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The Development of Comparative Didactics and the Joint Action Theory in Didactics in the Context of the French Disciplinary Didactiques.


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Introduction

For more than 30 years now, a scientific field gathering the so-called “didactiques des disciplines” is growing in the French-speaking community of educational researchers, accounting for the “irreducible” role of the knowledge content in teaching and learning. This approach is supported by the triadic model [teacher-student-content], in which the relationships are shaped by the specific ways of knowing related to disciplines as cultural categories of human practices. In this view, there are no single “didactique”, but as many “didactiques” as there are disciplines (school subjects). In the following I should use the term disciplinary didactiques as a means to discuss the cultural specificity of this research field, without dissolving it too rapidly into a broad international term (e.g. subject didactics) that unavoidably changes its meaning.

The importance of disciplinary didactiques in the field of educational research may be assessed by the existence of associations gathering research communities across French-speaking countries.

- Association pour la Recherche en Didactique des Mathématiques (ARDM)
- Association Internationale pour les Recherches en Didactique du Français (AIRDF)
- Association pour les recherches en Didactique des Sciences et des Technologies (ARDIST)
- Association pour les Recherches Comparatistes en Didactique (ARCD)

Other disciplinary didactiques (including history, geography, social sciences, arts, sports, literature, philosophy, foreign languages, etc.) may simply be institutionalized through the existing research subgroups in the related academic discipline, in the educational sciences academic department, or in teacher-training institutes.
This seeming simple reality faces two types of challenges \textit{within and beyond} the piece of reality defined by the school subject matters:

(i) \textit{Within the subject matters}, certain researchers contend that \textit{subfields didactiques} should be defined to better describe some distinctions in parent academic disciplines. Typically, they would argue that the \textit{didactique} of science overlooks the specific issues of teaching biology relatively to those of physics, etc. This perspective goes even deeper with such questions like: should we set up a didactique of genetics, of algebra, of music listening? Another type of contentions comes along the new topics introduced by the curriculum makers at the crossroads of the traditional subject matters: socio-scientific issues, ICT uses, citizenship, health, etc. Should we define some corresponding \textit{crossfield didactiques}?

(ii) \textit{Beyond the subject matters}, it is tempting to consider the triadic model [teacher-student(s)-content] as a potential common ground for developing a network among the various concepts and theories being developed within each disciplinary didactiques. Such attempts are often regarded as provocative with respect to the invoked disciplinary rationale of the \textit{didactiques} that precisely enabled them to distinguish themselves from \textit{pedagogy} or \textit{general didactics}. Indeed, these traditional research trends within education departments and teacher training college typically borrow their models to philosophy and other social sciences (sociology, psychology, language and communication) to suggest content-free models for teaching to be further adapted to the necessities of the subject matters. The major breakthrough of the emergence of the disciplinary \textit{didactiques}, 30 years ago is a contest of this applicative approach. Indeed disciplinary \textit{didactiques} claim the development of their own conceptual tools for explaining at which conditions a piece of knowledge can be taught and learnt. But does it means that each disciplinary \textit{didactiques} is an autonomous research field? Is it possible to ground a scientific research field in the shadow of the subjects organized by the curriculum makers (subject matters in tension with the parent academic discipline)? Could we identify some generic patterns in teaching and learning from the specific practices tied to the subject matters?

In this paper, I will argue that any networking approach that would start from concepts developed here and there in the field of the disciplinary didactiques can barely work out of an empirical work of the classroom realities.

Certain concepts such as

- the \textit{milieu}, the \textit{didactic contract}, the \textit{devolution / institutionnalisation} dialectics from the Theory of Didactic Situation in Mathematics (Brousseau, 1997),
- the \textit{didactic transposition}, the \textit{knowledge chronogenesis and topogenesis} from the Anthropological Theory of the Didactics (Chevallard, 1985/91, 2007)
the reference practices in teaching natural science and technology (Martin 1986; 2003),

have disseminated within the didactiques in more or less extended manners. But in each case, the ends-in-view attempted by researchers are not the same: not only across the variety the disciplinary didactiques, but also within single ones.

