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# **The concept of agrosystem in French college**

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## **Summary:**

The concept of agro system can be presented in a productivist manner or according to a sustainable approach; represented in a linear or cyclic way. If the circulars of Education to the Environment for a sustainable Development (EEDD) propose a sustainable vision and a systemic will, the body of the programmes of Biology of 16 years old students (ES and L) defines the agro system according to a paradigm productivist. The studied handbooks use different strategies but poorly integrate the EEDD into their chapters devoted to the study of an agro system. Vis-à-vis a teacher wanting to insist on the EEDD and working with a very productivist handbook, tested pupils find themselves confronted with a didactic paradox

## **Key words**

Agro system – Didactic transposition - sustainable development – didactic paradox

## **1. Introduction.**

Since the report of Bruntland (1987), the “sustainable development” was essential in the media (De Cheveigné, 2000) and in all the great branches of industry and in particular in agriculture (Bonneviale et al. 1989, Marshall et al. 1994). Vis-à-vis the models of development based on the accumulation of the industrial capital (Harribey 1998), the sustainable or bearable development is presented in the form of an alternative, which encourages the consumers, the industrialists and the states with being responsible for their behaviors with respect to the environment. French National Education did not remain in withdrawal of this debate. In 1977, a first circular instituted the “education of the matter pupils of environment”. It was supplemented the following years by various notes and teaching instructions. Thus, the circular of July 8, 2004 generalizes as well on the level of the primary school as of the secondary education to a development for a sustainable development (EEDD). Consequently, the teachers of all the disciplines called from 2004 to answer this institutional request find themselves vis-à-vis the problem of the integration of this concept in the disciplinary programs in place. We will study here the case of the scientific teaching suggested in Arts person (L) and Economic and social (ES) curricula. In part SVT (Earth and Life sciences) of this teaching, it is a question of the concept of agro system which was worked little by the community of sciences education with the difference of other concepts related to environmental education like biological environment (Astolfi and Drouin, 1987) or ecosystem (Forissier and Clément 2003, Magro et al. 2003).

## **2. Aims and framework.**

### **2.1 -Didactic Transposition.**

This study only relates to the internal transposition (Verret 1975, Chevallard 1985) of the concept of agro system because we want to characterize conceptions in the official instructions, in the handbooks and in certain pupils’ conceptions. The rules of the transposition (Chevallard and Johsua 1982) or interactions between these various levels of transposition will however not be analyzed on this example. If we fall under the theory of the didactic transposition, we are conscious of the limits of a linear modelling and restriction of the object of teaching on a knowledge (Forissier 2003)

### **2.2 -Produce more or produce better.**

For Malassis and Colin (museum.agropolis.fr), during the history of humanity, the desire to produce more always existed. The evolution of the agricultural production, proceeds for these authors in three times: the préagricole age (until the appearance of agriculture) the agricultural age (until 18th) and the agro-industrial age which appears with the chemical treatments and where we live. For P. Rabhi (Internet site of association Ground and Humanism) “the industrial option of the Western countries induced the agricultural productivism to meet the needs for an urban population in continuous growth, and to correct the shortages caused by the wars. With this intention industry provided the agricultural producers in reduction continues the artificial fertilisers, the pesticides of synthesis, the selected seeds and a mechanization increasingly more powerful making it possible always less farmers to produce always more and until the agricultural surpluses. ”. This model appears for this author as unsuited to our planet where the fossil energy resources are limited. Thus since the years 1970, the productivist mode is called in question. Even its French most convinced

