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The Determinants of Joint Action in Didactics: The Text-Action Relationship in Teaching Practice

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1 Introduction

This contribution addresses the complexity of the teacher's work to make sense of curriculum material in designing day to day lessons on mathematical topics.

I would like to introduce my research focus with the following vignette. During the course of an interview with the researcher, Claudia, a 4th grade generalist teacher in the Swiss canton of Vaud, comments on a teaching document named "Encadrement" (cf. Appendix 1) that she has used in a couple of previous lessons:

Claudia: This is an activity that I like very much as an inquiry-based activity / because first there is a formula to be found / and I would like to know at this step who is able to discover it... / this is my idea on different teaching needs for heterogeneous students / but moreover it is a stepping stone to introduce the notion of perimeter / I think it is a good activity to start with it / (...) then there is also the geometrical notions that will be taught in the second part of the year / and here there are opportunities to make the students aware of the geometrical vocabulary / (...) in the discussion the corner became an angle but I did not insist too much / and later on when I will talk about polygons / I will recall the Joconde painting and mention that we used a specific word to designate the corner / in fact I like to pave the way like this / but of course this is not the main objective (...) then / I found it pleasant / it always works because this is a well-known painting and it wakes up their interest easily

Researcher: Ok / then your main goal ... / I mean the core mathematical notions in there...

Claudia: What is central for me in this activity is to measure side-lengths / what they already know but the important thing they have to notice is that there is no need to measure the four side-lengths but only two of them because it is a rectangular shape / and then multiply / they are supposed to know how because we already worked out multiplications (...) but what did not spring out is to add up the two side-lengths and then multiply by two (...) then / there is this extension of activity / so the way the students discover that in fact four extra centimetres are required

Researcher: This is embedded in the formula isn't it?

Claudia: Yeah, I would have expected that they found it more easily / fortunately it sparked from Heloise and this enabled me to engage in differentiated teaching / I mean pushing forward the students who are ready for it / to precisely practice the formula with them [27/01/2005 – 44'30'].

Claudia's discourse about the mathematical contents that she envisions in the task "Encadrement" instantiates certain typical features that are aroused when primary school teachers are inquired about their intended plans involving curriculum material in mathematics. Claudia's discourse exhibits her commitment to inquiry-based activities, to differentiated teaching actions, her specific attention to "paving the way" for the upcoming lessons and in sustaining her students' motivation. The core epistemic content that can be afforded by the task is evoked as a taken-for-granted element in the first part of the discussion. Indeed "the formula" and the steps to teach it do not come up in the discourse until the researcher triggers it. When Claudia engages herself in this description, her discourse involves the students' doings. She merely thinks about this task through her students’ actual or potential actions to achieve it: "what they already know", "they have to notice", "they are supposed to know", "the

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1 The French word "Encadrement" describes the art of framing paintings and pictures.
way the students discover" etc. The epistemic content highlighted in the teacher's discourse is not separated from the students' actions as if the mathematical problem set up in this document does not exist for its own sake.

These features are not the mere facts of Claudia's thoughts on that day about this task. They are common features in my research interviews that surveyed two French teachers and two Swiss French-speaking teachers of grade 4 about their teaching of measurement in mathematics over one school year (Ligozat, 2008). Both the facts that the epistemic content is merely taken for granted in the first place and that the description of the task is made through the students' actions suggest the deep embodiment of the knowledge contents in teaching and learning joint actions and, consequently, the limits of the mere interviews for understanding the rationale of the teacher's action in co-ordinating teaching designs. In ordinary activities in classrooms teachers have little opportunity to develop a discourse about the succession of tasks which they present to the students and hence they are hardly used to eliciting the epistemic organisation underlying their teaching projects. In fact, the teachers are poorly tooled to develop a consistent discourse about this important facet of their practice. In my view, this is a major issue to be taken care of in order to foster a content-centred reflection on classroom practices in the context of teacher education and professional development.