The case of the “didactique des mathématiques” is an inspiring example of the tensions existing within a so-called research field, and that actually led some of us to a reconceptualisation of the relationships within the triadic model in terms of didactical joint actions (to be developed in section III).

I - The polysemy of the word “didactique” in the French-speaking educational research

I regard didactic research as essential to educational sciences but also being part of the broad landscape of social and human sciences. Identifying the epistemological tensions with a research domain is a sine qua none condition to make knowledge progressing. The analysis of the polysemic use of the word “didactique” among a broad (but culturally bound) research community may be an interesting way to unveil these tensions and to make them productive, without dissolving them too quickly.

I start my point with a first quotation from Michel Caillot, who attempted to characterize the disciplinary didactiques in the French perspective.

“If I compare the French term didactique with the English one, didactics, in dictionaries for example, many differences appear. Didactics is recognized as a noun in English whereas [the noun] didactique is usually not [mentioned] in a French dictionary, although I will here use it as noun. However the corresponding adjectives have practically the same meaning: “intended for teaching or instruction”; yet there is another meaning in English where [the adjective] didactic has a pejorative meaning: “too much inclined to teach others: boring and pedantic or moralistic” (Caillot, 2007, p125)

In Caillot’s introduction, the noun “didactique” is not defined. In English, the substantive noun "didactics" exists only with "s"; it can be singular or plural in construction. It refers to “systemic ways of offering instruction”¹ but it is barely used in educational research literature in English-speaking countries. In French, “didactique” exists as a singular or plural noun (with and without "s") and furthermore, it can be either masculine (le didactique) or feminine (la didactique). Both are frequently used in the scientific literature but in subtle different ways that are related to different research paradigms.

Les didactiques (plural female noun) refer to the disciplinary didactiques as a myriad of research fields attached to the school subject matters and the relative academic disciplines, as I described in my introduction. In most cases, a problematisation of the content to be taught is involved (analysis of knowledge transposition and/or out of school practices of reference) to distinguish the life of academic or professional bodies of knowledge and the subject contents taught and learned (legitimacy, epistemological coherence, social purposes in changing societies...etc.). The consequence for teaching and learning may be studied in analyzing the ordinary teaching practices or in building teaching designs to be tested in classrooms.

Recently the need to model the teacher’s role (driven by the development of teacher training) brought about extensive analyses of classroom practices in order to grasp the content effectively taught and the dynamics of teaching and learning process (I will come back to this in the subsequent part devoted to the Joint Action Theory in Didactics). The French tradition for the disciplinary didactiques is oriented toward a comprehensive science of the teaching and learning phenomena, involving qualitative or mixed methodological approaches. However, research trends towards the development of subfields and crossfields didactiques tend to be more interested in building specific methodologies for teaching certain topics rather than producing descriptive models upon the functioning of the triadic system embedding these topics. As Schneuwly (2011) points out, disciplinary didactiques remain in tension between an interventionist approach (a science for the teachers) and a descriptive / explicative approach of phenomena occurring in the teaching and learning process of particular topics.

Didactique: plural noun with a terminal "s"

Feminine substantive (la didactique) or masculine substantive (le didactique) based on the adjective (didactique → didactic) are much more controversial.

La didactique (female noun in French) is sometimes used as a shortcut to designate the set of disciplinary didactiques gathered in a shared statement: the specificity of knowledge to be taught determines the ways of teaching and learning it. In a paper entitled “Origines, malentendus et spécificités de la didactique”, Develay (1997) discusses the emergence of la didactique, without focusing on any particular discipline, but contrasting the theoretical orientations of research within the field of the disciplinary didactiques. The diversity of institutional backgrounds from which the researchers come from (related disciplines in universities, social and human sciences, teacher education institutes) and the multiple borrowings to the contributive sciences (cognitive and/or social psychology; sociology, epistemology, etc.) are invoked to explain differences in purposes and in focuses (domains of investigations). Develay profiles the study of “rapport au savoir” (meaning-making about the content taught) as a common ground for any disciplinary didactique. In his view, this common ground could incorporate psychological, sociological and epistemological aspects of
this relationship and hence provide an anthropological foundation for la didactique (a science to be construed).

