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# THE CHOICE OF INTERDISCIPLINARITY IN FRENCH AGRICULTURAL EDUCATION<sup>1</sup>

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**Abstract:** Agricultural education very early on tested a generalized mandate of modular interdisciplinary education. In this regard, it constitutes an interesting medium for observing the conditions required for developing interdisciplinarity in an academic context. Based on a historical approach, this text shows how a series of experiments led to a generalized mandate of interdisciplinary education in the whole of training concerned, as well as the questions raised by this generalization. Analyzing the discrepancy between the prescription and declared or observed interdisciplinary teaching practices leads, in the conclusion, to a series of hypotheses on the obstacles encountered.

**Key words:** Interdisciplinary curricula, academic reforms, systemic approach, agricultural education.

## Introduction

Pluridisciplinarity has been a key component in the pedagogical aim of technical agricultural education in France for over 30 years. This largely explains why the agricultural institution, which is under the supervision of the ministère de l'Agriculture, is considered an innovative laboratory by the entire French educational system. Its small size and professional vocation

make it a highly responsive and constantly adapting system. Consisting of 220 establishments across France, it offers initial training through academic programs, general scientific programs, and technological and professional programs (ChloroFil, 2010). These paths prepare students for national diplomas and are developed by the Direction générale de l'enseignement et de la recherche of the ministère de l'Agriculture et de la Pêche. Devoting an article of this special issue to examining the experiences of technical agricultural education in France is interesting for several reasons:

- First, for its historical interest. As far back as the 1970s, it extensively piloted interdisciplinary teaching practices. A complete reform of the programs in the form of pluridisciplinary modules in 1985 broadened the mandate to encompass the entire initial training system (DGER, 1985a). It is therefore possible to analyze the evolution of the prescriptions and forms of curricular organization over several relatively long reforms and to analyze the impact of a strong institutional directive on the evolution of teaching practices;
- The study is also of epistemological interest due to the particular characteristics of content taught in agricultural education. Programs are characterized by different areas:
  - learning a culture of life;
  - understanding complex subjects such as the functioning of a farm within the social structure of a given territory;
  - becoming familiar with skills that enable intervention in a group of professional situations characterizing agricultural and rural occupations.

This text is divided into four sections. The first traces the historical background of the principal development steps of interdisciplinarity in agricultural education. It allows for an understanding of the origin and meaning of the forms of interdisciplinary education prescribed therein, and for raising awareness of a few aspects of this system's culture. The second section describes the form of interdisciplinarity as prescribed in the curricula, as well as the main interdisciplinary teaching content they define. The third section seeks to account for establishments' interdisciplinary teaching practices based on data from various studies and research that we have reviewed, distinguishing what pertains to declared or described

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practices from what is directly observed by a third person using an explicit methodological frame. We conclude by analyzing how the history and experiences specific to technical agricultural education can shed light on the larger question of the development of interdisciplinarity in schools.

## 1. A History of Interdisciplinarity in Technical Agricultural Education in France

### 1.1 *The Aims of This Educational System*

The history of agricultural education (Boulet, 1983; Boulet & Mabit, 1991; Charmasson, Lelorain & Ripa, 1992) shows that its evolution has always been determined by the role that farmers were expected to play in society. Under the supervision of the ministère de l'Agriculture, technical agricultural education was developed as a tool to accompany the policies implemented since the beginning of the 19th century concerning the rural world.

In France, following the last war, the need to ensure food self-sufficiency led to the 1960 law on agricultural modernization. This law, primarily through its structure policy, sought to make the agricultural sector productive and cost-effective, thanks to scientific and technical advances resulting from research and modern methods for commercializing its products.

Training played a key role in this plan as a complement to a development model conceived as an organized application of a group of techniques. In 1945, agricultural education concerned only a small number of farmers, 98% of whom had no technical training, (Boulet & Mabit, 1991). The establishment of a real system for initial and ongoing training can be situated in 1960 as a pedagogical component of this plan for agricultural modernization. Consistent with this policy, a twofold objective was bestowed on agricultural education: to train competent farmers capable of ensuring competitive agriculture and to enable farmers to become a part of the French educational system in their own right, by providing young people from rural settings with equal access to general education and culture.

The recourse to interdisciplinarity was therefore promoted very early on in this system as a way to support students' integration of knowledge:

- To enable them to understand the natural and social environment in which they live, and in which they will take part as citizens and professionals. This gave rise to the practice of the “environmental study” (*étude de milieu*) in the 1970s. The notion of milieu here goes

beyond that of the natural milieu and includes all systems with which human beings interact;

- To inform technical actions and decisions required in the future practice of a professional activity.

### 1.2 *The Origin and Evolution of Interdisciplinarity in Technical Agricultural Education*

The various documentary sources (Bascle & Bouillier-Oudot, 1998; Leblanc, 1998; DGER 2000) relating the history of interdisciplinarity in agricultural education cite two founding steps: environmental studies in the 1970s and experimentation in the training of farm operators (FoCEA), which led to the creation of the agricultural technician diploma with a specialization in farm operation (BTAO CEA). We present a summary of the aims given to interdisciplinarity in these initiatives as well as the measures implemented.

**1.2.1 Environmental studies in the 1970s: Interdisciplinarity in the service of a project-based pedagogy.** Studying the nearby environment using detailed monographs has been a traditional part of agricultural education since its beginnings. At the end of the 1960s and in the 1970s, sequences referred to as “environmental studies” were developed in the movement of active pedagogies<sup>2</sup> (Meirieu, 2008) and certain social movements led by ecologists and new rural dwellers. These sessions, which can be situated as a first form of environmental education (Bouillier-Oudot, 1999), were organized into a one- to two-week immersion, in chosen areas outside the establishment, of an entire classroom group accompanied by a pluridisciplinary team of teachers. Presented as an alternative to traditional compartmentalized education (Camusard & Maddens, 1988), these sequences provided agricultural education with significant avenues for pedagogical innovation in which were piloted, in a project-based pedagogy, environmental approach methods drawing on the whole of the dimensions of a given subject.

