

ANALYSING TECHNOLOGY EDUCATION THROUGH THE CURRICULAR EVOLUTION AND THE INVESTIGATION THEMES

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Twenty years ago, many of them started with this new concept: introducing technology education (TE) in our curriculum. From this point, we developed many project implementing this new subject area and we built progressively meaningful to this area. The aim of this paper is to present this evolution from the French viewpoint with some interest to compare with foreign experiences.

We present this evolution through two perspectives: the curricular evolution and the place of investigation. Briefly, we can observe through the French national curriculum a phase of epistemological delimitation, followed by a phase of activities definitions, arriving, recently, to a phase of activities defined as applied sciences without poor link to the initial epistemological definition. Over these factual dimensions, we can analyze this evolution as the weakness of the knowledge meaningful expressed in the national curriculum, weakness that reinforce the weakness of the TE in front of other subjects as math, literature, foreign language...

Many works tried to analyse this particular approach but their audience never really get out the little sphere of TE investigators. A birthday is more the occasion to open perspective and project some ideas and the experience taught us that the position of TE is more a question of social positioning through the knowledge than a question of purposed activities' interest.

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1. CURRICULUM EVOLUTION IN FRANCE

The aim of this paper is to present you some aspects about Technology Education in the French school. French schooling has two levels. Primary school starts at the age of three and lasts until the age of eleven, in three cycles: the initial learning cycle (children three to five years old), the basic learning cycle (five to eight years), and the fundamental learning cycle (eight to eleven). Secondary school is divided into two main cycles: middle school (ages eleven to fifteen) and high school (fifteen to eighteen for general education or fifteen to nineteen for vocational training). Technology education was implemented at each of these two levels in the early eighties.

1.1 THE FIRST CURRICULUM

1.1.1 Some elements about the general background

The main idea of French schooling is the progressive elaboration of the different school subjects. Understanding the world of children goes hand in hand with organizing that world in different knowledge areas, from the general view to the particular description given by the different subjects. Technology education, like that of science, history, or geography, appears as a school subject specific to the middle school level (Ginestié, 2001a).

The second idea of French schooling is the concept of project pedagogy. The introduction of this pedagogy in the Eighties was a departure from a traditional idea that the academic and dogmatic transmission of knowledge is the sole approach to teaching. Under the pressure of a massive rise in number pupils in middle and high schools, project pedagogy was presented as a possible solution to meeting the needs of the diversity of pupils, addressing their individual needs, and developing pupil autonomy (Ginestié, 2002). It was in this context, in 1985, that technology education was introduced in France as a part of science and technology education in elementary schools, as a new subject for all pupils in middle schools and as an optional subject in high schools. We can note four stages of organization of technology education between 1985 and today.

1.1.2 1985-1991: the implementation of the first curriculum

Technology education was conceived of as a new subject and took the place of MTE (manual and technical education) in terms of hours, classrooms, and teachers. The curriculum emphasized the industrial environment, leaving little room for home economics and craftsmanship (COPRET, 1984). It had two different elements that made these references plain. On the one hand, the general part of the course described the overall goals, context, and aims of technology education in France. The aims were in terms of pupils' attitudes towards technology (as related in many papers, e.g. de Vries, 1994; Jones, 1997; Compton & Jones, 1998; Gardner & Hill, 1999; Dugger, 2000) and in terms of the social and professional world of industrial production (this idea can also be found in many papers all over the world, e.g. Kantola et al., 1999). It offered a broad perspective to prepare pupils for professional training. At that time, the middle school became the intermediate cycle where pupils had to make their own personal plan for school, and technology education was responsible for indicating possible career choices. On the other hand, general goals were broken down into concepts and skills. This second element of the curriculum described the organization of concepts based on four domains of reference: mechanical construction, electrical construction, and economics management and computer science. Clearly, the chosen references oriented technology education in

the world of industry towards electro-mechanical production, to the exclusion of other possibilities (Ginestié, 2001b).

The main problem in introducing the TE curriculum has been to link the general aims to the specific fields (Sanders, 1999; Ginestié, 2004). These difficulties appeared with in-service teacher training programs. Earlier, the French Ministry of Education strongly affirmed the principle that TE was not a compendium of a little mechanics, a little electronics, and a business management with different aspects of computer science as a binder. To link these subjects together, teachers have had to connect general aims and specific concepts into an overall pedagogical project (Ginestié, 2005). Many in-service teacher training programs develop this orientation rather than aiming simply for the acquisition of specific knowledge. The implementation of technology education has not been reduced to the simple substitution of cooking or handicraft lessons by lessons in mechanics, but the true construction of a "new world" (Ginestié, 2003). Many original curriculum experiments were conducted at the same time to develop new teaching approaches (differential pedagogy, autonomous work, cooperative work, personal projects, etc.) and to integrate the new references to industry, the market economy, and new labor organizations by taking into account the needs, design, production, marketing, use, and rationale of industrial methods. The major plan was to combine the pedagogical project with a theoretical industrial project method (IPM). We can note comparable initiatives in the UK at the same time (e.g. Hennessy & Murphy 1999).