historical defenders, such as the FNSEA (National Federation of the Trade unions of the farmers) give an opinion in favour of the reasoned agriculture since 1996 (history of Internet site of the FNSEA). : “the FNSEA, despising productivism to which its detractors would like to reduce it, gives an opinion in favour of the reasoned agriculture and a development of agriculture towards non-food productions”. However this trade union, one of the first and more powerful agricultural trade unions, supported, at the time of the installation of the CAP (common agricultural policy) the attribution of European subsidies in favour of the most productive exploitations, with the detriment of those supporting an artisanal agriculture, not very productive but supporting the quality of the products. Since the years 1980, other agricultural trade unions are set up and are distinguished from the FNSEA, the such Country Confederation which calls into question the productivist system and preaches country”, “respectful agriculture known as a “of the grounds and environment, harmoniously distributed on the territory, in breeding as in culture, creative of correctly remunerated employment. In short, an agriculture which takes into accounts the request of the citizens”. (Bové, Dufour; 2000)

Today, one of the reference works of future biological teachers (Soltner, 1999) announces as of page 4 that there are two types of agriculture: integrated or sustainable agriculture and “productivist”. agriculture . This opposition productivist/sustainable will be used by us as criterion in order to characterize the conceptions present in the analyzed corpus; knowing that the majority of the works which are addressed to the teachers on this subject (Bonneviale et al. 1989 and Marshall et al. 1994) privilege the global solution or sustainable

### **2.3 -Linear causal or cyclic representation.**

The sustainable analyses of problems fit basically in systemic models by the integration of various types of approaches (economic, social, environmental,...). Like the concept of ecosystem, the term of agro system implies (in a lexical point of view) to refer a priori to the systemic theories. Thus, we can expect to see privileging in the different corpus studied many cyclic representations as well as systemic analyses of situation in order to register the teaching of agro system in an approach sustainable. The circular “Environmental Education for a sustainable development” (EEDD), appeared with the BOEN of July 2004, also announces that “this modelling of the agro system must be systemic in order to take into account the existing interactions of all the aspects: food, economic, social, environmental, medical (...) who take part in the concept of agro system”. Contrary, the productivists reasoning can more easily be modelled by linear chains of causalities having for single consequence to obtain a maximum production

These two types of oppositions: to produce more/better and linear causality/systemic approach was used as grid of analysis to characterize the conceptions present in the official programs, in the handbooks and in a class of pupils.

## **3. Methods.**

### **3.1 -Study of the official instructions and the handbooks.**

In this part, we will present our methods of analyses of the conceptions of the concept of agro system conveyed in the official texts (programs and accompaniment of the programs) and in three textbooks of the same level. We will proceed to the study of the official and manual documents following:

- The scientific curricula: B.O 2000 HS N°7 of August 31,
- Accompanying documents of the scientific curricula

- The handbook Bordas: Earth and life sciences 2001 - 1st L; Coll Raymond Tavernier, Claude Lizeaux;
- The handbook Hachette 2001: Scientific teaching - the 1st ES;
- The handbook Hachette 2006: Scientific teaching - 1st L;

To make this study, we carried out an analysis of contents of speeches inspired by an article of Pierre Clément (Clement, Act of Esera summerschool 2002). This semantic method is inspired by the method of the pivots terms ((Harris Z.S, 1952); and models the logical bonds of the corpora by arrows in order to emphasize the logic structure.

### **3.2 –Qualitative Study of pupils conceptions.**

The conceptions of the concept of agro system of the pupils of a class of literacy curricula of the College Providence in Guadeloupe were analyzed before and after the realization of the chapter “food Production and environment”. The sample is composed of 27 pupils (21 girls and 6 boys). It acts for the teacher of a class of rather good level or the average age is 16 years. The teaching of SVT is done by group of half classifies, each group having 1 hour 30 of course one week out of two, in alternation with the course of Physics-Chemistry. The Post-test consisted in giving to the pupils the questionnaires filled of Pretest, so that they can correct or supplement, in another colour with writing, their answers. The sequence of course had a double objective.