An anthropological approach indeed grew up with Yves Chevallard’s theorization of the institutional relationships within the didactic systems (any system in which someone intend to teach something to someone else). Didactic institutions (in Douglas’s sense, 1986) select and organize the content taught and learnt in time and across social relationships (Chevallard 1992; Mercier et al., 2005). Chevallard defines la didactique as

“a science of the conditions of diffusion of knowledge in any institutions, such as a class of pupils, society at large...etc. More particularly didactics [sic] is the scientific study (and the knowledge resulting thereof) of the innumerable actions taken to cause (or impede) the diffusion of such and such a body of knowledge in such and such institution” (Chevallard, 2007, p133).

In Chevallard’s view, since a scientific field has necessarily an empirical basis, a specific object that is the knowledge content always particularizes studies in the field of la didactique. Hence, it is not possible to understand properly what is going on in a classroom, without studying (i) the content at stake, and (ii) the problems that this content may arouse for the students and the teacher. Hence, la didactique necessarily embeds the study of the bodies of knowledge being dealt in schooling institutions. Chevallard acknowledges that the development of the disciplinary didactiques is a useful epistemological breach to challenge content-free psycho-pedagogical approaches2, but he argues that there is a need to move beyond. The domain of study of la didactique is made of didactical facts: “any fact that can be in some way looked at as the effect of a socially situated wish [purpose] to cause someone learn something” (idid, p133; also see Chevallard 1988).

In this view,

• didactical facts are a sub-category of more general social facts and they are shaped within institutions.
• disciplines are categories of thought based in bodies of human practices, disciplines are institutions per se.
• the boundaries of disciplines (and the related school subjects) need to be studied to grasp the logics of didactical facts.

Hence, disciplinary didactiques are judged too narrow for explaining and theorizing didactical facts. The institutionalization of la didactique as a field of research grounded in didactic facts is a means to strengthen this field of research against the background of social sciences.

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2 In France, "la pédagogie" is not regarded as a science, because it does not have a proper theoretical basis.
*Le didactique* (male substantive noun in French) appeared in mid 90's in Chevallard’s writings and it subsumes the set of didactical facts as an empirical basis for *la didactique*. The term is particularly used in the development of *la didactique comparée* (translated below as *comparative didactics*), as a “new kid on the block” in the landscape of the French-speaking didactic research.

**II – The emergence of *la didactique comparée* (comparative didactics)**

All the French-speaking didacticians do not share Chevallard’s point of view on *la didactique*. First, possible confusion with general didactics or pedagogy is feared. Tenants of the disciplinary *didactiques* contest the relevance of designating with a single word such a set of facts that are intrinsically heterogeneous because they are rooted in distinctive disciplines or distinctive body of practices. Second, Chevallard’s view tends to deny the existing tensions between interventionist approaches and descriptive approaches within disciplinary *didactiques* (about this distinction, see Schnewly, 2011). Indeed, this new perspective cannot change the various schools of thoughts developed in a research community in a single move. Changes come from new problems and new necessities perceived from the inside of the research community, but also the practitioners. Third, those researchers working within a disciplinary *didactique* (ex: mathematics) as a distinct research field endorse a strong content specific approach often supported by an initial background in the related academic discipline. They do not feel legitimized to engage in didactical researches involving other types of knowledge contents. In its present state, Chevallard’s elaboration of *la didactique* lacks of empirical grounds to characterize and handle the so-called *didactical facts* from the crude observations of what happen in classrooms and the school community at large.