European domain-specific educational research still has little to say about the way teachers effectively work out teaching designs from the curriculum material they have at hand, and how topics are mapped along the time line of the school year and across teaching designs. In the USA, advanced works on this matter were prompted by implementation of the Principles and Standards for School Mathematics (1989) and the need to support teachers when using new waves of standard-based curriculum material. If the implicit view of the teacher as a mere conduit for the curriculum has been seriously questioned now for two decades, the extensive review by Remillard (2005) shows that the coherence of the research results on the teacher-curriculum relationship in mathematics is far from being ensured. Her analysis reveals important differences in the meanings assigned to the concept of curriculum use (following/subverting the text; drawing on the text; interpreting a text or participating in a text) together with a limited discussion of the theoretical assumptions underlying methodological decisions. A study by Sosniak & Stodolsky (1993) of elementary teachers' use of textbooks entails significant differences across subject matters. Teachers who tended to enrich the textbook's suggestions in reading and language tended to stick rigidly to the exercises in the mathematics textbook. The study suggests that the use of curriculum material should be accounted for in teachers' larger curricular agendas. For Doyle (1993), this includes investigating how teachers enact the curriculum in classrooms and necessarily involves interpreting the intent of the various resources used.

Recent researches in the French-speaking didactique tradition are also increasingly interested in the integration of resources and documents in teaching practice. Arguing that the generalised availability of digital resources for mathematics teachers entails deep changes to a teacher's professional knowledge, Gueudet & Trouche (2009) draw on an instrumental approach to feature the documentational genesis in the teacher's work. The interesting dimension of their contribution is that the teacher is not a mere reader or interpreter of texts and resources, but also a text producer through the documents that they elaborate. This approach, extended to all kind of resources (Gueudet, Pepin & Trouche, forthcoming), illuminates an underestimated part of the teacher's work that is done out of the classroom, but still influenced by the institutional conditions and constraints of the didactic transposition (Chevallard 1985/1991) and the development of professional collectives.

My general contention is that we need to elaborate descriptive models of the teaching and learning practices that account for the use of textbooks and curriculum-based material available to teachers within the school institution. A mixed top-down and bottom-up
methodological approach enables us to study the relationships between the national context-specific curriculum requirements encrypted in texts and the content that is dealt with in teachers' and students' joint actions as a re-configurated form of text in practice. Elaborating on the stratified layout of the didactical joint action (Sensevy, 2007), this chapter displays my theoretical assumptions on teacher-curriculum interaction in the light of the didactic transposition theory (Chevallard, 1985/1991; 1988; Mercier, 2002) connected to a hermeneutical approach of action in texts and discourse (Ricoeur, 1991; Bronckart et al. 2004). It suggests a threefold categorisation of the co-determinants prevailing in the elaboration of teaching projects according to an institutional educative agenda.

2 Theoretical lenses for looking at the enactment of curriculum texts in classrooms

(i) The didactic transposition of knowledge

In the French-speaking tradition of didactique studies, the theory of the didactic transposition of knowledge (Chevallard 1985/91; 1988) dominates the landscape of the socio-historical approach to contents being taught in different school disciplines (Mercier 2002; Schubauer-Leoni & Leutenegger 2005). Didactic transposition theory introduces a distinction between knowledge as it is known and used in out-of-school spheres of social activities (ranging from everyday life and professional "expert practices" to scientific/academic practices producing advanced knowledge) and knowledge that is packaged for the specific purposes of teaching others. Structuring a formal curriculum entails several processes of decontextualisation of the genuine "practice-knowledge" complexes (praxeologies in Chevallard's words) that were born in "out-of-school" human activities: fragmenting "big" questions, selecting salient elements of answers and reconfiguring them into ordered subject matter, sequencing topics etc. Through this process, particular types and forms of knowledge are sanctioned according to social and ideological views on education held by curriculum makers. Hence, the knowledge-to-be-taught packaged into a communicable form (the "text of knowledge" in Chevallard's words) embeds epistemological and ideological values that are reflected in institutional documents (e.g. teaching programmes, studying schemes, textbooks etc.) and discourses (e.g. professional development trainings). The major breakthrough of this perspective is that the curriculum contents become questionable constructs against the background of the genuine practices that exist in human "out-of-school" activities.

