respect to autochthonous knowledge and other sorts of knowledge, the use of autochthonous languages, the teaching and *the integration into the educational programs of the world-views and the autochthonous conditions of viability* (UNESCO, 2004).

Challenges of the higher agricultural education in Mexico

The challenge in higher agricultural education is a proposal of teaching, research and diffusion that responds to the different economic, social, ecologic and cultural scenarios of the country (Gómez, 2004a).

The challenge is the transition from an agriculture that is heavily dependent on external material and financial resources toward an agriculture based upon endogenous development; replacing as much as possible material supplies with intellectual supplies, as a response to a development with equity (Zepeda, 2003: 77-80).

The challenge is *quality* education, conceiving it as a social concept and under construction, therefore quality has different interpretations and ex-

pressions in function of the context, *it is not possible to build quality into education in an abstract manner, it has to be necessarily linked to a concrete society*. Quality in education must be contextualized in the framework of national, regional and local realities, hence considering the diversity of cultural expressions (Calivá, 2003).

In the global context, the challenge is to change from a traditional reductionist education to an integral education, under the criteria stated by UNESCO in the Delors Report: Learn how to recognize, make, do, be and coexist (UNESCO, 2001).

The challenge in the epistemological sphere has to do with the proposal of new ways to build up and access knowledge (Tunnermann, 1996), the new approaches to construct knowledge that emphasize the importance of the context and generation of new strategies.

To sum up, the challenge is to recognize and evaluate the teachings of history so as not to make the same mistakes; to recognize the value of diversity; substitute material supplies with human supplies; move toward an endogenous model, self-managed and self-generated from the resources at hand, with technologies suitable for the restraining conditions of Mexico, that propitiate agricultural development with equity and sustainability in a competitive market, by means of a heavy technologic component (Zepeda, 2003).

Trans-discipline a new paradigm in higher education

As from XIX century, the organization of knowledge in universities has occurred through disciplines, understood as an organizational category of knowledge which pinpoints at the specialized division of labor. Disciplines and specialization have their origin in the Napoleonic university, supported on the plot-like division of knowledge (Baldovinos, 2005).

In the schools of agricultural learning and teaching at higher education levels, from Chapingo Autonomous University (*Universidad Autónoma Chapingo*) to those created in the seventies, this disciplinary and specializing schema has prevailed (Victorino, 2003). In the context of the new millennium, characterized by diversity, quick scientific- technologic changes and the complexity of social issues, the disciplines turn out to be inoperative (Vilar, 1997); that is the reason why a more interdisciplinary orientation is

needed as an alternative to eradicate the problems of inapplicability of knowledge in a generalizing sense (Victorino and Huffman, 2001: 51-52).

An alternative proposal is trans-disciplinarity, which does not have as an object the encyclopedism in the sense of *addiction*. Its objective, from complex thought, is to organize knowledge, from the most important points and with a cycle of interrelations. Trans-discipline enables organizing disperse knowledge, since fragmented knowledge according to disciplines, prevents the link between the parts and the totals from operating; so, there must be another way of knowledge able to comprehend the objects into their contexts, complexities and sets (Morin, 2004: 23-27).

It is necessary to draw to trans-disciplinarity as the reality present in the national agro-sphere is characterized by complexity and integrality. When it comes to approaching agricultural activities, not only is, for instance, the genetic factor that determines the prospective yield approached, but also the factors that propitiate the expression of said potential: weather factors with their temperature, humidity, and wind elements; the edaphic factor in its physical and chemical aspects; the biotic factor with its components, weeds, plagues and diseases, as well as the social, economic and cultural factors (Gómez, 2004a).

Piaget (1978) refers to the classifications on the interdisciplinary relations: multidisciplinary, interdisciplinary and trans-disciplinary, and considers the latter as the supreme stage of integration, of construction of a total system where there are no boundaries between the disciplines. Keeping the dimensions of the European Piagetian thought, in Latin America is not but after half the XX century when a complex object of study appears, where there are interactions between social and natural sciences, and thereby the generation of a sciences with conscience (Morin, 2004).

Educational model to take TAK to the academy

The current models of professional formation are unsuitable for the context of the third millennium, since they are limited to the school space, considering suppositions of cognitive processes and socio-affective with the least pertinence. International organisms such as UNESCO, World Bank and the International Monetary Fund, among other, question the quality and pertinence of HEP's that do not meet the contemporary demands (Ángeles, 2003).