In parallel to such debates (disciplinary *didactiques* versus *la didactique*), comparative *didactics* progressively grew up in the late 90's from a series of symposia organized within the network “*Recherche en Education et Formation***”. The purpose was to discuss concepts built in the disciplinary *didactiques*. The *didactical transposition* and the *didactical contract* respectively featured by Y. Chevallard (1985/91) and G. Brousseau (1997) in the domain of *didactique* of mathematics were the first concepts to be tested beyond research in mathematics education (Raisky & Caillot, 1996; Terisse, 2001). Could these concepts be considered as describing some generic dimensions of the teaching and learning practices beyond the epistemic specificity? More generally, how could the epistemic specificity of teaching practices be empirically studied and distinguished from more generic forms of teaching that would be common to all topics? What methodological device to set up? What kind of empirical data may be used? What more general theories and concepts from the human and

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3 It is interesting to note that Chevallard attempted an English translation of *le didactique* in translating the name of his theoretical elaboration (Theory Anthropologique du Didactique → Anthropological Theory of the Didactic, ATD).

4 The network "Recherche en Education et Formation" (REF) is an international network for research on education and training. It was created in 1990 by researchers from France, Belgium, Switzerland and Quebec. A conference is organized every two years in one of these countries, staging closed symposia based upon papers submitted, reviewed and shared for reading before the venue.
social sciences are likely to be invoked and/or adapted for building models in subject specific didactics?

Progressively, such questions led to the outline of a new research field at the crossroad of works carried out in disciplinary *didactiques* and against the background of trends of thought in human and social sciences (namely social interactionism, linguistics and pragmatics). Considering Chevallard’s definition of *la didactique* as a horizon (but not a reality yet), comparative didactics investigates the nature of *didactical practices*, as a set of *human actions* that are purposively organized towards the diffusion of a socially legitimated culture and the transformation of the addressed individuals in knowing. Accordingly to Chevallard’s definition of the didactical facts, didactical practices are not separated from their institutional conditions of existence. The specific instances of didactical practices observed in classrooms and tied to the school subject organizations may be compared to each other in order to feature the generic patterns of teaching and learning. A special issue of the “*Revue Française de Pédagogie*” entitled “*Vers une didactique comparée*” (Towards Comparative Didactics), was published by Alain Mercier, Maria-Luisa Schubauer-Leoni and Gerard Sensevy (2002). It contains a series of comparative empirical studies that a major institutionalization of the field of comparative didactics in the French-speaking educational research community.

Without assuming that the disciplinary *didactiques* can be subsumed directly into a single science (*la didactique*), comparative didactics aims at starting a dialogue among the existing elaborations issued from disciplinary didactics to in order to

- avoid an ever-growing fragmentation of the didactic research into as much sub-themes as there are contents;
- provide some methodological tools for enabling comparison of didactical practices at different scales (the classroom, the teaching designs, the conception of teaching resources);
- initiate a reflection about how the learner makes sense of the contents encountered within each disciplines; how these contents may be related in the school day experience of the students (the “*rapport au savoir*” as a common ground suggested by Develay, 1997).

To sum up at this point, this short essay about “*didactique*” in the French-speaking research community aimed at showing how language in use provides a symbolic system of the forces playing therein. It also shed some light on the future challenges. Comparative didactics aims to be an integrative field, providing tools for extending the landscape of disciplinary didactics, without reducing them into a single theoretical approach.

III - A joint action theory for modeling teaching and learning practices

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5 Either “live” practices or “crystalised” practices described in texts.
As I mentioned earlier, comparative didactics embeds an “actional turn” (in the light of what happens in other social sciences, like linguistics for example) that led to consider human actions in which knowledge is transacted, as a unit of analysis for carrying out comparisons of practices across institutional settings (disciplines / subject matters, informal / formal teaching and learning structures, national schooling contexts). Since we consider that it is not possible to directly compare the theoretical constructions made within the disciplinary didactiques, comparative didactics requires to go back to an empirical ground and to (re)define tools for browsing it.