The didactic transposition of knowledge is not restrained to the construction of the formal curriculum and the associated teaching material. It also entails the recontextualisation process of the formal curriculum items into effectively taught knowledge forms (the "enacted curriculum" in Anglo-Saxon researches). When the knowledge-to-be-taught packaged in the curriculum texts is unfolded into dynamic situations involving the teacher and the students' participation, the contents targeted by the curriculum makers undergo further transformations. For a long time it has been a common research question to explore the extent to which textbooks and curriculum material determine what is effectively taught in the classroom by the teacher (Freeman & Porter, 1989; Ball & Cohen 1996). But the second breakthrough offered by Chevallard's transposition theory is that the recontextualisation of knowledge in the classroom does not merely depend on teachers' individual characteristics. The transposition at large is an institutional process governed by various layers of determinants ranging from

2 The overall transposition process is not deliberately controlled by particular individuals but is a collective process. As Chevallard (2007) suggests, "the main point of the didactic transposition is that it considers knowledge as a changing reality, which adapts to its institutional habitat where it occupies a more or less narrow niche" (p. 132).
the most general ones related to the educational dispositions adopted by societies (such as school structures, evaluation steps etc.) to the most specific ones related to the epistemological norms prevailing in school disciplines. In this perspective, the teacher and the students are not mere individuals interacting in a face-to-face situation but are institutional subjects whose activity is finalised by the collective purposes of the social organisation to which they belong. Chevallard (1992) defines didactic institutions as structured social organisations with the purpose to make someone learn "something". Of course, such a broad definition applies to schooling systems as well as classroom tutorials; the latter being a specific instance of the former.

The seeming triviality of Chevallard's remark has an important consequence for investigating the recontextualisation process of curriculum contents in my work. Considering classroom situations as a local instance of a broader institutional organisation allows us to relate the logic of the situated events observed in the teacher's and the students' actions to the activity formats that are pre-constructed in the definition of the curriculum contents at the level of schooling systems. In this framework, the Joint Action Theory in Didactics that we unfold next furthers the Didactical Transposition Theory in the plane of the participants' activity.

(ii) The pragmatics of didactical joint actions

The Joint Action Theory in Didactics that has been progressively and collectively elaborated during the last decade (Sensevy, Mercier & Schubauer-Leoni, 2000; Sensevy et al., 2005; Sensevy & Mercier, 2007; Ligozat & Schubauer-Leoni, 2010; Sensevy, 2010) originates in a pragmatist perspective on classroom social interactions and discourses.

The theory envisions the teaching and learning practices 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. making the students learn a knowledge content – only if the students get involved and act in a certain way. The expected way of acting defines the rules of the learning progression in the didactic contract (Brousseau, 1997). 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 from which the meanings are construed in joint actions. 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) inform each other about the meaning content that the objects have in a specific situation. A common ground of meanings is progressively instituted in the collective and serves as a reference for making inferences in further actions (mesogenesis). In classrooms, the teacher’s and the students’ mutual adjustment of lines of actions is ruled by the asymmetrical positions of the participants with respect to knowledge. The teacher's

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3 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 in order to orient their action toward an expected mathematical strategy. In this chapter, I use the term "primitive milieu" to describe the conditions organised by teachers as a device to engage them in a certain type of action, meanwhile the terms of the primitive milieu earn some meaning contents (mesogenesis) over time.

4 Blumer (2004) refines G.H. Mead's theory of meaning-making in social acts (1934/1992, pp. 75-82) in terms of joint actions as the conditions for an object to exist for an individual: "The meaning of an object to an individual is constituted by the way in which the individual is prepared to approach it, use it, handle it, treat it or refer to it in conversing with others" (p. 43).
institutional task relates to the conveyance of a pre-existing culture embedded in curriculum texts that is to be (re)enacted in living didactic situations; whereas the student's task is to study the questions proposed by the teacher in order to (re)build such a cultural content in his/her experience. The asymmetrical accountability in the classroom activity shapes the division of the work (topogenesis) and the direction that learning takes (chronogenesis).

Thus, the Joint Action Theory in Didactics includes a set of analytical categories to describe the dynamics of the co-construction of meanings in classroom situations, namely the \textit{[meso, topo, chrono]-geneses triplet} and the \textit{structural quadruplet of the teacher's participation} to the didactic game\textsuperscript{5}. These categories are powerful means to grasp the meaning-making process in classroom events as long as an epistemic analysis of the practices involved in the students' tasks is performed, and they serve as a benchmark for identifying the learning progression (Assude & Mercier, 2007; Ligozat & Leutenegger, 2008). However, in order to understand the rationale of the teacher's action in designing, selecting and ordering tasks on a time line, we need to extend our model of didactic joint action to the socio-historical determinants of the teaching practices that are crystallised in the institutional texts available to the teachers.