Reviews from this period show that this was hardly a marginal practice: 65% of establishments organized this type of sequence (Coudray, 1977). The publications of the Institut national de recherche et d'application pédagogique (INRAP) of the ministère de l'Agriculture, created in 1968 (Benois et al.,

<sup>2</sup> Movement of *Éducation nouvelle* developed in the CEMEA: *centre d'entraînement aux méthodes d'éducation active*.

1977), which was involved in the formalization and promotion of these sequences, enable a description of the prescribed pedagogical approaches.

An environmental study can thus be described as a pedagogical sequence aiming to teach students to construct their own knowledge and give meaning to their learning by anchoring it in the social reality with which they are confronted. It involves beginning with experience or an experienced action, to stimulate interest and base learning on the question of becoming familiar with the environment in a context of active research. One essential aspect of the approach is that students are in direct contact with reality; they observe it in order to perceive phenomena globally in a sensory way before acquiring isolated and rational knowledge. The environmental study originally promoted by physical education teachers is comparable to outdoor activities in nature.

Beyond this sensory approach, teachers are asked to support and organize learning by creating the conditions needed to pass from spontaneous experience to rational and methodical knowledge. This requires the use of references from various disciplines as well as student integration of these references to construct a synthetic and relevant model of the studied reality. The hypothesis is that it is insufficient for students to acquire an organized set of knowledge to be able to use it as a tool for questioning and interpretation. Students must develop a procedure for elaborating a global and dynamic conception of the reality in which they find themselves. For this to occur, documents formalizing the methodology insist on two points:

- The importance of activities related to information communication and processing (spoken and written language, mathematical language, symbols and codes, drawings, sketches, diagrams, maps, audio-visual elements). It is a matter of expressing one's perceptions, of encoding perceived information that is collected and constructed so as to make it intelligible in view of being able to debate it in the context of group work and to communicate it to the social players of the studied milieu;
- The relevance of using a systemic approach to establish relations between elements observed in the field, or gathered information, is to build (model) meaningful wholes (systems), understand how these models evolve or are maintained, and explain a certain number of phenomena by situating them in the appropriate integration level (ecosystem, farm, drainage basin, commune, small farming area, etc.).

This systemic approach provides bases for interdisciplinary methods in agricultural education. It can be said to constitute a series of increasingly encompassing levels characterizing its principal teaching content: the parcel of land, the farm, the drainage basin, etc. Certain disciplines are pertinent at one level but not another.

**1.2.2 The FOCEA (formation des chefs d'exploitation agricole) experiment: Interdisciplinarity in the service of professionalized training.** The origin of this experiment can be found in a directive addressed to the INRAP by the Direction Générale de l'Enseignement et de la Recherche (DGER) of the Ministère de l'Agriculture to reconsider farmers' initial training in view of enhancing professionalization (Hatzfel et al., 1981). This directive was based on a twofold observation. First, the competencies acquired by students were inadequate and poorly adapted to enable them to run a farm with the efficiency expected in a context of modernized agriculture. Second, most of the program content amounted to a mere juxtaposition of disciplinary knowledge.

The experiment approached the problem first by defining the training objectives on the basis of a study of the farming occupation, then by piloting, within the actual conditions of the educational system and over two complete training cycles in 15 volunteer establishments, methods for more adapted training.

This led to the articulation of several main themes for the reform of agricultural education programs (Hatzfel et al., 1981):

- It is necessary to base professional training on a study of the occupation (that is, a description of the practices the subject must carry out in the context of the occupation). This equates with defining training based on a logic of knowledge use rather than only on a disciplinary logic. Analysis here leads to identifying the particularities of the farming occupation: no division of labor, no separation between professional and family life. The experiment underscores the importance of training in decision making, in order to enable action within a complex system such as a farm;
- Professional training must lead to the acquisition of competencies. It must be centered on the development of the student as a social player. The competency students must acquire is demonstrated by the mastery of operations to be carried out in the professional situations with which they are confronted in the practice of their occupation. Training leading to qualification must relate three

elements: professional situations, operations, and a corresponding combination of knowledge to be mobilized. This knowledge is identified as theoretical, practical, and procedural;

- Finally, the experiment concludes in the need for establishing a pedagogy that allows for preparing students to develop skill-related intelligence, that is, intelligence related to decision making in complex situations and to implementing these decisions. This pedagogy is supported by training situations related to real professional problems. These situations must allow students to confront the complexity of the field and must lead to the application of solutions to a given problem. The FOCEA experiment, which is centered on an objective-based pedagogy, considers interdisciplinarity a vital part of its propositions. It has enabled a definition of certain types of situations corresponding to the acquisition of primary competencies that it defines as 16 required points (*points de passage obligés* or PPO). For instance point number four specifies “Raising awareness of the farm system, the family, the environment.” Consisting of aims, objectives, concerned disciplines, and promoted activities, PPOs can be characterized by several principles:
  - Involving students by engaging them in the project;
  - Involving teachers of various disciplines in these pluridisciplinary crossroads, which are prepared, realized, and collectively managed by a teaching team;
  - Ensuring consistency between the training objectives and the evaluation methods used.

Identifying these PPO led to a reconsideration of the objectives assigned to on-farm practicums. Practicums had been considered a part of technical and practical training based on the mere participation in farm work before 1979, when their objective became to develop a global understanding of the functioning of a farm.

In line with this movement, a methodology for an interdisciplinary approach to farming (global approach to farm operation) was formalized and hence constituted a reference for high schools specialized in agricultural education (Marshall, Bonneville & Franfort, 1994).

**1.2.3 Program reform in 1985: The generalized mandate of interdisciplinarity.** This reform was recognized in the French educational system for its voluntarism and innovation.

It was implemented in 1985 with the agricultural technician diploma (*Brevet de technicien agricole* or BTA) and represented a clean break from preceding programs primarily organized into groups of subjects, that is, according to a disciplinary logic (DGER, 1985a).

The BTA curriculum generalized pedagogical knowledge issuing from the above described experiments. It included them in an aim characterized by the will to train students globally in view of a group of social and professional practices, to compartmentalize the disciplines and better define general and professional training.