Comparative didactics involves:

(i) the elaboration of methodological tools for defining grounds for comparison, isolating units of analysis, and combining them towards the elucidation of the logics at work in didactical practices.

(ii) the reconceptualisation of certain theoretical tools construed within the disciplinary didactiques to attend new questions raised by comparative purposes.

In this purpose, elements of a Joint Action Theory in Didactics (JATD) were developed by Gérard Sensevy (Rennes), Alain Mercier (Marseille), Maria-Luisa Schubauer-Leoni (Genève) and Chantal Amade-Escot (Toulouse) and their respective collaborators (Sensevy & Mercier, 2007; Amade-Escot & Venturini, 2009; Ligozat & Schubauer-Leoni, 2010). JATD tries a system of tools for describing and understanding the logics of the didactical practices. It is primarily built against the background of the transposition process (both its effect in the definition of curricula and its temporal and social expansion within the classroom) and the dialectics between the milieu and the didactical contract theorized by Brousseau. It is not possible to recapitulate here the step of this collective construction which started in the early 2000 with “A model of the teacher’s action in the Race to 20” (Sensevy, Mercier & Schubauer-Leoni, 2000; Sensevy et al. 2005) and actually undergoes some specific developments against the background of pragmatist philosophy (Sensevy, 2011; Ligozat, Wickman & Hamza, 2011).

**Basic principles of JATD**

(i) Teaching and learning is envisioned as a joint action in which participants develop interdependent purposes and expectations (a “didactic game” in Sensevy's words). The teacher achieves his/her goal – i.e. the students learn knowledge content – if the students act in a certain way. The expected way of acting defines the logics of the learning progression in the didactic contract.

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6 The teacher and students “joint” action stands for the interdependence of the classroom actions: what the teacher does and its direct effects on the students (and vice-versa) toward a shared reference for further acts. Such a joint action involves separate and distinctive acts that are bound together to make the collective action progressing, within an institutional interdependence of the purposes and plans developed by each category of participants: in preparing her lessons, the teacher continuously envisions the potential students’ actions to take part to it; in working on a task proposed by the teacher, the students keep thinking about the teacher’s expectations upon this task, with respect to a more general context (what was done before for instance).
(ii) For the students to learn, the teacher has to design a set of conditions made of material and symbolic objects bound to a question, a task or an inquiry to be attended. To make a decision about a line of action, the students identify some ends-in-view in the set of conditions provided by the teacher. These ends-in-view do not necessarily match the learning outcomes targeted by the teacher. The set of conditions defines the “primitive” milieu\(^7\) from which the meanings are construed in joint actions.

(iii) The actions carried out respectively by the participants towards the objects in the setting ("anything" that can be referred or designated in Mead's sense, 1967) inform each other about the meaning that the objects have in a specific situation. A common ground of meanings is progressively shared in the collective and works as a reference for making inferences in further actions. The mesogenesis defines the meanings construed in action over time.

(iv) In the classroom, the teacher’s and the students’ mutual adjustment of lines of actions is ruled by the dissymmetrical positions of the participants with respect to knowledge. The teacher's institutional task relates to the conveyance of a pre-existing culture embedded in curriculum texts that is to be (re)enacted in didactic situations; whereas the student's task is to study the questions proposed by the teacher in order to (re)build such a content in his/her experience. The asymmetrical responsibility in the classroom actions shapes the division of the work (topogenesis) and the direction that teaching takes (chronogenesis).

(v) It follows that the topogenesis and the chronogenesis are strongly related to the teacher's actions because of his/her leadership in the didactical relation. The teacher is supposed to orient the student's actions, but also to notice the student's elaborations in order to designate a new knowledge built. Therefore, some chronogenetic and topogenetic moves contribute to the building of a common reference (objects, relations) upon the mesogenesis.