\textbf{(iii) From text to action and vice versa: the configurative power of discourses}

The study of written institutional texts for teaching is a prevailing means to map the knowledge to be taught and learned in the intended curricula. However, this vision needs to be widened to encompass the dialectical relationship between the didactic action and the institutional texts. I regard the texts used in didactic institutions (curriculum material and policies) as \textit{discursive layouts of practices} from which the teacher and the students (re-)elaborate meanings in joint forms of action. Drawing on Ricoeur's hermeneutical approach of text and action\textsuperscript{6}, works by Bronckart et al. (2004; Bronckart, Bulea & Fristalon, 2006) elaborated the notion of discursive layouts of action to characterise the very interpretative nature of action in human activities. Forms of action including intentions, motives and purposes of agents are not directly intelligible to the subjects’ consciousness out of discursive layouts as interpretative schemes of the lived action. Beyond the identity of narratives and action that is suggested in Ricoeur's approach, Bronckart elaborates a theory of the text that accounts for the interpretative schemes of the actions performed by humans through the \textit{configurative power of discourses}. Due to their generic \textit{communicative function}, all texts entail certain structural regularities (textual genders in Bakhtin's sense) that originate in the social context of production and in the addressing purposes of the author. Any text (written or oral) results from a purposeful interpretative process developed by individuals with respect to certain collective ends-in-view. Hence, Bronckart contends that the addressed structural and linguistic organisation of the text (and not solely the temporal and causal structure of narratives according to Ricoeur) shapes human actions with respect to the social contexts in which the discourse unfolds. In other words, from lived actions to the figuration of actions in discourses, actions are interpreted as more or less generalised practices, i.e. social ways of

\textsuperscript{5} A full description of these categories in English may be found in Sensevy et al. (2005); Sensevy, (2010) and Ligozat, Wickman & Hamza (accepted).

\textsuperscript{6} For Ricoeur (1992), action is layered in three main forms: action performed by humans in the "real" world may be re-configured in narratives that overcome the discordances in the aspects of the world perceived by the individual subject. Narratives offer a fictive world that (re-)organises events and individual actions into a temporal and causal structure supposed to make sense for the actors. Hence, narratives as "open worlds" (autonomous entities) are available to all human beings as interpretative frames of the modalities of individual participation in the social frames of activity.
dealing with the world. Consequently, texts crystallise and convey a set of the collective pre-constructs of human activities in Leontiev's sense (1979).

3 A socio-historical stratification of didactical joint action

(i) The pre-constructs of didactical joint action in curriculum texts

Beyond the teacher-curriculum relationship as it has been traditionally taken care of, this approach opens the way to consider the prefiguration of the teacher’s and the students’ actions in the discursive layouts of curriculum texts. How do teachers and students "exist" in the texts? What is their intended relationship with the content to be learned by the authors' standards? Which underlying teaching/learning models are promoted through the practices suggested in the teaching material? Some further remarks have to be made with respect to the specifics of what we call curriculum texts. This includes different types of texts that are available to teachers in terms of written documents. In particular, I draw a distinction between the curriculum frames and objectives (e.g. lists of items, competencies, recommendations to teachers) on one hand and the associated curriculum material that is used to teach (e.g. a student's textbook, a teacher's guidance book, a student's worksheet etc.) on the other hand. The main function of curriculum frames and objectives is to tell the teacher what to do and how it is to be done with respect to general ends in view in a national educational context; which knowledge contents should be learned at which stage of schooling. Associated curriculum material may be designed or selected by the school authority as the "official resources" for teaching, or directly selected by teachers in the schoolbooks editorial market; or even constructed by the teachers themselves. In these teaching materials the discursive layout of the actions to be performed in the classroom necessarily encompasses the (re-)configuration of certain social practices involving a content to be learned. I call this the epistemic pre-constructs of the didactic practice. This category of pre-constructs is related to the modalities of production and validation of knowledge within a domain of practice (e.g. the mathematical modelisation). It is specific of the knowledge content embedded within a type of task. Since a genesis of these modalities is privileged in the curriculum (the core of the early didactic transposition theory) the epistemic pre-constructs are not to be separated from their epistemological conditions of emergence. Further, in re-organising the social framework of the epistemic practices to make them practicable in classrooms, curriculum texts also mediate certain socio-educative ends-in-views bared by didactic institutions. I call this the ideological pre-constructs of the didactical practice. They are related to the general teaching and learning models that are privileged by curriculum makers (e.g. learning through errors, problems, mediation of the teacher etc) and to the presumed function of knowledge in society.