Initially, the teacher wanted to present at the pupils the productivist and linear conception of the operation of the agro system, present in the parts “Notions and contained” of the programs as in their handbook (Bordered). The second objective was to build another systemic and sustainable conception of the agro system starting from local examples (with the difference of the handbooks). For that the teacher carried out an alternation of study of documents of the two handbooks analyzed (Bordas 2001 and Hachette 2001) and the realization of investigation on agro systems of their choice (Fields of canes, bananas)

The questionnaire includes two simple questions:

First is: “Definite a agro system”. Our objective was here to identify the pupil’s conceptions of the concept of agro system. For that we defined 3 categories of answer to this question:

- category I: To produce More
- category II: undifferentiated response compared to this criterion
- category III: To better produce

For the second question, the objective was to determine how the pupils represented the concept of agro system: in linear form, or a cyclic form having of positive or negative feedbacks. The question was: “Represents with the back of the sheet, an agro system by a functional diagram (representing words dependent between them by arrows; put a word of explanation at the top of each arrow)”. We then sought in the diagrams of the pupils the absence or the presence of interactions. The categories carried out were as follows:

- category I: Linear modelling (without interactions)
- category II: Undifferentiated modelling or intermediary (between linear and systemic, without interactions)
- category III: Systemic or cyclic modelling (with interactions)

## **4. Results.**

### **4.1 -Analyse of official instructions.**

The curricula of L and ES shares the topic completely “the food and the environment” although it is obligatory in L and with the choice out of ES for the 2005 (see the memorandums N°2005-028 of the 16-2-2005 and N°2006-060 of the 3-4-2006 of the ministry for national education) body of the program devoted “to analyze the operation of a agro system and its consequences environmental” is identical. The agro system is defined there like a place “of intensive exploitation” The analysis of the logical bonds (Fig 1) of the definition of agro system reveals the pesticides, manures but also pollution and the harmful effects on health like a logical and ineducable consequence with the intensive production inherent in all agro system.

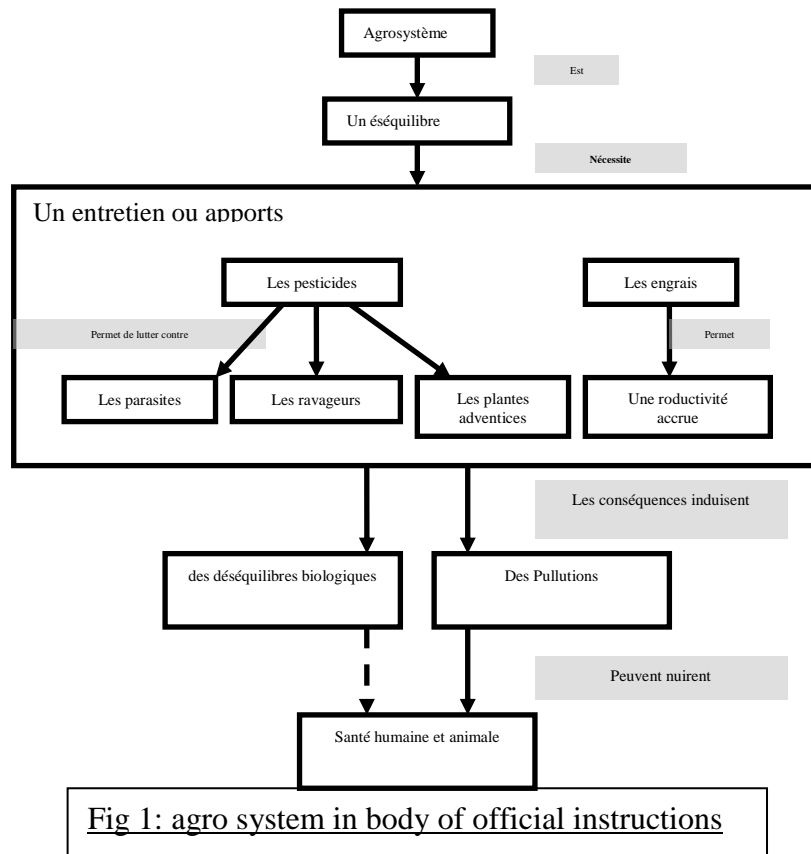


Fig 1: agro system in body of official instructions

The official instructions as a whole allow the teachers and the handbooks to present the two studied conceptions of the concept of agro system but by the place of these designs (body of the program or introductions and circulars) like type of knowing (definition or reference social's mark of the stakes), leave a greater place to the productivist conception.