- Chronogenetic moves are anything that the teacher may do in order to orient the students' actions toward the piece of knowledge to be learnt.
- Topogenetic moves are anything that the teacher does to regulate his/her involvement in the joint action and to assign a role to the students all together or as individuals.

Chronogenesis and topogenesis feature the didactic monitoring of the common ground of meanings being shared in the classroom.

vi) The specification of the joint action to the content being taught and learnt operates through the analysis of the nature of the epistemic tasks that are to be achieved.

- What is the purpose of the tasks as presented in the teaching design?

\(^7\) The notion of "milieu" is initially featured in Brousseau's Theory of Didactical Situations in Mathematics (1997) to model the system of constraints and possibilities that are opposed/offered to the student in a learning situation. I use the term "primitive milieu" to describe the conditions organised by the teacher as means to engage the students in a certain type of action. The primitive milieu generates a meaning-making process over time duration, i.e. a mesogenesis.
What content could be learnt from a general perspective?
To what bodies of practices this task may relate in the out-of-school culture (academic disciplines, professional practice).

The “pre-existing culture” necessarily comes in when studying how knowledge to be taught is presented in the teaching materials and curriculum texts. But the logics of the ordinary practices in classrooms may be rooted in some multi-determination levels in which epistemic ones stand by more general ones: implicit theories on teaching and learning supported by teacher’s collectives discussions, the texts of the teaching materials, in-service training, etc. (see Chevallard, 2002; Sensevy, 2007). Beyond the situated analysis (at the scale of small episodes), larger units of analyses may be delineated to grasp the structure of the teaching design operated by the teacher, from the resources displayed.

The scope of the Joint action Theory in Didactics is extended to the study of the socio-historical determinants of the teaching practices that are crystallised in the institutional texts available to the teachers (Ligozat 2008; 2011).

<table>
<thead>
<tr>
<th>Determination levels</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EPISTEMIC / IDEOLOGICAL PRE-CONSTRUCTS</strong> (curriculum texts)</td>
</tr>
<tr>
<td><strong>PROFESSIONAL THOUGHT STYLES</strong> (teachers’ collectives)</td>
</tr>
<tr>
<td><strong>PRACTICAL INTERPRETATIVE SCHEMES</strong> (classroom biography)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The projected joint action</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ <strong>EPISTEMIC ANALYSIS</strong> of teaching tasks: Practices and knowledge contents to be learnt</td>
</tr>
<tr>
<td>➔ <strong>TEACHING DESIGN</strong>: Contextualisation; Material Display; Temporal sequence; Social distribution; Assessment</td>
</tr>
<tr>
<td>➔ <strong>CURRICULUM MAPPING</strong>: connecting tasks in global teaching units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The actualised joint action</th>
</tr>
</thead>
<tbody>
<tr>
<td>➔ Purposeful Task for the student: “PRIMITIVE” MILIEU, CONSTITUTIVE / STRATEGIC RULES, ENDS IN VIEW</td>
</tr>
<tr>
<td>➔ The meaning-making process: MESOGENESIS, TOPOGENESIS; CHRONOGENESIS</td>
</tr>
<tr>
<td>➔ The structure of the teacher’s participation of the learning progression: DEFINE, DEVOLVE, MANAGE CERTAINTY / UNCERTAINTY, INSTITUTE</td>
</tr>
</tbody>
</table>

Table 1: From the classroom to the determination levels of the joint action

To sum up, JATD attempts a set of conceptual tools for comparing and relating various kinds of specific didactical practices, beyond the boundaries of the fragmented disciplinary *didactiques*. Hence, *la didactique comparée* is an empirical field of investigation of the human transactions organized about the transmission of a socio-historically built culture. JATD reworked some concepts primarily used in the *didactique* of mathematics to grasp the teacher and the student's agency within the institutional structures.