In order to illustrate certain pre-constructs of didactical joint action in curriculum texts, I explore the various practices embedded in the task "Encadrement" that was used by Claudia (cf. the introductory vignette). In the Swiss Romande context, a set of teaching materials for mathematics (known as the Moyens d'Enseignement Romands pour les

7 In my work, a document is regarded as a material artefact that concretises the separation of the text from the author. It stabilises a text (written or oral) and makes it communicable beyond of the presence of the author.

8 In this case, they result from a more or less extended documentational genesis (Gueudet & Trouche, 2009) involving parent documents.

9 The Swiss romande common school authority (CIDP) gathers delegates from each French-speaking canton (Genève, Vaud, Jura, Valais, Neuchatel, Fribourg, Berne). Within the CDIP global curriculum framework, each canton remains free to redefine local objectives, evaluation process, school organisation etc.
Mathématiques – MERM – grades 1-6) is designed by an expert group for teaching mathematics in line with the definition of a shared studying scheme (Plan d'Etude, grades 1-6). In the late 1990s, a new wave of MERM was officially adopted by the school authorities in each canton. This implies that the teachers are supposed to use this material for most of their teaching. Since the set is very extensive and not chronologically sequenced, the teachers have to make important decisions about privileging certain tasks and mapping them over the school year to cover all the mathematical topics.

The document "Encadrement" (cf. Appendix 1) is taken out of the teacher's guidebook, more precisely from the "Measuring problems/Measuring with standard units" section. In fact, the document is made up of two kinds of texts. The central part of the document is a copy of the student's worksheet (including Joconde's painting), whereas the teacher's guidance for handling this specific task is laid out beside it. The incorporation of the student's text into the teacher's one pre-figures the division of responsibilities (topogenesis) in the co-elaboration of meanings by the teacher and the students. The students are empowered with the practical construction of the frame and the collective discussion of eventual mistakes, whereas the teacher has to prepare and show the available material (strips of 1 cm wide paper). During the construction of the frame, the teacher's action is restrained to providing the strip-lengths on the student's request without commenting on the correctness of the length. On one hand, the teacher is supposed to organise a collective discussion on the basis of the frames made by the students (this part of the activity is not described in the students' text) but, on the other hand, the teacher seems to be excluded from this collective discussion featured in terms of the students’ action only. Conversely, the extension of the activity (reworking the problem with 2 cm wide strips) is exclusively in the teacher's hands. From this brief overview the students’ possible ends-in-view turn out to be very practical: managing a frame from a single strip length that touches exactly the edge of the picture without any overlapping of the strips and without any pieces of strip left. But what can be learned from this? The students’ text merely features the primitive milieu and the constitutive rules of the task, but the teacher's text does not feature what meaning relations could be construed by the students in this setting (mesogenesis), nor the relations that the teacher should foster in order to warrant knowledge progression on the time line of the lesson (chonogenesis). The epistemic features of the task are not indicated in the teacher's text. However, they may be unveiled in carrying out the task from the instructions that are provided in the students’ text.

Certain epistemic practices are enacted when the frame is taken care of and, moreover, when the strip width changes (the extension of the activity). Different total lengths of the strip may be ordered by the students depending on the type of frame that is targeted\(^\text{10}\). If there is no other condition than what is said in the students’ text, measuring both the side-lengths of the rectangle (15 cm and 11.5 cm) and adding them to get the perimeter of the painting (P = 53 cm) enable a type of frame to be made that is not continuous (cf. Illustration 1).

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\(^{10}\) In the following illustration, I used a common picture of the La Joconde (the French name of the Mona Lisa) painting found on the web [http://www.vaisseaudevinci.com/] that is not identical to the funny-style picture presented on the students' worksheet (cf. Appendix 1: La Joconde with a mathematical textbook in her hands!).

Illustration 1
If continuity is required, then the minimal total length of the strip is the perimeter length \((P = 53 \text{ cm})\) plus four times the strip width \((W = 1 \text{ cm})\) (cf. Illustrations 2a, 2b, 2c & 2d). In order to avoid the empirical calculation of the complement when the strip width changes, the relationship between the total length of strip \((L_T)\) and the strip width \((W)\) is modelled by the increasing function: \(L_T = P + (4*W)\).

Moreover, if a continuous frame is expected with some bevelled angles (cf. Illustration 3), the total length of the strip needs to be increased due to the loss of triangular pieces of strip needed to make the bevels.