As an answer to these questions, the Seventh Meeting of the Inter-Governmental Committee of UNESCO (2001) recommends that the pedagogical process must be focused on the student. In Mexico, the policies of the 2001-2006 National Program of Education (*Programa Nacional de Educación, PRONAE*) consider the incorporation of educational processes that develop the students' capability to learn to learn along their lives, bearing among their criteria the pertinence of socially relevant knowledge and an educational activity centered on learning.

Ofelia Ángeles (2003) affirms that this orientation of an education approach centered on learning is characterized by objectives, strategies and resources, so as to achieve significant learning and learning to learn, emphasizing the student's autonomous activity and the possibility of relevant and pertinent learning. This implies that the student must be considered as a whole; said proposition is framed in "The seven necessary items of knowledge for education in the future" which is proposed by UNESCO (Morin, 1999), where it is stressed to develop in education the study of the brain, mental and cultural characteristics of human knowledge, of its processes and modalities, as well as both the psychical and cultural dispositions.

In order to intervene in the development of the learning process it is necessary to design proposals supported on approaches of cognitive-contextual nature that assist the individual in an integral manner, which implies educational proposals centered on the learning that comprehends a continual interaction between what is inside and outside of the one learning, where the internal dimension (the subjectivity, which gives meaning) determines the success of the process of learning (Ángeles, 2003).

A model of education centered on learning is the one called psychogenetic-constructivist, which has its origin in Piaget, in 1930, in his proposal of genetic epistemology. Other researchers who contribute to this educational model are Vygotsky (1920), who under the cultural-historical approach makes the proposition of the *Zone of Proximal Development* (ZPD) and *Scaffolding*; David Ausubel (1976) with *Meaningful Learning*; A. Maslow (1943) and Carl Rogers (1950) with the integral processes of human personality. This model has as an epistemological attempt the construction of knowledge (that depends on previous knowledge) in the interaction with

objects. Said model, conceived as a paradigm, (Ángeles, 2003) can be considered a summary of the other models centered on learning: the cognitive, the humanist and the critical-historical.

Some organizing principles of the contents under models centered on learning can be the following: articulated contextualized contents; construction of contextual weavings based on categories; identification of contrasts; holistic perception as a method to approach complex problems; development of affective and cognitive sensibility toward the environment and its conservation (Bourdieu, 1990).

There are other academic programs in special in Chapingo Autonomous University with similar intentions, such as *History of Agricultural Technology in Mexico* or *Alternative Technologies* in the curricula of Agricultural Engineer specialized in Agro-ecology, with a disciplinary approach or in phyto-technics through the academy of Ecology such as *Traditional Agriculture* and *Traditional Systems of Agricultural Production*.

The contribution of this proposal to the present work points at the rescue, systematization and comparison of knowledge-science, from a trans-disciplinary perspective and from an constructivist educational model centered on knowledge.

An approximation to Traditional Agricultural Knowledge

Some components of the work by Gómez Espinoza (2004b) are stated, since they are not only proposed as basic bibliography on Traditional Agricultural Knowledge, but also as a manual of the program as for procedures and methodology, mainly on the part of practical fieldwork which at least represents 50 percent of the suggested academic activity.

Among the components a theoretical framework is presented to approach SAT, considering the characteristics of the theories, positivism and emergent proposals; qualitative methods; SAT in the frame work of scientific knowledge; characteristics of traditional knowledge; approaches to agriculture in Mexican contemporary history and the study of SAT in the context of agro-ecology. The methodology that was used is based on the revision, analysis and reflection on and of documents.

A following chapter puts forward a methodological proposal of *Rescue and Systematization of Traditional Agricultural Knowledge* (Rescate y

Sistematización de Saberes Agrícolas Tradicionales), through ethnographic research carried out in indigenous communities. The organization and categorization is proposed on the base of criteria defined in function of the context, and using quanti-qualitative methods as instruments for a better understanding of this sort of knowledge.

Likewise, in the present study a comparative methodological proposal is made in order to determine possible correlations between the knowledge system of modern agricultural science and traditional agricultural knowledge.

It is necessary to point out that a pioneer of these works was Efraín Hernández Xolocotzi via “huarache research”, through Traditional Agricultural Techniques (TAT). Among his followers worth mentioning are: Bernardino Mata García, with his works on Participative technological development in Cholulteca populations; Leobardo Jiménez, with the creation of Plan Puebla; Artemio Cruz León, with his researches on “Productive resources and Traditional Agricultural Technology”.