1.2 THE CURRICULUM EVOLUTIONS

1.2.1 1992-1999: Introduction of the Industrial Project Method (IPM)

At the beginning of the Nineties, IPM appeared to be a good solution for implementing TE in the middle schools. Certainly, IPM has taken an overwhelming place in TE leaving no other alternatives for organizing technology education courses. This position was made official with different additions and modifications to the initial curriculum. The main decision to use IPM was published in 1992 by the French Ministry of Education. This method allows for the simultaneous definition of content and method for organizing the teaching learning process in TE. Everything was done so that each TE teacher plans and organizes a new project each year for each group of pupils.

1.2.2 1999-2004: The second curriculum

Three problems arose that reduced the role of the project in TE. First, projects were mainly single production projects without any real progression from one year to the next. Secondly, the teachers' profile evolved considerably during this period, with a large increase in new graduates from the advanced technological universities. Thirdly, the union of industrial science and technique, with teachers exerting pressure to open the curriculum to new technologies and new patterns of labor organization. The implementation of the new curriculum took four years, from 1996 until 1999. These changes tried to organize the relationship between the respective roles of the project and the concepts. For the first three years of middle school, pupils have to make different modules of the whole project, but they do not have to make all of it. The teacher's task is to focus the attention of the pupils on specific points. During the last year, the pupils have to do a complete project (Ginestié, 2001c). The IPM is always a very strong frame of reference for TE in middle school (Ginestié, 2002).

1.2.3 2005: And so long, another change

There is actually a new phase of curriculum change. The Ministry of Education wants to promote the pupils individual choices about their future and by consequences the study they have to do. We can observe a real reduction of the TE as general and

cultural subject. The general aspects are more and more developed as applications of sciences; the general method is not the process of design and technology but more and more the process of observation and experimentation (as we can find it in sciences education). The main knowledge properly identified as technological knowledge is banished and the first draft of this new curriculum promote the links with the scientific knowledge. The IPM is still a reference but it is more an object to study more than a method to use with pupils.

2. CONDITIONS OF STUDY IN TECHNOLOGY EDUCATION

As we can see briefly, the TE curriculum is unstable as we can note through these major changes since the first writing. These changes are not linked with the technological evolution but mainly due to the lack of understanding about the place of TE in the general systems and to the misunderstanding about the aims of this subject and the knowledge taught. This lack of knowledge's definition is patent when we observe the structure of the curriculum. This question of knowledge is not so easy to solve.

Entry through analysing the conditions of study about TE's knowledge supposes, in terms of questions for research, a strong agreement with two points:

- There is some thing to study in technology education ;
- There would be multiple study conditions, perhaps different.

These two points don't make evidence. A majority of opinion is that TE is simply a kind of mix between handicraft activities and elements to highlight vocational training choices (Ginestié, 2000; Chatoney, 2003; Brandt-Pomares, 2003). In this posture, all the knowledge comes from sciences and TE is only a question of activities or applications. Evidently, this kind of entry weakens the position of TE as school subject and the recent French evolutions must be understood like this. It is the radical opposite we choose to work in our laboratory. First orientation we choose is to understand the significance of the anthropological approach.

2.1 THE ANTHROPOLOGICAL APPROACH

The anthropological approach allows registering knowledge in a theory of the activity and in a social field identified. The articulation between task and activity is incomplete if we do not speak about the manner to make. The manner to make relieves of the technique employed by the person to realise the task, that it is appointed by the situation or by him. The articulation between the task and the technique defines a know-how that expresses the manner to realise a determined task type (Ginestié, 1995). To get off this private organization either to account for the activity, or to clarify the manner to make, supposes the utilisation of language mediation.