The minimal loss is obtained in cutting alternate trapezoidal segments on the strip. In this case, the minimal length required is then \(L_T = P + (5*W)\). If there is no constraints on losses, the length required is then comprised between a minimum value \([L_T \min = P + (5*W)]\) and a maximum value \([L_T \max = P + (8*W)]\) as shown in Illustration 4.

This brief overview of the mathematical practices involved in the framing activity sheds light on the implicit socio-aesthetical norms upon which the mathematical activity is relying. These norms are dropped in the discursive layout of the framing practice in both the students’ text and the teacher’s one. The author of the text might presume that the students will spontaneously target the most common type of frame in everyday life, but the analysis shows that it is the most difficult to anticipate in terms of the strip length required. The epistemic pre-constructs of this type of task rely on the geometrical properties of rectangular shapes and the mathematical modelling of the dependence between two sets of measures (strip length and width) in terms of an algebraic function. These pre-constructs are embedded in the mathematical culture and may be enacted through this task in achieving several frames with different strip widths.

Some ideological pre-constructs are also encapsulated in the discursive layout of the respective actions that should be accepted by the teacher and the students. First, in tying the
mathematical knowledge (measuring, adding, anticipating the complement to the perimeter etc.) to everyday life activities it is supposed that the problem makes sense to the students straightforwardly. Since picture frames are found almost everywhere in our houses, the students are expected to import their commonsense knowledge about it. However, this task is not designed in order to improve the students’ framing skills because this is not the purpose of classroom activities. Some mathematical knowledge-content is packaged in it, but the meaning relations the participants should establish are not figured out in the teacher's text, as if these meanings could spring out naturally and unavoidably from the actions. Second, the division of the work in the textual layout of the document suggests a prominent role of the students in elaborating the frame, noticing and reworking mistakes, whereas the teacher's action is minimised. The knowledge is supposed to spark from the students’ actions and eventual mistakes and not from the teacher's interventions that are not featured in the document. Since there are no chronological steps in the teacher's text, a wide space is left to the students' explorations in small teams. These elements (also confirmed by the analysis of the general guidance text that is provided with the set of teaching materials) suggest a student-centred model of learning in which the teacher is merely the provider of the "good" initiating situations whereas the students are the main constructors of their knowledge.

From the researcher's point of view, the epistemic and ideological pre-constructs behave as a broad interpretative frame of the joint action observed in the classroom.

(ii) Professional thought styles

Whatever the level of definition of the practices in a text (e.g. general objectives, open questions versus structured tasks with a list of instructions), the curriculum material may generate learning situations only through a teaching design that is elaborated by the teacher. Indeed, any task in which the students become involved, even if it is presented directly from the textbook, is the result of a selection operated upstream by the teacher. Here, another layer of interpretation comes into play in the genesis of the didactical action. Along with Sensevy (2010), I assume that the types of decision made by teachers about the use of curriculum materials are driven by the professional thought styles arising among communities of teachers. In studying the development of scientific ideas, Fleck (1938) described the historical constitution of collective structures of thought that constrain the way individual scientists notice and make sense of patterns in the experience of nature. Fleck insists on the dual function of thought styles in that they both foster new elaborations from the recognition of patterns and at the same time they inhibit alternative pathways. As a designer of didactical situations from the available curriculum materials, the teacher's perception of the objective structure of the text is oriented by the cumulative professional experience that is shared with colleagues through reading textbooks and by partaking in professional development sessions, commenting on classroom events with colleagues etc. The "training" of the teacher's thought is provided by the historical sedimentation of the ideological pre-constructs of teaching practice in the teacher's experience.