This training program was structured entirely according to a modular pluridisciplinary logic. The organization of knowledge clearly belongs to a systemic approach that “by relating the elements in a coherent whole creates a conceptual frame” (DGER, 1985b, p. 16). The modules plan for and quantify the participation of the various disciplines concerned.

This reform institutionalized a new curricular structure that continues today to organize the training related to agricultural technical education. We will describe this structure more specifically in the second part of the text.

**1.2.4 In the 1990s: Interdisciplinarity in the service of new environmental themes.** Although less marked than the preceding step that institutionalized a new curricular structure, this development nevertheless concerned all of the reformed programs. Various authors (Thiébaud, 1994, Hervieu, 1993) consider 1990 a pivotal year in the evolution of the perception of farming in French society. A politicization of the debate contributed to bringing agriculture into environmental problems addressed by social regulation, similarly to other industrial activities. This resulted in a new perception of agriculture and the rural milieu. A number of questions were raised, bringing to light the incoherence of a system that over-produced, polluted, created territorial inequalities, and offered risky food. Economic and ecological imperatives led to the need to rethink the developmental model of French agriculture. Training was quite directly questioned.

The impact of this evolution on programs is clear. The objectives given to training were revised. New disciplines were used more, largely in programs such as ecology, geography, and history, in order to lay the bases for a new conceptual frame to replace the aim of dominating matter, which had characterized the years of agricultural modernization. Besides the creation of training programs centered on new occupations related to agricultural education and focused on the management of natural

milieus and environmental education, all programs were enriched by new interdisciplinary themes intended to train students in view of a systemic vision of natural dynamics and to make them aware of the impact of technologies on the environment. These different periods of experimentation and innovation resulted in institutionalized transformations through a process of curricular reform.

In the following paragraph we describe the structure of these curricula and analyze their evolution by examining two key training programs in agricultural education: the *brevet de technicien agricole* (BTA) and the *brevet de technicien supérieur* leading to the qualification of agricultural development advisor (*conseiller en développement agricole*).

## 2. The Mandate of Interdisciplinarity in Technical Agricultural Education: An Analysis of the Structure of Curricula and Their Evolution in the Various Pedagogical Reforms

We will base this description of curricular structure on the *brevet de technicien agricole* (BTA) which, as the first diploma that was changed, initiated a framework elaboration process spanning approximately 10 years. This diploma, which later became a professional bachelor's degree, leads to the qualification of farm operator (*chef d'exploitation agricole*).

We will then examine the processes by which the designers of these programs contributed to the evolution of the mandate, by seeking to underscore changes made in the pluridisciplinary organization of the curricula.

### 2.1 The Choice of an Organized Modular Construction

The reformed BTA curriculum consists of a set of modules. Each module represents a coherent pedagogical unit, defined by a general pedagogical objective. This objective is organized into a tree structure of increasingly precise objectives leading to a level permitting an unequivocal description of the pedagogical intent by means of an observable behavior under defined conditions (operational objective), according to a methodology issuing from objective-based pedagogy (Mager, 1975; Hameline, 1979), to which the program explicitly refers. The promoted training content is shaped to correspond to these objectives. The choice of a modular logic underlying this approach is based on the hypothesis that, to be trained in view of competencies, students must integrate knowledge from various subjects in a logic of oriented action.

This group of modules belongs to a structure composed of three broad categories as seen in Table 1 below.

**Table 1**  
**Elements Constituting the Curriculum of Each Diploma**

<p><b>Fundamental modules (relative to general education) common to a level of training:</b> Fundamental learning (written and spoken expression, foreign language, mathematics).</p>	<p>Definition of a level of general culture.</p>
<p><b>Modules specific to a professional sector:</b> Shared scientific bases; Approach to biological and socio-professional systems within which the applied techniques acquire meaning.</p>	<p>Culture specific to a given professional branch. Collective and organizational dimension of qualification.</p>
<p><b>Modules specific to each option or specialization:</b> Technological processes common to various practices.</p>	<p>Technical dimension of qualification.</p>

The fundamental modules constitute a first category common to the whole curriculum for a level of training: here, that of technician. These modules target fundamental learning and its application in the context of a social and cultural practice. This category contains six modules: French, literature, and communication techniques; knowledge and practice of a foreign language; knowledge of the body and physical/sports activity practices; social knowledge and practices: learning related to civic and social life; knowledge of the contemporary world: thinking critically and forming an opinion; and mathematical knowledge and processing numerical and statistical data. A second category contains modules common to the set of qualifications relative to a professional sector, that is, pertaining to a particular social, economic, and cultural environment. The third level focuses on technological knowledge and professional practice specific to given qualifications. It contains two types of modules. In the production sector the first type of module targets the development of scientific and technical knowledge underlying a global understanding of a production process. More specialized, the second type of module enables

students to acquire the principal knowledge and know-how related to a given production type. Each student chooses one or two production types to support a methodology that can be transferred in the realization of other agricultural production types.

## 2.2 Analysis of the Evolution of this Curricular Structure

### *During the Process of the Reform of the Whole of Programs*

This process lasted approximately 10 years, during which all diplomas of the various levels of training were revised in view of being integrated into this curricular model. A report presenting a review of the reform (Rémond, 1994) shows that the structuring mode initiated in 1985 sparked a series of debates that are highly interesting for our study.

#### **2.2.1 The problems posed by the entirely pluridisciplinary curricula.**

One first preoccupation concerned the risks of atomizing disciplines within all of the modules, a process likely to prevent the establishment of genuine learning of the conceptual frames specific to each discipline. Indeed, each discipline expresses a world view according to a certain number of rules, principles, mental structures, instruments, cultural norms, and/or practices specific to it (Fourez, 1996). Within the modules, the fragmented disciplinary contributions are devoted to solving problems, making decisions, and choosing action in an opportunistic manner. Consequently, throughout the reform of the various levels of training following this BTA, an evolution can be observed in the manner of integrating the disciplines into frameworks (Bouillier-Oudot, 1999). Progressively, a few monodisciplinary modules reappeared, notably in mathematics, biology, and foreign language.