To tell the manner to make necessitate proceeding to an extraction of the individual praxis to elaborate a praxéological organisation, significant of the manner to realise the type of tasks and the context in which these tasks are registered. In fact, it concerns to give the senses in the typical articulation between tasks and techniques by elaborating a field of meaning in connection with a technology, perhaps with a theory. It is this elaboration of meanings on the practice that defines, in the anthropological perspective, knowledge. This approach allows rendering account organisations of knowledge as relationships between praxis, taken in the senses of the activity oriented to finality, and a field of significations that allows referring practice to a technology and/or to a theory (Ginestié, 2001c). The epistemological entry is interested in the nature of knowledge (well obviously in the evoked anthropological perspective above) and to the demarcation of a field of reference (Ginestié, 1997). Some articulations allow thinking these fields, objects to know that

are fastened there and the manner of which they are or been able being, taken into account in the framework of a technology education:

- i. The world of technical objects, their mode of existence and social organizations by and in order that these objects exist so as to register the technological education in the human and social activity field;
- ii. The articulations between functioning, function, structure, form in the senses of a lighting of interdependences and the different manners to describe an object;
- iii. The articulation design, production, utilisation notably for marks given on process put at stake in each of terms, but equally, of a more global manner, either in a specific approach on an object, or from an evolutionist viewpoint, in a perspective of an history of technical activities;
- iv. The articulation object, activity, language in an ergonomic inscription (from the thing to the object, the object to the tool, the tool to the instrument) as revealers of the bonds between gestures and techniques, techniques and technologies. The report to techniques is thought in this framework as a demarcation; the report to languages notices the elaboration of symbols (in a relationship meaning, meant) but equally tools to think the world of technical objects and to act in this world.

Well obviously, this qualification of fields is a bit coarse, it needs to be specified, notably if we want to be able to read existent curricular organisations, perhaps to propose evolution of these organizations. The curricular approach is one way to understand the knowledge's organizations for teaching purposes. The problem is not the transposition of praxis but the transposition of praxeological organizations. It is not difficult to ask to pupils making something, but it is difficult allowing them to construct the meaningful on what they make. Certainly, the important instability of our curriculum is based on this difficulty to elaborate this meaningful. Furthermore, the curricular entry is envisaged here as one of the stages of the didactic transposition process: that the placement in text of teaching objects in an prescriptive aimed that has to organize the teaching activity, to the breadth of the production of these teaching objects in the framework of the class to elaborate some objects of study for pupils, objects of study that are going to determine activities of pupils. This placement in text defines the matter to teach and induces the manner to teach it.

2.2 SCHOOL INSTITUTIONALIZATION

We can thus notice the specification and identification work that operates in this process of scholastic institutionalisation. School institution is characterized as the placement of interactions, surely tensions, between three poles: the pupil, the professor and the knowledge. As soon as we wish to describe these interactions, we are confronted with a problem of methodology, methodology that derives of course the framework in which place our study. Thus, analysing the conditions of the study is going to concern us in what the school institution puts to the study and the manner that's this study functions. This crossing of analysis rests on the articulation between task and activity:

- The task is significant to the knowledge put at stake in the elaborated situation by the teacher in the framework that is fixed (curricular organizations, conditions of exercises, particular constraints, etc.);
- The activity is significant to the work undertaken by the pupil to progress in the task that is appointed it by the teacher and representative of the knowledge's learning process.

It concerns to define a framework of analysis that allows looking the functioning of a teaching situation (Ginestié, 1992). The initial framework, elaborated by these analyses method, does not prejudge of:

- Knowledge put at stake, their presence or not and their school form;
- Organizations elaborated by the teacher so as to organize conditions of the study of these knowledge;
- Activities developed by the pupil that are induced by the organization put in game for this study.

These two cross analyses, task and activity, characterize the interactions between three complementary existing logics but that can also appear as rival: the logic of subject, the logic of teaching and the logic of learning. The first one follows from knowledge organisation and requires an epistemological study; the second one takes in account the professional activity of the teacher considering his organisation, his style, his manner to do, the professional gestures he develops; the last one can be highlight by the learning theories, specifically the viewpoint of socio-constructivism theories. Many works have shown the incidence of these logics on the school situations and how they are inscribed in different references and different temporality. In fact, stressing these three logics in a school institution can be looked of different manners. But, for ourselves, we are really interested by what it happens in a class; specifically, we try to analyze the effects produced by this placement in tension (Ginestié, 1996).

On the one hand, this approach allows the identification of the organisational and structural elements that act and interact in the process of teaching-learning. In this perspective, the task appears as the preferential expression of the teaching's logic. It express simultaneously what is at stake, the context in which it is situated, what it is waited and what it is necessary that the pupil makes to achieve the task. In this senses, the task is a concentrated expression of a totality of values, models, elements of theories, knowledge that base the subject's references and that identify the teacher in a teaching population. The analysis of the task is therefore significant how curriculum is implemented, in the particular intimacy of a specific class. It is equally significant activities that it induced at pupils. It is also characteristic of the epistemological, curricular, didactical or pedagogical presupposition (Ginestié, Brandt-Pomares, 1998).