Claudia's interview (see above) sheds light on the institutional nature of discourses developed by teachers. The type of discourse developed about a specific practice (e.g. framing a picture) is a function of the purpose of the social organisation in which this practice unfolds. When Claudia describes the emergence of the need to add 4cm to obtain the total length of the strip length ("I would have expected that they found it more easily / fortunately it sparked from Héloïse and this enabled me to engage in differentiated teaching"), we understand that it is the students' main responsibility to find out the strip length for obtaining a continuous frame and that Claudia does not envision herself participating in this process. This piece of discourse is congruent with the global management of the students’ responsibilities during
lessons. The students worked in pairs for a total of 55 minutes over the 81 minutes duration of the teaching unit. During this time, none of the students managed to build a continuous frame from the first trial; most of them were successful with a second trial and a few of them needed a third trial to succeed. The students' responsibilities concern the making of the "right" frame (a continuous one) whatever the time it takes, to a certain extent. The conditions for helping the students to model the relationship between the length of the strip and the width of the strip are not part of the teaching design (e.g., discussing the mathematical operations reflecting the different trials made in pairs and sending the students back to new trials on this basis). I contend that these conditions are not "seen" by Claudia because the teachers' collective to whom she belongs (through the use of the MERM and associated in-service professional development sessions) prioritises a general student-centred model of learning over the epistemic analysis of the task. Claudia's reluctance to intervene during the students’ search phase is the practical expression of a professional thought style saturated by the ideological pre-constructs conveyed by institutional texts. Beyond the patterns of joint actions pre-figured in the teaching material, ideological pre-constructs can be easily tracked back to the generic manners in which mathematical teaching practice is described in the Swiss Romande institutional texts (cf. Ligozat, 2008; Schubauer-Leoni & Leutenegger, 2009) and probably in other national contexts adopting a socio-constructivist perspective. Paradoxically, the professional thought style that is developed by teachers upon these pre-constructs does not enable them to "see" the epistemic necessities of teaching practice.

(iii) Practical interpretative schemes

The last component of the text-action relationship in teaching practice features the teacher's agency in reconfiguring the didactical practices from curriculum texts into the time and space of the classroom. The construction of a teaching design from the curriculum material also depends on the teacher's situated ends-in-view at the scale of a whole teaching unit. Not only are the pieces of curriculum material reconfigured at the scale of a lesson but, moreover, they are temporally mapped within a global teaching project unfolding over several weeks or months (Remillard, 1999). The global teaching project about a "grand" topic is progressively shaped by the overall objectives to be achieved in terms of the content being taught and/or competencies to be developed but also in terms of the students' responsiveness to day to day tasks. Hence, the construction of a teaching design involves some practical interpretative schemes enacted by the teacher with respect to the biographical development of the classroom experience. Practical interpretative schemes also contribute to reconfiguring the texts provided in the teaching material into the course of classroom activities.

Exploring the development of Claudia's lessons about the "Encadrement" task, we notice that Claudia introduces some changes in the supply of the strips of paper: the students are requested to measure the total strip length they want from the tape. While the students are working in pairs, Claudia focuses her attention on the students' technique for measuring the strip in turns. She checks the correct use of the 30 cm ruler (that has to be iterated once to measure 57cm for example) and she systematically suggests reworking a second measurement to improve the accuracy. In comparison to the duration of her various interventions, the time spent on defining the expected structure of the frame and on decomposing the steps to make it is very short, and this occurs at the very end of the teaching unit.

As discussed earlier, Claudia does not try to make all the students generalise the "formula" to obtain the total strip length from the strip width. The teaching design is not

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11 This notion is derived from A. Giddens' distinction between practical and discursive consciousness in the theory of social stratification (Giddens, 1984).
oriented towards the potentially high cognitive demands of the contents that are embedded in
the task but towards practical measurement techniques. The definition of the perimeter is the
most prominent content to be institutionalised for all students in the synthesis. The focus on
the measurement techniques results from a practical interpretative scheme of the text featuring
the teaching task "Encadrement". The lack of visibility of the epistemic pre-constructs in the
text is compensated by the broad objectives to be attained in the "grand" topic about
measurement at grade 4, i.e. being able to measure lengths with standard units. On this
matter, the teaching design is consistent with the orientations of Claudia's global teaching
project about measurement and the assessment tasks that are defined by the school teachers’
community. The notion of practical interpretative schemes features the local adjustment of the
教学 designs to certain broader institutional agendas.

4 Methodological consequences for analysing classroom joint actions

The polysemy of the word "design" interestingly expands the traditional understanding of
"intentions" underlying human action as a mental entity to the practical expression of
intentions into a material observable pattern (Baxandall, 1985). Different meanings of the
word "design" are interwoven in the act of teaching: i) a project (or scheme) in which means
to an end are laid down; ii) the process of selecting the means and contriving the elements,
steps and procedures for producing what will adequately satisfy some needs; and iii) the
disposition of material, signs and positions in the form of a layout. Such a layout may exist
physically in a document written by the teacher (lesson plan) but, in addition to that, we
consider that it exists practically in the overall direction that classroom actions take. My
work privileges this latter conception of the teaching design. Drawing the chronicle of the
events that are controlled by the teacher in the course of the joint actions of the teacher and
students enables the researcher to infer the teaching design from classroom observations. In a
similar vein, the actors make sense of their actions through narrative layouts in Ricoeur's
view; therefore the units of action analysed by the researcher have to be assigned into the
temporal course of classroom actions. Since it is impossible to account for the continuum of
classroom activities day after day, the data collected on the basis of a specific research
question are explored at different time scales, inspired by Tiberghien, Malkoun, Buty, Souassi
& Mortimer (2007):