Methodological elements

The elements of a curriculum of SAT are presented in a general manner, without giving it a specific name, as for example *Traditional agricultural sciences* or *Traditional technology*, so that it adjusts to the context of the educational institutions that might consider adopt it.

The *content* of the academic program is apportioned in five chapters:

- 1) Conceptual bases for the study of TAK
- 2) Their rescue
- 3) Systematization
- 4) Interpretation
- 5) Possible correspondences with the scientific method

These topics are approached in the three first chapters of a doctoral thesis by Gomez.¹

¹ (2004b), whose work has been the basement of this proposal and of which there is a book version titled *Traditional Agricultural Knowledge: its incorporation in agricultural education (Saberes Agrícolas Tradicionales: su incorporación en la educación agrícola)*, edited by Chapingo Autonomous University in 2006. A summary appears in *Revista Ra Ximhai*, vol. 2, num. 1, in its January – April, 2006 publication, pp 187-199. These documents are suggested as basic bibliography for this program.

The academic program on *Traditional Agricultural Knowledge* is located in the educational model centered on learning, known as constructivist which, because of its humanistic, critical-historical and cognitive characteristics, assumes education in an integral manner. As it is seen in the work by Gómez (2004b), the integrality is the substantive characteristic of TAK.

Under this model, the general structure of the program of study is presented considering objectives, object of study, problem, system of knowledge, contents, methods and didactical techniques and evaluation forms:

Objectives: the objectives are focused on the student and on the significant learning and in the processes of a *meaningful learning* and that of *learning to learn* (Ángeles, 2003). Thus, the objectives are written so that the level of assimilation, depth and systematization of the content become evident, with verbs which mean concrete actions (Rafael, 2002).

Instructive objectives are proposed (those directed to the contents as abilities) as well as *educational objectives* (those directed to achieve transformations in the student's personality), arranged in general objectives for the program, and specific by unit. In their redaction the abilities the students have to acquire, and how to achieve them, must be clear (Rafael, 2002).

In the structure of the program are also presented: *the object of study*, *the problem*, and *the systems of knowledge*.

The *contents* are shown contextualized, related to the objectives in a direct manner. They are structured in thematic units (Rafael, 2002). Likewise, in this proposal they are presented under a trans-disciplinary approach.

Methods and techniques; in the models centered on learning, the strategies and techniques are diverse and complex to build up knowledge from cognitive competences (Ángeles, 2003), and the resources are diverse for the intervention of cognitive processes (capabilities, skills and abilities) and affective (values and attitudes) into the meaningful learn and learning to learn. Nonetheless, *formative research* is suggested as a methodological resource so as to integrate theory and practice (Villarreal *et al.*, 1974).

Evaluation; this activity, as another moment of learning, implies the evaluation of both the academic activities in the classroom and in the field. Considering a model of integral formation, the valuation will cover cognitive as well as affective and value-based aspects.

General proposal of curriculum of TAK

General objectives:

Instructive general objective: studying the *Traditional Agricultural Knowledge* as a support for conceptual bases in the construction of a sustainable agriculture, by means of its rescue, systematization and TAK-Science intercultural dialogue.

Educational general objective: valuing the importance of the *Traditional Agricultural Knowledge* from its integral and holistic perspectives, both as farming survival strategy and in the formation of values of solidarity and respect to different cultures and the environment.

Instructive specific objectives

1. To discuss on philosophical, epistemological and technical concepts, making use of the analysis of documental sources in order to identify a conceptual framework on the study of *Traditional Agricultural Knowledge*.

2. To gather data from farming and indigenous communities on TAK, using ethnographic methods and techniques such as interviews, participant research and surveys.

3. To organize the *Traditional Agricultural Knowledge* identified in this work by means of its categorization to be interpreted within a context and under the farming logic.

4. To correlate *Traditional Agricultural Knowledge* rescued and interpreted in the local contexts with the agricultural knowledge of the scientific method, with an intercultural dialogue which privileges the mutual fertilization of the two systems of knowledge.

Object of study

Traditional Agricultural Knowledge through an emergent conceptual framework that allows its rescue, organization and TAK-modern science intercultural dialogue as a conceptual base for a sustainable agriculture.

Problems

Under which conceptual framework and by means of which methodology is the rescue of TAK possible? How to organize this knowledge? How to start an intercultural dialogue between TAK and scientific knowledge? How TAK procures sustainable agriculture?