Starting in 1996, in professional bachelor's programs, pluridisciplinarity was articulated in most modules through a pilot discipline imprinting its logic to the whole. This includes the module "Connaissance et pratique de la langue française, approche d'une oeuvre littéraire" in which French is the principal discipline with 125 hours including 24 to be realized in a context of interdisciplinary sequences. This discipline involves documentation (9 hours), sociocultural education (10 hours), and history and geography (5 hours). These measures are accompanied by more specific indications for situations in which pluridisciplinary must be used. "Concrete pluridisciplinary situations" are thus identified with a fixed schedule for each of the disciplines used (Bouillier-Oudot, 1999).

A review of the programs clearly shows that the only entirely pluridisciplinary modules structuring the programs correspond to the understanding of complex subjects specific to agricultural education, such as the farm and its environment, for which an interdisciplinary method had long been implemented in establishments.

**2.2.2 Can interdisciplinarity be mandated?** A second series of questions raised by this reform concerned the appropriateness of prescribing interdisciplinarity. Based on foundational experiences of interdisciplinarity in agricultural education, it can be observed that environmental studies have always developed on the fringes of more traditionally implemented programs. The sequences were experimental in nature, often involving disciplines other than professional, scientific, and technological ones central to training in agricultural education.

The Rémond report (1994) points out the difficulty of a priori planning of interdisciplinarity, that is, the a priori construction of the form according to which the disciplines must be integrated over an entire framework and the definition of the nature of the disciplines that will necessarily be associated.

Interdisciplinarity is never justified in itself but rather by the favorable effects to which it can lead. It is established in a specific way in a project, when its absence would lead to a loss in the meaning of action undertaken. It is the project itself that must guide the procedures for the use of the disciplines. (Rémond, 1994, p. 40)

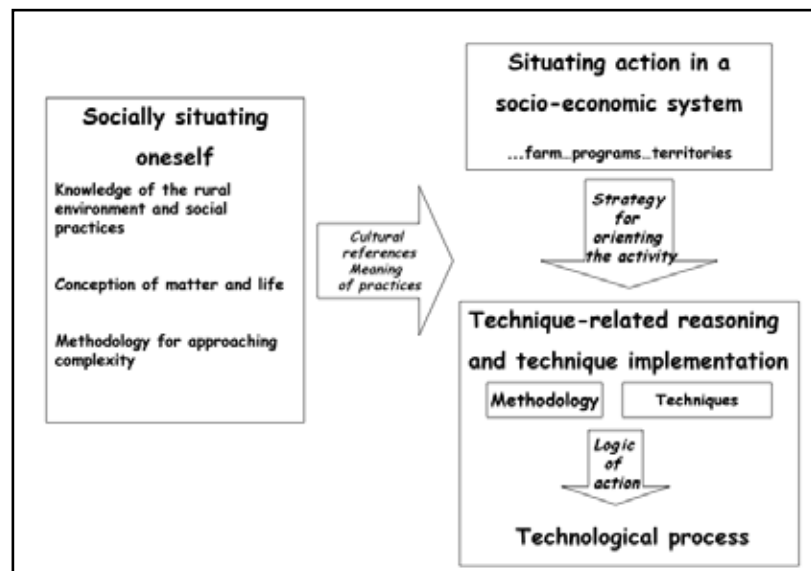
The report advocates a return to greater flexibility, by agreeing with the idea of required points, that is, the interdisciplinary crossroads of the FoCEA experiment, and by granting greater latitude to establishments in the implementation of the rest of the framework.

The author, in contrast with those recommending exceedingly integrated or constrictive frameworks, objects to the fact that the choice of learning situations and the nature of disciplines to call upon fall under the competency of teachers, within a frame fixed by the institution: pedagogical objectives, competencies to master. The collective work presiding over the definition of the project on which students will work is essential for creating the necessary conditions for interdisciplinary learning and for bringing together a pedagogical team. Consultation, which is indispensable in this practice, only works well in the dynamic of a pedagogical aim.

### 2.2.3 From the prescribed program to the aim of the pedagogical team: The question of the meaning of the curriculum and its interpretation by teachers.

As a result, the curricular structure implemented by the reform in 1985 is complex and can be perceived as restrictive because it imposes disciplinary grouping. An in-depth analysis of these programs has nevertheless led us to conclude that they, in fact, tend toward greater establishment autonomy, but also toward greater expectations in terms of competencies required for their implementation by teaching teams (Bouillier-Oudot, 1999).

The curricular structuring initiated by the BTA can be analyzed as a construction allowing for the formalization of three systems of meaning that transcend the implementation of technological processes specific to the various qualifications, as shown in Figure 1 below (Bouillier-Oudot, 1999, p. 62).



**Figure 1.** The various relations between the groups of pluridisciplinary modules in reformed programs.

For each professional program, this structuring is oriented by the definition of the set of competencies to be acquired by students. While the notion of competency is associated with the ability to act appropriately (Rey, 1998), it is essential not to dissociate the learning of action (management of the technological process) from that which contributes to bestowing the

students with a critical view of their environment to guide this action (the cultural references and understanding of the professional context) and to give it meaning.

This is what is at stake in the articulation of the various knowledge types within a module, as well as between the various module categories we have presented in Figure 1. In the context of an interdisciplinary pedagogy,<sup>3</sup> this establishment of relations supposes that the teacher offers training situations leading students to use these different knowledge types within an oriented approach: e.g., analyzing a situation, solving a problem. Teachers' ability to analyze globally the meaning of a curriculum and to ensure its didactic and pedagogical translation, that is, transforming a list of objectives into training situations integrating knowledge from various disciplines, is central to the implementation of this reform.

To illustrate this point, we find it interesting to analyze the meaning and functions of a central discipline in programs of technical agricultural education: biology-ecology in successive versions of the BTA program.<sup>4</sup> In the version written in 1989, the main biology module entitled "Knowledge of Matter and Life" constitutes one of the modules of this sector. It contributes to the development of the scientific culture common to the entirety of qualifications relative to agricultural production occupations. This module thus targets the acquisition of fundamental knowledge that allows for understanding physical, chemical, and biological phenomena underlying agriculture as an activity centered on the mastery of biophysical systems (Bouillier-Oudot, 1999).