#### 4.2 -Analyse of handbooks.

We will initially present the plan of the various handbooks in order to find there the logical bonds between the parts. These bonds taking again the parts of a chapter are by definition linear (a beginning and an end of chapter) but the logical articulation of the parts is not therefore productivist.

Edition du manuel	Bordas 2001	Hachette 2001	Hachette 2006
Introduction	p 81: food production and environment “6 Billion men today, 8 billion in 25 years” Objective: to satisfy the needs for all but also to consider the consequences of some practise agricultural”	p 108: food production and environment “How to nourish 6 billion men?” “Objective to know: matter producers, means of increasing the food production, dangers to the environment of an agriculture and a breeding intensives, the solutions brought to continue to better produce more”	112: food production “In 2050 it will be necessary to produce 3 giga-tonnes cereals to nourish probably 9 billion men on a world SAU of 2 billion hectares” “which are the constraints of an agricultural production of quality, in sufficient quantity, respectful of the environment, and releasing an income with the farmers”
Activites	1: production of matter along the food chains (primary education or secondary producers; output of the food chains) 2: Agro systems, ecosystems artificially balanced by the man. 3: the water pollution by nitrates and phosphates 4: other means to improve the agricultural outputs (pesticides, complement nutritional, antibiotic, hormones) 5: effects on the health and the environment of the “race to the outputs” (pesticides, hormones, antibiotics) 6: waste recycling and the disease of the “insane cow”	1: Primary production and secondary production 2: Production of a agro system 3 disadvantages of some practise farming 4 of the possible solutions	Part “food production” 1 to quantify the circulation of energy within an ecosystem 2 to cultivate plants: to ensure the primary production of a agro system 3 To nourish the livestock: to ensure the secondary production  Part “Food health and environment” 1 production of food and their conservation 2 pollution to the water treatment

Tab 1: plans of handbook

The three handbooks chose to start this part by the presentation of a problem: how to nourish the future population of planet estimated according to handbooks' between 6 and 9 billion (Tab. 1). The problems thus are immediately centred on the quantity of production. This productivist approach is then moderate in two of the three handbooks (Hachette 2001 and Hachette 2006) by the idea of quality of production. Pollution is approached in these two handbooks like “dangers” or “constraints”. Like in the official instructions, Bordas handbook considers pollution like “consequences” induced by all agro system.

The plan of Bordas 2001 takes again the causal linear logic of the program (Fig. 1) and presents the pesticides like others (other that pollution) average to improve the agricultural production. These practices appear in the handbook Hachette 2001 as disadvantage of some practise agricultural leaving thought that there is the different one which will be approached in activity 4 as solutions. This idea to present the paradigm sustainable as a solution disappeared in version 2006 from this handbook.

Documents	Bordas 2001	Hachette 2001	Hachette 2006
Linear	5	1	4
Cyclic	1		2
Produce more	9	5	6
Produce better		1	0
Manure, pesticides interest only	5	2	3
Pollutions as consequences	5	3	1
Pollutions is not necessary		2	
Total number	28	17	18

Tab 2: quantitative analyze of handbooks activities

The majority of the documents of the three handbooks rather present linear representations (Tab. 2) than cyclic and productivists documents rather than aiming at improving quality of production. The documents showing the activities aiming at knowing to produce more as for example calculation of the quantity of manure to be used with as only indicator the output (Fig. 2) are most numerous for the three handbooks.