- The micro-scale analysis concerns internal lesson significant events according to the
  analysis of the gestures and discourses used by the teacher and the students.
- The meso-scale analysis concerns one or more lessons corresponding to one teaching
design elaborated by the teacher on the basis of a topic or a type of task. Typically, the
  teaching designs are based on the smallest autonomous units of activity offered in
textbooks.
- The macro-scale analysis concerns the connections among several teaching designs within
  a global teaching project that cover a thematic unit in the subject matter.

The size and form of thematic units and activity units may vary significantly from one
disciplinary field to another and from one national educative context to another. It is then a
methodological matter to tune the scope of the micro-, meso- or macro-scales with respect to
the empirical specificity of the research.

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12 Source: Merriam Webster Unabridged Dictionary
To sum up, curriculum texts are regarded as a first locus of the genesis of the forms of joint action, whereas the enacted teaching designs and the global teaching project are a second locus of this genesis. A third locus may be found in the teacher’s discourse about the teaching design and classroom events as a subsequent reconstruction of singular events experienced by the participants. The analysis of the different loci and the comparison of the reconfigured forms of joint action at each locus contribute to a clinical approach (Schubauer-Leoni & Leutenegger, 2002) of action in didactic institutions. The empirical reconstruction of the forms of didactical joint action in the different loci and in the multi-temporal scales is a long haul work that exceeds the available space of this chapter. Unveiling different aspects of Claudia's case, I have tried to single out three major components of the determinants at play in the classroom joint action. In the framework of the Joint Action Theory in Didactics, these components feature the teachers’ modes of participation to the knowledge transposition process. On this basis, further research aiming at developing the epistemic analysis of the tasks embedded in teaching resources is currently running in teacher-researcher collaborative work concerning early science.

5 Concluding remarks

The account of the text-action dialectics in didactical institutions sheds new light on the stratification of the didactical joint action that is suggested by Sensevy (2007). The pre-constructed formats of the practices that may be identified in curriculum texts occupy a prominent place in the determinants of classroom activity without totally determining the course of the actual joint action (the events observed in the classroom). The level of the determinants of the joint action is featured by a tension between the pre-constructs of the didactical practice in the texts, the professional thought styles sustained in the teachers' collective and the practical interpretative schemes that are elaborated in the classroom biographical experience of the teacher. This tension operates in the projected stratum of the joint action preceding the actualised joint action in the classroom (see Figure 1).

**Figure 1: The triple stratification of the didactic joint action and the related analytical tools**
One of the specificities of the didactic type of actions relies upon a certain level of anticipation by the teacher of the effects upon the students of the structure of the lesson. Adopting a purposive definition of action, Schütz (1951) features anticipation as a prerequisite for making a projection. Anticipation involves the visualisation of a forthcoming action as if it was already performed (action in a future perfect tense, p. 162). This is done on the basis of the knowledge of previously performed acts that are related to the present situation. As far as didactic actions are concerned, this view implies that the construction of an epistemically consistent teaching design departs from the knowledge of which (student) types of actions may vouch for a certain learning outcome. The identification of such epistemic actions in classroom practices lies at the core of the analysis of the mesogenesis in the Joint Action theory in Didactics (cf. Ligozat, Wickman & Hamza, accepted).

References


Appendix 1: "Encadrement" – Document from the teacher's book

**Task**
- Measuring four segments and adding up their lengths.

**Implementation**
- To favor the appropriation of the task, the teacher shows strips of paper but does not provide it to the students for trials.

**Process**
- The teacher cuts the strips of paper according to the length requested by the groups of students, without making any comments.

**Collective discussion**
- If necessary, the students notice the eventual sources of mistakes (not accounting for the strip width, measuring mistakes, calculation mistakes etc.).

**Extension**
- The teacher suggests the following instruction:
  "Rework the problem with strips of 2 cm wide."

**Number of students**
- 2

**Material**
- Student worksheet p65
- Strips of paper of 1 cm wide

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Note: the original size of the painting on the students' worksheet is 15cm long and 11.5cm wide.

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