This agricultural technician program was revised in 1992 (DGER, 1992) at a moment when the world of professional agriculture found itself confronted with environmental issues. To take into account this new social demand, biology-ecology appeared in the following ways:

<sup>3</sup> To describe these practices, we must clarify our definition of *pluridisciplinarity* and *interdisciplinarity*. In line with Lenoir (1991), we consider a pluridisciplinary practice one that leads to a juxtaposition of various disciplinary points of view in order to shed light on a theme and to build a more complete and more global understanding of it. We associate an interdisciplinary practice with a constructivist approach to pedagogical intervention that favors methods of cognitive inter-structuring (Lenoir 1995). These methods take into account both the need for interaction between the learning subject and the learning objects and that of a mediation of the relation between the subject and the object through an organized learning approach (Lenoir, 1993, 1996).

<sup>4</sup> Outside the significant reform movement we have described, the professionally-oriented curricula are regularly revised to take into account the evolution of occupations.

- In terms of basic modules contributing to student construction of social and cultural references: an introduction to the geo-biological dimension of the human environment as an element to consider in the organization of social relations;
- In terms of modules describing technological processes: a reference to an ecological approach to the production environment, an introduction of the notion of agricultural ecosystem.

We consider another change worthy of mention: the explicit appearance in pedagogical program recommendations of links to be made between the various module levels in their implementation.

A third step was reached in 1996 (DGER) when the BTA became a professional bachelor's degree. The basic modular structure was nevertheless preserved. Continuing to trace the ecological trajectory, we observe that at this period it was the sector modules that were again affected with the appearance of the study of ecosystem dynamics. The objective of the module became to reason concerning one's actions as a citizen and player in the milieu (Bouillier-Oudot, 1999). Other fundamental disciplines used in basic modules such as history and geography contributed to this evolution of the frame of reference based on which the future technician would examine and make choices concerning environment-related actions.

These three steps characterize the evolution of farm operator training over 10 or so years and shed light on the function of the disciplines within pluridisciplinary modules and within students' global training via the establishment of inter- and intramodular relations. The dynamic of construction of these curricula leads to subjecting the choice of content and use of disciplines to the political aim of the institution and to the objectives defined by the prescribers. The changes we have highlighted answer the needs:

- To contribute first to the conceptual frame, the cultural references of the agricultural world until then trained for intensive production through mastery of natural factors and for operating farms according to an essentially economic logic. Curiously enough, in 1989 ecology replaced philosophy with regard to the function of making students reflect on the relation between humans and nature. It is ecology, at least in France, that first became the voice of a necessary awareness of environmental problems. It was therefore used first, and precisely in order to carry out this function of

raising awareness of a new world view, even if scientific references permitting the creation of new production practices and strategies were, as yet, seldom operational;

- Next, to found strategic farm-related choices differently. In 1996 (DGER, 1996), ecology returned to its function as a scientific discipline permitting the diagnosis of production environments and of milieus influenced by this production. The relations established between biology modules and the economics module centered on the analysis of farm operation led to the development of a global analysis of the farm-environment system based no longer only on economic data but also on a diagnosis of the natural environment. The entire orientation strategy of farming was therefore modified. More sophisticated "clean" technologies complemented this process. However, it is not at this level that the most significant orientation changes took place, but rather at the level of strategic choices farmers would make in a logic of sustainable development of their farms; this is where the key issues reside.

In this process of changing choices concerning interdisciplinary projects, the nature of chosen training situations used and the disciplines mobilized by teaching teams are essential for orienting the meaning of learning. How did teachers appropriate these prescriptions? And what is to be said of interdisciplinary teaching practices in high schools specializing in agricultural education?

### 3. Interdisciplinary Teaching Practices in Agricultural High Schools

We present these practices across the system using a series of studies spanning 30 years. These studies are primarily based on surveys. They take stock of teacher opinions and conceptions regarding the relevance of interdisciplinarity and the procedures for its implementation, and describe declared teaching practices. The only study including a direct observation of teaching practices using a sizable sample of establishments was conducted by an inspection agency in 2000 (DGER, 2000). Reviews of practices in environmental studies we have consulted also appear to be based on field observations made in the context of action research. The published documents nevertheless remain very general and do not explain the methodologies for observing chosen practices.



The review here proposed is therefore a result of information from these various studies and reviews on the practice of the environmental study (Coudray, 1977, Aboudarahm, 1980, Tessier, 1981), on the evaluation of the agricultural education reform (Rémond, 1994), on the national consultation realized in 1998 by the Education Nationale on “What knowledge should be taught in high school?” (DGER, 1998) including a section on agricultural education, and finally on the review carried out in 1998 by the Centre d’expérimentation pédagogique de Florac (CEP, 1998) concerning the implementation of “concrete pluridisciplinary situations” prescribed in the professional agricultural bachelor’s degree.

The latest large-scale study carried out by the inspection agency in 2000 draws on two information sources to evaluate the implementation of pluridisciplinarity:

- Analyses of teaching sessions identified by the teams as pluri- or interdisciplinary. Fifty-three sessions were observed, addressing all training levels in establishments across France;
- Interviews with teachers before the observation of sessions, and with the management team in order to ascertain the institutional level of implementation of interdisciplinarity in the establishment.

All of these documents, spread out in time, could have led us to examine the evolution of practices throughout the reforms. We have nevertheless observed that regardless of the steps involved and the changes in mandating methods, there was strong convergence among collected information according to three broad themes. The following review is based on these themes.

### *3.1 The Importance of an Adapted Institutional Organization*

Starting in the 1970s, reviews of environmental studies took an interest in the question of inserting interdisciplinary practice into an education that had remained traditional. The environmental study was seen as an experience isolated from the usual educational context. These sessions consisted in one-week practicums outside the school premises, thus reinforcing this perception. They were essentially courses without exams and involved an environmental study practicum (Coudray, 1977).