“Synthesis” of the Bordas handbook, releases a productivist conception with nevertheless a reflex ion on the disastrous consequences from this mode from production. Even the alternative practices which would make it possible to decrease the risks are approached with a view to mass production. It does not release from them sustainable conceptions in term of take system into account various elements having interactions between them. The handbook follows the notions of the program strictly, but does not take into account the circular on the EEDD which requires of the teachers to sensitize the pupils with the social current stakes (Pollution, poverty, diseases human and animal...) and with the choices to make to allow a sustainable development.

This handbook also proposes a diagram assessment of a page divided into two parts:

- a first diagram representing “the production of matters in the ecosystems”;
- a second being entitled diagram: “Agro systems, of the unbalanced ecosystems” .introduce by: “The intensive exploitation of the agro systems requires a maintenance”

The Bordas handbook thus shows only the conception present in the body text of the official instructions, develops it in detail by many productivist activities and insists on the linearity of the modelling of an agro system. It is about a strategy of confrontation of the problem arising from the presence of two contradictory conceptions in the official instructions which consists in presenting only the most explicit conception. In the handbook Hachette 2001, the synthesis occupies only one page and is constituted of two large axes (Fig 3): “To produce more” (32 lines) and “To better produce” (6 lines is approximately 1/6 of the 1st axis). One notes from the start the relative importance brought to each axis, in term of space occupied in the handbook. The second axis, “To better produce” does not exist any more in the synthesis of the Hachette 2006.