On the other hand, the passage to the real supposes to put in stake an analysis of the activity of the pupil. His perusal of the task, the manner he has to organize its activity and to orient its actions, what it takes in consideration and what it does not see even, allow characterising his learning process. In this perspective, we can notice difficulties that he meets, the manner whose he processes them, adopted strategies and the planning of his different actions (Ginestié, Andreucci, 1999). Reading activity through the description of the task allows proceeding pupil's activity with some precise characteristic elements of the task. We can value difficulties met by the pupil and identify which are relevant to the context (the formulation of the task, the organization of conditions of the study, the use of models, materials, etc.) and which notices obstacles to the learning (Amigues, Ginestié, 1991).

3. SCHOOL ORGANISATION AND PUPIL'S WORK

Organizations implemented at school, in the classroom and by the teacher have a direct influence on the work of the pupil and on the result of this work. Concerning the technology education (but it is not specific for these subject), it is important to specify and to define what is waited from the pupil, recourses he disposes to get there, the manner whose he gets there. Therefore, we have to understand the evaluation the

nature of the goal, the manner to get there but also the breach of the goal; everything that allows to bring in front understanding about the process of knowledge's transmission-appropriation. From this point, we are not in a curricular approach that has for object to define contents of teaching and to determine goals to reach; we discuss goals fixed by the institution, their institutional pertinence, their coherence in a scholastic organization datum. Of course, the temptation is great to believe that we could have act on prescription as to reduce these gaps. The evolution of curriculum shows that this kind of actions is limited because it enters in social negotiations that the research can illuminate to defect to inspire them, even to affect them.

3.1 TASK ANALYSE

Our entry by the situations is an analytic viewpoint to render real situations of classify or in a prospective perspective to think possible evolution. For that, the crossed analysis task-activity presents a good framework. The task's analyse gives some understanding about the placement in text (or the placement in word) of the object of study. This placement in text constitutes one of the last stages of the didactical transposition, stage in the course of which the teacher anticipates and executes the production of the object of study that it makes return in its class. Many indicators allow characterising some ingredients of the organisation that it counts to put in place:

- The nature of knowledge that he exhibits,
- The display of the result expected at the end of the sequence,
- The spatial and temporal organization type that he puts in act,
- The strategies that he gives to orchestrate the activity of pupils,
- The different levels of evaluation on which he counts to lean (evaluation his activity, the progress of his sequence, the activity of pupils, the breach of results),
- The devices of mediation and remediation that he envisages,
- etc.

Others indicators allow to notice explicit or implicit models that he uses for the organization of this production:

- model of the logic of pupil learning organized around acquisition of competence noticed to the breadth of significant observable behaviours versus a constructivist approach based on the elaboration of knowledge;
- Model of the activity of pupils according to a logic of smooth away difficulties versus a logic of confrontation to obstacles;
- Model of the teaching organisation according to a logic of guidance of the action of the pupil versus a logic of problem-solving;
- Model of the organization of knowledge references that one can caricature in a binary alternative: in technology education, there is nothing to know versus there is only knowledge.

The construction of these models supposes the elaboration of a strong theoretical reference by which we can predict the appearance of the objects of study and how they become into school organisations. Of course, we front three different viability risks: one is an instant risk about what's happen with the course that is going to unfold here, at this hour, in this classroom, with this teacher and these pupils; second is a progression risk about what happen in the duration of the class, the articulation of the different sessions and their succession; third is durability risk about the permanency of a teaching at such level, in such class, in such context, according to evolution, development, interaction with the other subjects as a kind of general educational ecology.

3.2 ACTIVITY ANALYSE

The analyse of the activity, as for it, tries to understand the logic of pupils in their evolution to achieve the task that is confided them and the manner of which they adapt conditions organised by the teacher. Retained indicators refer directly to theories of the apprenticeship, notably through:

- The strategy they adopt,
- The manner to organize their actions,
- The manner to notice and to anticipate difficulties and to overcome them or to avoid them,
- The manner to notice or not constraints imposed by the situation and to take into account them or no,
- etc.

Analysing the activity of pupils is a powerful tool that allows to notice, to qualify and to valorise gaps between what the teacher waits them, what they obtain really and the manner that they use to reach this result. It concerns, on the one hand, to give indicators of efficiency of a device concerning learning and, on the other hand, indicators on the manner to conceive plan. To adopt a criterion of efficiency of plan put in place by teachers is not easy. That supposes to place the question of the acquisition of knowledge by pupils to the heart of the educational act, what is not without consequences in TE.

This challenge is important if we want to reinforce the position and the role of the TE as a general education subject. Through our French experience, but also through some related experiences in different countries, we have change of period. The first time of innovation and implementation is definitively done. Many countries know a decrease period with disaffection for TE: decrease of budget, reduction of school time devoted to the subject. At the same time, more and more teams develop investigation in TE. May be, we have to diffuse the results of these investigations and to develop the support that we can provide to the teacher but also to the curriculum designers, this is our challenge to bring our contribution to TE.

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