System of knowledge

What science is, sorts of science, concepts and characteristics of the theories, positivism, qualitative methods, interculturality, ethnography, participative research, in-depth interviews, systematization and categorization, modern agriculture, traditional agriculture, history of agricultural science, agro-ecology, conservation, biodiversity, strategies of multiple use, ethno-science, genetic, edaphic, biotic and social factors that have an impact on agricultural activity.

System of abilities

Cognitive abilities

To identify key elements of documental sources; summarize and discuss documental conceptual or theoretical proposals; compare different theories, methods and techniques; discuss and explain the results from formative research; state discussions, and in the case, constructs or generalizations; carry out in-depth interviews, participative research and surveys; systematize data on rescued TAK; identify the factors of the agricultural activity from the agronomical and farming perspectives; identify possible correspondences between TAK and science; interpret the context and its importance on the application of science or techniques.

Integrating abilities (those of the affective and valuing spheres)

To respect the different forms of culture and rationality; to respect and care for the environment in all of its expressions; have an attitude of solidarity with every living being; behave in a tolerant and respectful manner; learn from the coexistence with the farmers the values of justice and equity; assume a humble attitude in order to learn how to learn to live the entire life in different contexts.

Content

1 *Introduction*

2. Background of agricultural science in Mexico

2.1 Maize, rector axis of the agricultural science in Mexico

2.2 Approaches of agricultural science

2.3 The spheres of agricultural science

2.4 The protagonists of agricultural science

2.5 Summary of agricultural science in contemporary Mexico

3. *Factors of agricultural activity*

- 3.1. Integral conception of the agricultural activity
- 3.2. The genetic factor (as potential of expression)
- 3.3. The environmental factor (weather, soil, biotic, man as expression of the potential)
- 4. *Theoretical and conceptual aspects to study TAK*
 - 4.1. Theory as a model and instrument of interpretation
 - 4.2. Positivist stance of the science
 - 4.3. Emergent modes of the science
- 5. *Methodological and technical aspects*
 - 5.1. Qualitative paradigm
 - 5.2. Ethnographic method
 - 5.3. Participative research
 - 5.4. In-depth interview
 - 5.5. Surveys
- 6. *Traditional knowledge, agro-ecology and sustainability*
 - 6.1. Theoretical and practical aspects of traditional agriculture
 - 6.2. From myth to science
 - 6.3. Indigenous agriculture
 - 6.4. Revaluing of traditional agricultural knowledge
 - 6.5. TAK in the construction of a sustainable agriculture
- 7. *Systematization of traditional agricultural knowledge*
 - 7.1. Concepts of systematization
 - 7.2. Criteria and methodology of systematization of TAK
 - 7.3. Data coding
 - 7.4. Categorization and interpretation of TAK
- 8. *Correlation science-traditional agricultural knowledge*
 - 8.1. Intercultural dialogue
 - 8.2. Identification of the problem
 - 8.3. Presentation of ethnographic knowledge
 - 8.4. Contextualization
 - 8.5. Qualitative interpretations
 - 8.6. Reflection and synthesis of correlations

It is convenient to point out that most of these contents are considered in the first three chapters of the thesis by Gómez (2004b), a document that has become the basic bibliography of this program. The practical stage of

the program, which makes up at least 50% of it, will be carried out in rural and indigenous farming communities with the methodology suggested by the aforementioned author, instrumented with participative research, open and closed interviews, surveys, et cetera.

Didactical instrumentation

The methodology and techniques understood as didactical strategies of the educational models centered on learning require the intervention, not only of cognitive processes (capabilities, skills and abilities), but also those related to affection and attitudes (values and attitudes), so a great deal of diversification of resources is needed (Ángeles, 2003). In this proposal of Educational Program on Traditional Knowledge formative research, learning based on problems and participative research are proposed.

On the evaluation

In the educational model centered on learning or on the student, the evaluation is conceived in an integral manner, so it will also cover the different aspects of their formation: intellectual abilities as well as those related to values and attitudes.

It is suggested to carry out a continual evaluation as part of the program: homework, reports, attendance and participation in the lesson, work in communities, seminars, etc.

The evaluation will incorporate qualitative and quantitative elements agreed with the students; in the models centered on learning one starts from the premise that the student is the protagonist and responsible for their learning, so it is suggested to propitiate self-evaluation as part of this feedback task in the learning process.

It is also suggested to assign a balanced value to the theoretical activities as well as the practical or formative research activities here proposed.