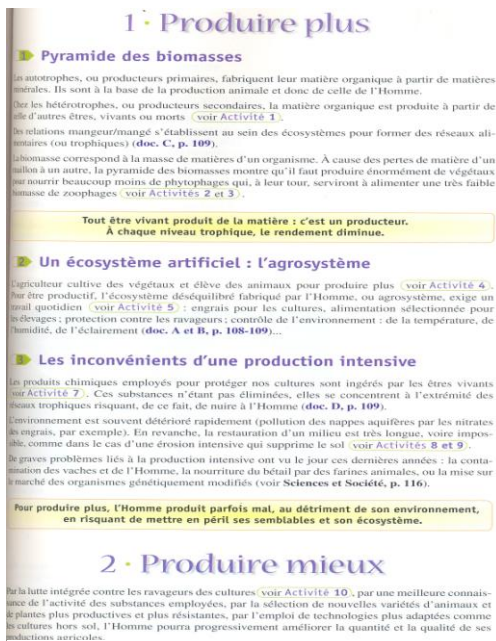


Fig 3 : synthesis of Hachette 2001

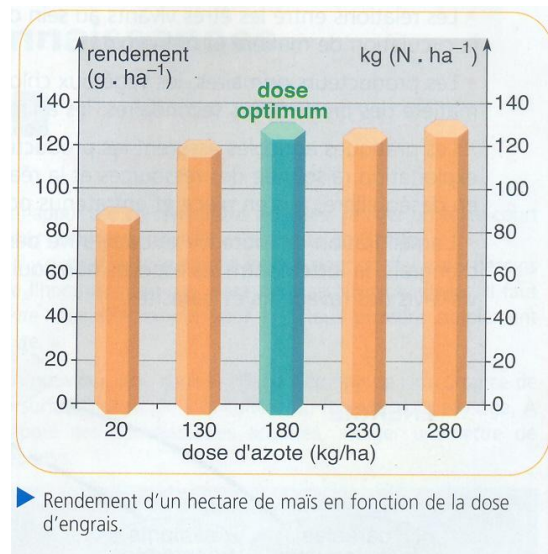


Fig 2 : Exemple of document Hachette 2001

#### 4.3 -Analyze of conceptions of pupils.

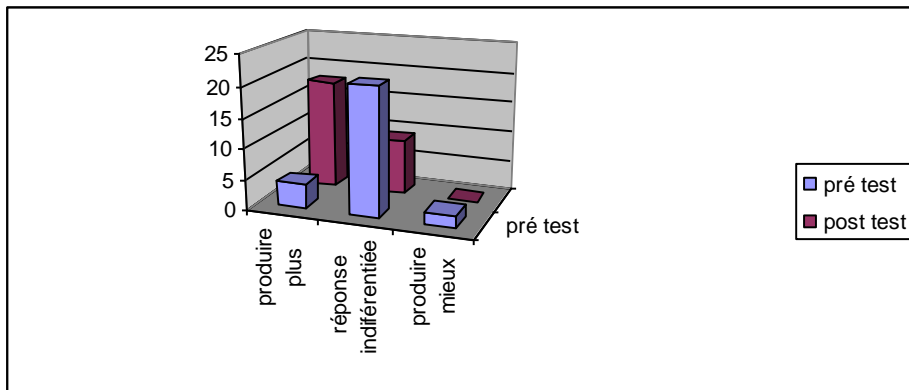


Fig 3 : Define an agro system

The observation of the results of question 1 (Fig. 3) shows, that in Pre test, nearly 80% of the pupils did not give a definition of the agro system giving indications on its mode of production. The percentages of pupils having a productivist conception (15%) or sustainable conception (7%) is not very important. In post test, the distribution is definitely different (Chi 2 = 0.2% with correction of Yates +/- 0.5), more half of undecided expressed themselves for a productivist vision, moreover two pupils who had proposed a definition indicating the importance to better produce gave a productivist definition.

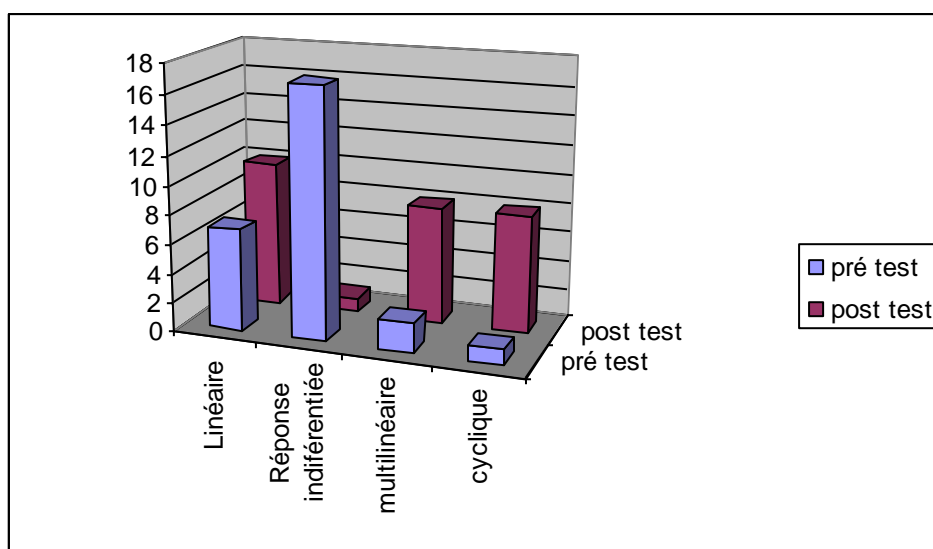


Fig 4 : schema of an agrosystem

For the diagram of agro system (fig. 4) the effect of the course is also undeniable ( $\chi^2 = 0.001\%$ ). Close to the 2/3 of learning did not give an undifferentiated answer before the course, only one afterwards. The diagram then obtained are linear, multilinear and cyclic.

## 5. Conclusions and implications.

The productivists conception and sustainable conception coexist in the French official instructions of arts person or economic and social. This duality which reflects a historical debate of the didactic and media “noosphères”, must be perceived as a richness making it possible to insist on the fact that these conceptions are two possible modelling of a complex reality. However the sustainable conception seems impossible to avoid today in all places except in the body of the studied curricula. The contradictory situation of the conceptions present in official instructions can be seen as a transitory situation which will gradually see the sustainable conceptions replacing the productivists conceptions.