This raises a central question: How can a change occur from an environmental studies practicum to its integration in high school pedagogical practices, and, furthermore, to real pedagogical reform (Aboudarahm, 1980)? The need to test this didactic procedure in view of extending it to the whole of programs was underscored very early on (Marchal, 1975). A review of responses to

the establishment questionnaire (DGER, 1998) highlights that teaching teams consider the development of interdisciplinarity to be closely tied to an adequate organization at the establishment level. According to them, the collective dimension of this practice imposes a new management of time and space with regard to choices concerning:

- Personnel management: organizing teacher schedules from a global perspective over a year or other adapted period, facilitating all of the meetings and taking them into account in work time, promoting team formation by grouping teachers over a small number of programs;
- The manner in which planning schedules are established: ensuring flexibility. Paradoxically, this is based on precise organization. The specialized conception of a progression centered on professional situations appears to be more conducive to the development of pluri- or interdisciplinary actions.

Let us compare these opinions with the observations made in establishments in roughly the same period (DGER, 2000). The inspection agency notes a real involvement of management teams in promoting this type of education: in 70% of observed programs, a weekly fixed time slot of three or four hours for pluridisciplinarity is written in the student schedule (DGER, 2000). Other favorable plans were used, such as devoting, over a full or half day, a succession of complementary disciplines, permitting teachers to have potentially available time slots for common activities.

This availability of time specifically devoted to pluridisciplinarity did not benefit from the same follow-up or administrative control accorded to other more traditional sessions. This leads the inspection agency to conclude that the actual organization of pluridisciplinarity—that is to say the use of these period by teachers—constitutes an opaque mechanism. “Pluri” hours are not counted. A quasi-absence of documented work completed by students in the class’s folder of texts makes control all but impossible.

### *3.2 Positive Conceptions of Interdisciplinarity*

The studies we have consulted (DGER, 1998; CEP, 1998; DGER, 2000) all show that, despite difficulties encountered in its implementation, “pluri” is overwhelmingly recognized by teachers for its validity in motivating students, developing adaptability for professional life, facilitating access to theoretical knowledge based on concrete elements and their complexity,

and promoting individual work and student autonomy (DGER, 1998). It can be stimulating, and it provides avenues for innovative practices and the establishment of different types of relations with students and colleagues (CEP, 1998).

The inspection agency mentions in its interviews that neither teachers nor management teams are aware of the extent of change prescribed by program reform. Hence, for most of them, the practice of pluridisciplinarity is recommended rather than mandatory (DGER, 2000). It is one of the projects undertaken by teams to improve the pedagogical quality of education. Pre-observation interviews allowed for questioning 115 teachers regarding the pedagogical value of pluridisciplinarity.

The inspection agency concludes (DGER, 2000) that for teachers in agricultural high schools, pluridisciplinarity may allow for using the complementarity of disciplines to show their continuity, which may develop students' synthesizing abilities and promote a gain in teaching time in the programs. It may lead to the formation or reinforcement of pedagogical teams and to the diversification of pedagogical practices. It may be a privileged way for students to ascribe meaning to their learning. Incidentally, it may also provide a medium for professional enrichment for certain teachers and may promote greater openness to the outside world.

### *3.3 Generally Lax Teaching Practices*

To describe these practices, we use action research conducted by the Institut National de Recherche et d'Application Pédagogique on environmental studies that remain in the system as the first described and formalized experiences of interdisciplinary education, and on the report written by the inspection agency following the 53 observed sessions. These two information sources converge in their observation of generally lax interdisciplinary teaching practices, that is, practices that do not strictly speaking correspond to the definition we have already provided.

In the 1970s, confronted with the inadequacies observed in many environmental studies conducted only at the level of empirical practice and under the aegis of spontaneity (Tessier, 1981), the INRAP undertook the work of formalizing an interdisciplinary pedagogy for environmental studies and published methodological documents for use by teams (Benois et al., 1977; Camusard & Maddens, 1978). The converging recommendations of these various documents as well as their explicit references to observed deficiencies allow us to deduce what are pointed out as lax practices: The

sequences involve putting students into active situations without clearly defined learning objectives or explicit recourse to the disciplines.

In the works we have cited, the recommendations are clear and seek to make environmental studies practicums go from the status of an outdoor activity to the status of a training sequence enabling the situation of disciplines in an explicit educational aim. They suggest avoiding the traps of a thematic pluridisciplinary approach that may lead to an accumulation of knowledge on a given environment, and center instead on student learning of an approach for apprehending and constructing reality (Tessier, 1981).

Roughly 20 years later, the inspection report remains highly critical in its observations concerning the quality of these practices. In many cases, the observed sessions appear as incidental pluridisciplinary sessions prompted by the occasion of the inspection (DGER, 2000). The reality of practices thus appears to be distinct from the texts and the elements promoted by the frameworks, and the pedagogical recommendations are little implemented despite existing means. Pedagogical and didactic reflection remains superficial, and sessions said to be interdisciplinary by teachers appear to the inspection agency to be "isolated occurrences" that are not truly integrated into a progression of training sequences in the context of a coherent whole. Most of the sessions amount to a pluridisciplinarity of juxtaposition: in one same scheduled period, teachers follow one another before the students, in class or in the field. Their successive interventions or actions within a same session share the same frame, that is, the same theme, but they are disciplinary and involve lecturing. The chosen theme is not interrogated or problematized and interventions take place in parallel. The integration of concepts continues to be up to student initiative, without any methodological assistance. It should also be noted that there is no specific evaluation for this type of session (DGER, 2000).

The inspection report also points out the highly disproportionate teaching of disciplines. Agronomy, a central discipline in agricultural education, is frequently called on. When zootechnics are included, agronomic science is present in 75% of the observed sessions. Next are economics and ecology, which are present in 40% of the sessions. This can be explained by the fact that they are used in the context of a methodology consisting of a global approach to farming, and this methodology is widespread in the system. Sociocultural education, history, and geography make up only 15% of the sessions. Physics-chemistry, documentation, and physical education are rarely mentioned in the observations. Modern languages and mathematics are not mentioned at all. These observations bring into question teachers'

competency and training. What difficulties do they encounter and what type of support would they find helpful to commit to or improve this type of practice?