**III - Examples**
In this final part, I will try *an illustration of the analysis of teaching practices* in mathematics and sciences. For each subject matter, we carried out cross-national comparison in order to create conditions for contrasting the logics of practices with respect to distinctive socio-historical determinants. Both the tables will be orally commented in the symposium. The details of the bottom up analysis that was performed from the videos and the teaching materials cannot be developed here (a full paper in on the way). However, the patterns of the logics of the practice that are described below should be understood as the synergy of different scale analyses featured in Ligozat (2008).

**Table 2: Principles of construction of the macro, meso and micro-scales of analysis (from Ligozat, 2008)**

- The micro-scale analysis concerns *significant events within a lesson unit*.
- The meso-scale analysis concerns the relationships between several events during *one or more lessons within a teaching unit* elaborated by the teacher. Typically, the teaching units are based on the smallest autonomous units of activity available in textbooks.
- The macro-scale analysis concerns *the connections among several teaching units* within *a more global teaching project* that covers a thematic unit in the subject matter.
Example 1 - The logics of the practice in two teaching units in mathematics: France and Geneva

<table>
<thead>
<tr>
<th></th>
<th>France (9 y.o.)</th>
<th>Genève (9 y.o.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantities and measurement</strong></td>
<td>(MEN, 2002)</td>
<td>Real numbers and measurement (CDIP 1997)</td>
</tr>
<tr>
<td></td>
<td>Time planning of notions over the year</td>
<td>Kernel of skills / associated tasks</td>
</tr>
<tr>
<td></td>
<td>The design is pre-constructed → steps &amp; techniques in the teacher’s guidebook</td>
<td>The design is to be « created » by the teacher</td>
</tr>
<tr>
<td>Length (perimeters), weights</td>
<td>surface area of rectangles [3 sessions]</td>
<td>Length (perimeters), weights, capacities, time, surface area of polygons [2 sessions]</td>
</tr>
<tr>
<td><strong>A single « type of task » – 5 problems</strong></td>
<td>(i) A set of 3 rectangles to be ordered</td>
<td><strong>A single « big » problem</strong></td>
</tr>
<tr>
<td></td>
<td>(ii) Order the quantity of paper of « movable » rectangles → practical</td>
<td>- Set of 13 polygons (moveable) to be ordered</td>
</tr>
<tr>
<td></td>
<td>superpositions and transformation towards inclusion</td>
<td>[superposition according to their surface area, transformations, square grid]</td>
</tr>
<tr>
<td></td>
<td>Teacher indication: Quantity of paper same as surface area</td>
<td>Teacher indication: One of the polygon in the set may be a unit of measurement</td>
</tr>
<tr>
<td></td>
<td>(iii-iv) Compare surface area of 2 rectangles (not moveable) → uncertainty:</td>
<td>- Pacing all polygons with the smallest triangle</td>
</tr>
<tr>
<td></td>
<td>back to the perimeter?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(v) [Use square grid] ← → [draw the transformation]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>→ an inclusion monitored by counting sq.</td>
<td></td>
</tr>
<tr>
<td>Surface area: no instrumental</td>
<td>a specific measuring technique has to be constructed from the students</td>
<td></td>
</tr>
<tr>
<td>technique in everyday culture</td>
<td>experience in manipulating the geometrical shapes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Logics of the practice: Developing a</td>
<td>Logics of the practice: Helping each student to</td>
</tr>
<tr>
<td></td>
<td>collective inquiry upon the student’s</td>
<td>solve the problem by his own means before</td>
</tr>
<tr>
<td></td>
<td>individual techniques → Justification</td>
<td>opening a collective discussion → Resolution</td>
</tr>
</tbody>
</table>

Table 2: Results of the comparison of two teaching units on surface area at grade 4 in France and Geneva (from Ligozat, 2008)

Differences in the logics of the teaching practices produce differences in the mathematical complexity reached with the students: in France, the mathematical content embeds the justification of the square-grid technique used for comparing surface area; in Geneva, the mathematical content is oriented toward the use of the unit as a means for solving a problem.