However, this example of duality of model during the didactic transposition questions the transformation of scientific knowledge of the researchers into scientific truths of the class. This report was founder many work of didactic sciences since the years 1970. The question which is paused here is to characterize this dogmatization of sciences in bond with the theory of the didactic transposition. This effect of dogmatization is crucial in the case of applied sciences, and particularly in the case of conceptions composed of an important part of values. Is it a rule of the transposition as well as the modernization necessary of the erudite knowledge (or the aptitude to be translated into exercises and lessons) or a consequence of those rules? And especially how interacted it with these rules? It is possible to think that the coexistence of different models complexes the aptitude to be translated into exercise (which one could not easily be evaluated) and does not answer the representation of expert holder of truth that still the scientists today for a lot of peoples.

Vis-a-vis this standpoint of the curricula, the two studied handbooks adopt different strategies. Bordas built the unit of the concerned part on the productivist design explicit in the curricula without leaving place for the sustainable conception, object of several official circulars. The handbook Hachette 2001 exposes in first and in a detailed way the detail of the curricula then supplements this point of view by some activities introducing agriculture in bond with the EEDD.

The teacher chosen for this study had for objective to privilege the sustainable conception with the difference of the handbook of the pupils. The answers to the questionnaire show that its pupils presented more productivist designs in post test than in pre test. This very surprising result highlights the importance of the handbooks in the training of the pupils. An effect of didactic contract can explain this report: the handbook presents clear a productivist definition of an agro system as well as usual activities for the pupils. The didactic change of contract set up at the time of the second part of teaching could have been only interpreted by the pupils like a phase of opening and thinking. Within the framework of the questionnaire and request for a definition the pupils have, by effect of didactic contract, remobilized the definition learned in the handbook, reference of the waiting knowledge and thus mainly expressed a productivist situated conception (Clement 1994).

Initially, the analysis of the official instructions and official accompanying documents show that there are two antagonistic conceptions within: indeed, there is a productivist conception of a agro system in the body of the official instruction, whereas in addition incentives with environmental Education for a sustainable development encourages us to teach a sustainable agro system. These results can be explained by the persistence of a conception which has refers these last decades. In official instructions, another design of the agro system is set up only gradually. This one is adapted, in particular with the current stakes (environmental, economic, social...). There is thus coexistence of two conceptions, one older and persistent, the other more recent and of topicality.

In the second time, the analysis of the handbooks highlighted that according to the handbooks, the developed conceptions could follow more or less close the official programs and texts (circular EEDD). In our study, the handbook Bordas of the pupils, takes the party to develop the productivist conception of the agro system while the Hachette handbook in 2001 presents this design, but proposes another one: the sustainable agro system. This position was re-examined in favour of a productivist conception within the framework of the edition 2006. It is important to announce that this choice is independent of the total number of pages reserved in this chapter.

The transposition of the KVP of the agro system in 1ère L is an atypical example. Here, the linear model of transposition is not effective in term of conception. However, our analysis shows that on this particular example where two antagonistic conceptions are present in the official instructions. The handbook of the pupil proposes a design which seems contradictory with that of the teacher shows, the pupils are confronted with a didactic paradox: They must choose between the conception of the referent handbook and the evaluating teacher, they then give back to the teacher questionnaire presenting contradictory conception with those which it presented during his teaching.

Causal linear schematization remains strongly related in the official instructions and handbooks to the productivist paradigm. But in the evolution of the conceptions of learning if the majority give a productivist definition resulting directly from the handbook considerable number propose a cyclic representation of this same concept. If an effect related to the situation of questioning is undeniable, the parallel between mode of schematization and default values can be questioned. Indeed the same causal linear representation can be carrying different ideologies like the determinism in genetics or the productivism here. These ideologies are they to gather in the same paradigm which remains to be defined or the role of modelling in the interaction between science and ideology must it more finely be characterized.

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