The required competencies for implementing interdisciplinary teaching appear to teachers who have been questioned (DGER, 1998) to be essentially related to an empirical know-how integrated into their familiar practices. The difficulties identified primarily concern the organizational or relational aspects of this practice. Training requests have to do with the acquisition of methods required for the practice of collaborative work between teachers and the evaluation of learning realized by students in this type of session.

### Conclusion: An Examination of a Case Involving the Introduction of Interdisciplinarity in Agricultural Education

One first observation concerns the limits encountered in the application of interdisciplinarity by a reform originally cited as an innovation, making agricultural education a pioneer of interdisciplinarity. The discrepancy between the mandate and implementation of interdisciplinarity is partly due to difficulties encountered by all school reforms: The illusion that change rests primarily on the clarity, relevance, and legitimacy of a mandate that obscures the question of its appropriation by teachers and the role of training in this process.

Beyond this, however, it seems to us that the development of interdisciplinarity in high school education faces a series of specific obstacles. Interdisciplinarity, at least in high school education, constitutes a practice experienced by teachers as risky (Asloum & Bouillier 2007). Its implementation requires confronting teachers of other disciplines to establish a common purpose, to coordinate efforts in view of coherent implementation. Coordinating a joint project involves debating and agreeing on the aims of training. Interdisciplinarity is presented by Fourez (1994, 1996) as a political practice, that is, a negotiation between various points of view so as to ultimately arrive at an appropriate conception of a problem in view of a given action. Many interdisciplinary projects seek to put students into a professional situation or are based on a project related to a social reality. The organization of interdisciplinary sequences is sometimes the first occasion for teachers to compare their vision of the aims of training.

This practice is also experienced as a demanding and risky one by teachers, as it involves them in pedagogical approaches that put students into active situations with whose facilitation, norms, and evaluation these

teachers are not necessarily familiar. We have underscored the cautious strategies collectively put into place by teachers belonging to a team in order to ensure their mastery of the various phases of an interdisciplinary project with the possibility of resorting to “backup” lessons (Asloum & Bouillier, 2007). Therefore, when the institution prescribes interdisciplinary education, or when research or the inspection observes and analyses these interdisciplinary practices, the difficulties concretely encountered by teachers in the implementation of this type of teaching generally seem to be underestimated.

To conduct its study, the agricultural education inspection agency (DGER, 2000, Appendix 3) was compelled to explain what in its view characterizes realized interdisciplinary practice. It identifies four levels of practice from formal interdisciplinarity based on the juxtaposition of disciplines in the context of a pedagogy of transmission to a “desired” practice that associates the following characteristics: a team project, a problematization of knowledge in the form of competencies to realize, and a pedagogy engaging the student in an activity in a perspective of autonomy. This was done based on an observation of practices actually implemented in establishments. This is most likely what is missing for the development of interdisciplinarity, that is, an analysis of actual practices, an identification of obstacles encountered by teachers in the context of their work, and support via training.

### *A Practice Requiring Specific Training*

It was only in the 1990s, especially following the publication of the Rémond report in 1994, that awareness was raised concerning the need to train teachers more specifically for this type of practice. A national workshop organized by the ENFA<sup>5</sup> in 1998 enabled the formalization within the system of the issues, functions, content, and methods of initial and ongoing interdisciplinary training for teachers.

The main themes for introducing interdisciplinarity in initial teacher education (Bouillier-Oudot, 1998) were established based on references in the work of Lenoir (1991, 1998), Lenoir et Sauv  (1998a, 1998b) and Fourez (1997, 1998). This training is committed to developing teacher competency on three levels (Lenoir 1991, 1998):

<sup>5</sup> The *École nationale de formation agronomique*, under the supervision of the ministère de l’Agriculture, in charge of the initial training of all teachers of public agricultural high schools.

- At the curricular level, it targets the ability to analyze a curriculum collectively and globally, to understand its aims and to situate the function of the various disciplines in this whole. The curricular structure specific to agricultural education, as we have seen, makes this learning especially indispensable for teachers of fundamental disciplines detached from the systemic references on which these programs are based. This approach allows for interdisciplinarity to play its role fully by associating it with a clear perception by teachers of the aims of their training action in socio-educational terms;
- At the didactic level, it must allow for learning to plan interdisciplinary sequences corresponding to convergence points identified based on a preceding global analysis and to construct training situations enabling students to integrate knowledge in the context of an oriented activity. This construction also rests on the ability to inscribe one's action in a negotiated collective aim;
- At the pedagogical level, it must lead to the ability to facilitate educational sequences based on active methods, to guide group work, to supervise projects.

The islet (small island) method of interdisciplinary rationality proposed by Fourez (1997, 1998) has constituted a reference for introducing future teachers to a form of interdisciplinary modeling of a complex question before undertaking with them a reflection on the construction of this type of teaching addressed to a student public. Indeed, there quickly appeared the need to train young teachers in view of an epistemology of complexity and interdisciplinary modeling, since their previous studies, mostly disciplinary, had not prepared them for this.

### *A Necessary Evolution of Conceptions of the Teaching Act and of Learning Processes*

We believe that the gap observed between mandate and practice is essentially due to the fact that teachers do not generally have a clear conception of the practice qualified as interdisciplinary. Moreover, for a long time the mandate did not address the concrete procedures required for the implementation of this type of education. In agricultural education, in which this long-prescribed practice is familiar to teachers, it can be concluded that a group of collective conceptions are rooted in the two above-described time frames that marked the introduction of interdisciplinary

practices in agricultural education. These conceptions can sometimes constitute obstacles to the development of practices judged to be truly interdisciplinary. With regard to environmental studies, we consider the will to anchor training in social life to be one of the pillars of this system's culture, as an element that continues to account for a good deal of its dynamism. This foundation of training on social and professional realities has allowed the ministère de l'Agriculture to complement its development policy with training.

The studies we have consulted show that interdisciplinarity is almost exclusively equated with a project-based pedagogy essentially centered on putting students into an active situation and promoting formal and organizational aspects of its implementation without specific epistemological and didactic reflection. We qualify this first approach as adisciplinary, as it rests on educational perspectives (the training of citizens) and on the development of attitudes (or "postures" [*savoir être*] in the terminology then in usage) juxtaposed with cognitive and disciplinary learning identified in the curriculum.