Some generic socio-historical determinants contributing to the differences observed in the logics of the practice:

- In France, the textbook (ERMELE) provides teaching sequences with a progressive complexification of a mathematical task. The steps of the teaching units and the mathematical techniques to be used by the students are detailed in the teacher’s guidebook.

- In Geneva, the curriculum materials (COROME) provide a set of activity sheets, each one featuring a complex problem to be solved by students. The steps for solving the problems and the mathematical outcomes of the problems are not detailed in the teacher’s guidebook. Hence, the teacher has the full responsibility for « creating » a teaching unit and for identifying the mathematical content to be taught, from one or more complex problem.
Example 2 - The logics of the practice in two science units: France and Geneva

<table>
<thead>
<tr>
<th>Geneva (4-6 y.o.)</th>
<th>France (3-4 y.o.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>« The microfauna nearby our school » (DEP, 2007) - Ants sequence based on materials selected by teachers (8 sessions)</td>
<td>« Observing changes in animals life » (MEN, 2008) - Hen &amp; chicks sequence based on materials selected by teachers (10 sessions)</td>
</tr>
</tbody>
</table>

**What would we like to know about ants?**
- Reading of a documentary album;
- Categorizing pictures about ants into 4 thematics: [Shape of the body] [food] [« birth »] [environment];
- Describing pictures of the metamorphosis of the ant [3 states];
- Present the ant to other classes according to the 4 categories (verbal production with text, pictures, drawing on posters)

**(i) Observation of a hen in the classroom**
- What do we know about hens: food, « birth » and environment;
- Reading of documentary albums Chicken → eggs ⇒ mating of a male & female

**(ii) The experimental incubation of eggs**
- Turning eggs twice a day everyday and noting operations in the classroom calendar;
- Making hypotheses on the development of the chick in the egg from a succession of pictures [4 states];
- Hatch out of the chicks on the 21st day

Table 3: Comparison of two teaching unit in natural science at pre-school in France and Geneva
(from Marlot & Ligozat, 2011)

The differences in the logics of the teaching practices produce differences in the nature of science, as a content taught beside the biological process studied. In France, the teaching unit on the birth of chicks alternates empirical observations, notations and experience of duration. Scientific knowledge is a situated elaboration linking empirical events organized in time and models of biological growth. In Geneva, the teaching design on the life of the ants relies upon the interpretation of pictures on the basis of a text read by the teacher. Scientific knowledge is a set of information to be memorized.

The generic socio-historical determinants contributing to the differences observed in the logics of the practice are currently under investigation (need more data to be confirmed). However, we can already mention that in Geneva, there are no institutionalised teaching resources for sciences (conversely to mathematics and French language). Furthermore, the curriculum resources provided for teaching French language put strong emphasis on oral and writing skills for producing various textual genres. These materials include examples of texts found in encyclopaedias for children, featuring the description of animals, plants, and other scientific phenomena as starting point for training the students in producing short oral presentations, posters, explaining texts, etc. The lack of specific resources for teaching sciences may turn the teachers toward the use of the resources provided for teaching French, as a substitute. Of course, this has consequences on the nature of the content taught in the
science classroom: the content tends to be reduced to the management of scientific propositional knowledge into texts and discourses for communicating into the classroom.

To conclude

Comparative didactics is a new approach to the analysis of what is going on in the classroom, and more broadly in the schooling system. It has the potential to investigate content related issues in teaching and learning that may not be grasped and questioned from the perspective of a single disciplinary didactique, or even several disciplinary didactiques altogether.

The use of JATD is major breakthrough for developing comparative didactics. However, in its present state, the JATD still has to face different kinds of challenges:

1) Setting up a generic model for the study of the didactical practices without shadowing the content specificity in running the analyses;
2) Clarifying its epistemological stances (internal versus external constructivism; pragmatism versus historical materialism, etc.) with respect to the principles and concepts that are borrowed from other theories;
3) Defining methodological units to organize its (very extended) realm of reality, to avoid the risk of generating some misleading interpretations.

References