Discussion

On the function of the professor and that of the student

In the educational model centered on learning, the student takes on a central role in the construction of their own learning. The premise in the constructivist model assumed in this proposal is that every item of information acquires the character of knowledge, but only until the moment the

subject reconstructs it from their own perspective (that involves background, culture ideologies and interests) and from their particular cognitive logic.

In this process, the function the professor assumes is that of orienting and flexible leading through stimulating, advising or instruct the student, fostering the expression of the individual learning characteristics.

On hybrid disciplines

Incorporating TAK into the scholarly space of IAATL implies breaking a series of inertias, not only paradigmatic and epistemological but also of the traditional educational model that characterizes these institutions. Among the inertias disciplinarity is to be found, since TAK occur in an integral and holistic manner; they could not be understood under the plot-like form of the disciplinary structure.

Victorino (2003) mentions the concept of *hybrid disciplines* as forms of trans-disciplinarity. This concept has its roots in genetic science, where a hybrid is an organism product of the breeding of two or more lineages or species which originate a different phenotypical expression and with greater vigor (hybrid) than any other of their progenitors (Gómez, 2004b). In the hybrid product, the genotypes lose their identities to provide by means of genetic interaction (between genes), the interaction with the environment a different organism.

In similarity to the genetic concept, hybrid disciplines, as a cross-breeding of several disciplines, lose their identity as they interact with each other and the environment where they are expressed, creating a new dimension (holistic) of comprehension and interpretation of a complex reality, different from the particular interpretations of the disciplinary sphere.

On formative research

Educating for research and educating through research, in spite of seeming dissimilar, are rather complementary concepts when they are taken into the sphere of the educational methods, as not only do they impact on research, but also in the formation of the students, in the application of the scientific method and their questioning of the realities.

In this work's proposal formative research is suggested as a learning method for almost 50% of the activities of the program.

On spheres: complexity and contextuality

Along the educational proposal to instrument the incorporation of TAK into the curricula of IAATL, the implicit complexity in the perception of reality becomes evident, as well as its interpretation and transformation, which fosters in the student the instrumentation of processes both cognitive and affective, geographically, historically and socially contextualized.

On the educational model centered on learning

Other inertia to be broken is referred to the reductionist vision of teaching that only saw the systems in the curricula, disregarding the spheres related to affections, values and attitudes, elements and factors which are constitutive of the system of knowledge implicit in TAK.

In the educational models centered on learning there is a way to break with this inertia of traditional teaching. In this work it is assumed that in the model centered on learning, known as constructivist, the other three models centered on learning are summarized, which also include the humanist, the critical-historical, among other approaches. The premise of this model is that knowledge takes place as a construction process in each student in an integral manner.

Traditional agricultural knowledge is generated within a complex context, integral and contextual, so in order to approach this knowledge into formal educational processes, one draws to models that contemplate these characteristics. The educational models centered on learning are suitable to the formation of students with this knowledge, since they state integral formation.

The constructivist educational model fits the dimensions which characterize TAK, not only in the syncretic approach of the humanist, cognitive, and critical-historical models, but also because of its characteristic of construction of knowledge that the student must undertake from their particular capabilities, edifying multiple realities from their perception, a process which is also followed in the construction of TAK in farming and indigenous communities.

Conclusions

The educational model centered on learning, where the proposal of this work is to be found, meets the requirements for education recommended by UNESCO (1989): *learning how to learn, learning how to make and do and learning how to coexist*, and they are fully complemented with the proposal by the very UNESCO (1999) on the seven items of knowledge of education for the future, which give an integral and holistic approach to the process, for an education that fits the comprehension of a complex reality of a change of epoch the planet lives in.

In this analysis the constructivist model centered on learning as innovative educational proposal is approached, in order to take TAK to the curricula of IAATL as it adjusts to the complexity, integrality and the ways traditional agricultural knowledge is build in indigenous communities.

The constructivist educational model summarizes concepts which support cognitive, humanistic and critical-historical models, also identified as *centered on learning*. Because of this, TAK can be incorporated into the programs of studies, on the conceptual bases of this model.

In the proposed academic program on TAK instructive and educative general objectives, the problem to be studied, the system of knowledge, and the cognitive and valuing abilities expected to be acquired by the students are specified.

The methodological proposal or instrumentation of the lesson remains open to the specific characteristics of each academic community; nonetheless the methodological proposal of *formative research* is stressed. Didactical resources are presented in an indicative manner.

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