The foundations of the methodology required for making these sequences a means for implementing the curriculum proposed by the INRAP (Benois et al., 1977) already provided the bases for a real interdisciplinarity based on the socio-constructivist conception of training seeking to relate disciplinary learning to social realities in order to give them meaning. It is the difficulty of establishing this link that is highlighted by the negative review of the inspection (DGER, 2000), even if the 1985 reform imposes a quasi-generalization of interdisciplinarity involving all of the disciplines.

### *Founding Interdisciplinarity on an Epistemological Study of Teaching Content*

The history of the institutionalization of interdisciplinarity that we have presented shows that its development rests largely on the very epistemological nature of its teaching content. This brings us back to the second "historical" anchor of interdisciplinarity in agricultural education: the FoCEA experiment.

Considering the training of farm operators on the basis of farmers' activities and no longer only on the basis of knowledge obtained from agronomic research has brought about two major consequences. The first concerns the formalization of the conditions to put into place in order to

professionalize training and build competencies, which led to curricular reform in the 1980s.<sup>6</sup> This has been widely commented upon in texts on agricultural education. It nevertheless appears to us that too little emphasis has been placed on the epistemological dimension of work realized in this period.

Taking farmers' activities as a starting point also led the authors of this experiment to analyze and model the complex subject of farming by centering on its operation, that is, a global approach to its functioning in the short and medium terms in an uncertain environment in the perspective of orienting choices and decisions. This point of view was very new, including in milieus of agronomic research strongly marked by the as yet recent advances of agronomic science that led to a spectacular increase in the productivity of production systems and that produced technical protocols to be followed by farmers.

The theoretical references noted by the authors of this global approach to farm operation (Marshall et al., 1994) clearly refer to what Le Moigne (1995) defines as heuristic principles enabling an approach to complex phenomena, that is, phenomena exhibiting a self-organizing property. The systemic theory has thus proved itself a powerful frame particularly well adapted for studying farms apprehended as a complex system, that is, a group of intertwined actions that can be identified by their aims, a system evolving in an active environment in which it is organized and transformed without losing its identity (Le Moigne, 1990).

Systemic modeling seeks to separate these intertwined elements in order to build an intelligible and oriented representation of it. This modeling is organized by the aim or intent of the modeler, and strives to describe an action or phenomenon in its context. It is based on two methodological principles that have marked the training and programs of technical agricultural education: the interdisciplinarity implied by the global apprehension of observed phenomena and the embedding of levels of analysis to take into account depending on the objectives pursued by the modeler. Each level of analysis can mobilize different disciplines.

The farm is situated in an environment that can be considered in terms of different levels: the drainage basin, the "small farming area" (*petite zone agricole*), today designated as agricultural land, Europe, and world markets.

<sup>6</sup> In the late 1980s, the curricula took the form of frameworks consisting of a description of the occupation (professional framework), of a framework for certification (the validation of acquired competencies), and of a training framework including pluridisciplinary modules.

Depending on the nature of decisions and actions, this environment can be approached as a natural, social, and economic one based on references and concepts used in various disciplines: economics, ecology, geography, sociology, etc.

The global approach to farming is the subject of a pluridisciplinary module that constitutes the keystone of the entirety of programs corresponding to agricultural production occupations. As we have already shown, it is the establishment of relations between this and other modules that allows for modeling strategic or technical decisions while taking into account a natural, social, or economic environment. We have also underscored that it is through the introduction of new references into one or another of these peripheral modules for a global analysis of the farm that are introduced the principal changes in programs over the course of reforms.

We can therefore consider that this systemic vision of the primary teaching content of foundational training programs of agricultural education inspired the very structure of the programs. In our view, it is the extension of the vision to the entire program and to the whole of disciplines that posed a problem in the establishment of the BTA reformed in 1985, and that later led to a juxtaposition of the various types of disciplinary and pluridisciplinary modules in the following curricula. This can also explain the disproportionate use of disciplines in the interdisciplinary sessions observed by the inspection agency. Trying to insert certain general education disciplines into this systemic construction conceived according to teaching content that is foreign to them poses real fundamental problems.

### *Agricultural Education Today*

A review of efforts concerning the formalization and description of interdisciplinary teaching methods is currently lacking, and would justify a new investigation at the national level 10 years after the study conducted by the inspection. We have shown the extent to which the development of interdisciplinarity has been tied to the introduction in curricula of teaching content that is itself interdisciplinary: the social and natural "milieu" of the 1970s, the farm-environment system in the 1980s, and the openness of this system to questions of environmental preservation and natural resources in the 1990s. Today, beyond the permanence in these programs of this teaching content that has become "quasi-disciplinary" in the sense given by Fourez (1996), and to the extent that their disciplinary modeling is

sufficiently formalized to be taught as is, on which emerging fields can new interdisciplinary projects be based?

It seems to us that it is once again the social role of agriculture and agricultural education that holds the answer to this question. The most recently reformed programs identify scheduled interdisciplinary periods addressing social questions such as:

- Food: the quality of food, its sanitary safety, food-related habits. Technological advances such as cloning, genetically modified organisms, large-scale epidemics such as “mad cow” disease and the avian flu have contributed to transforming agricultural questions into “acute social” issues;
- Sustainable development, which goes beyond a strictly professional context and touches on civic education. In agricultural education, the search for sustainable territorial development, based on the concept of sustainability, again poses the question of rural development based on a diversification of activities and a less and less meaningful role for agriculture.

It appears to us today, it is around an educational dimension relative to socially debated themes that the new issues of interdisciplinary education in agricultural education are situated. These acute social questions require for all citizens, and especially youth preparing for these agricultural occupations that have an impact on human health and the preservation of natural and environmental resources, to be trained to analyze the widespread controversies and social “fears” elicited by these questions. Training in analyzing these controversies related to technological innovation, in analyzing the place of scientific knowledge, and expertise in these controversies may constitute the modern translation of the specificities of agricultural education through its interdisciplinary teaching content.

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