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From textbook to classroom: A research on teachers' use of pedagogical resources in the context of primary school in the French speaking part of Switzerland

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In French speaking Switzerland, primary school teachers use uniform textbooks edited by the government. These official textbooks are specific, they provide a source of activities but do not give information about how to organize the teaching. In this context, it is interesting to observe how teachers choose and organize in-class activities, the different ways they use textbooks, and the consequences in the classroom. Our research is a case study, which is based on interviews with teachers and classroom observation. The analysis we will present in this contribution were conducted using the model of Robert and Rogalski (2005), which allows us to describe teachers' choices as a coherent system that does not depend only on learning objectives but also on characteristics of the profession and on certain constraints.

Keywords: teachers' practice, textbooks, primary school, cross-analysis.

Introduction

School textbook is a field of research which has been widely increasing since the last three decades as described by Fan, Zhu and Zhenzhen (2013) survey study for the special issue of ZDM "Textbook Research in Mathematics Education". The authors conclude this survey by suggesting future directions in this field of research:

it is necessary for researchers to establish a more solid fundamental conceptualization and theoretical underpinning of the role of textbooks and the relationship between textbooks and other variables not only in curriculum, teaching and learning but also in a wider educational and social context" (Ibid, p. 643)

The large-scale cross national research study TIMSS allowed us to have a wider vision on the role of textbook in connection with social or political issues as presented by Valverde and al. (2002) who analyze textbooks in terms of cross-national differences in *educational opportunities* "the configuration of social, political and pedagogical conditions to provide pupils chances to acquire knowledge, to develop skills and to form attitudes concerning school subjects" (Ibid, p. 6).

Our contribution goes in this direction by presenting the results based on our PhD theses (Daina 2013), which aimed to describe and analyze:

- the social and political context in which the uniform textbooks are designed in French speaking part of Switzerland, known as "Moyens d'Enseignement Romand pour les Mathématiques"(MERM);
- how five teachers in Geneva use this resource for mathematics, considering their "ordinary" practices.

Our research brings a different focus on the question of the connections between social and political issues and teachers practices by considering a qualitative methodology and a theoretical framework which allowed us to understand the practice we observe as a complex but coherent system that is dynamic and does not depend only on learning objectives but also on characteristics of the profession and on certain constraints we can infer from the study of the context (Robert & Rogalski, 2005).

Research design

Our research is a case study, which is based on interviews with teachers and classroom observation. The data were collected from April to June 2009 in five classrooms in Geneva in two different schools. In every class, we collected the following data: an interview before the teaching sequence; the observations in class with video recordings of the various activities of the teaching sequence on the theme of area measure; an interview at the end of the teaching sequence.

To understand the political and social issues connected to our context of study, we collected selected documents, which showed different aspects of the official textbook design process (institutional requirements, project design, review report, etc.)

Theoretical frameworks and research questions

Our project aimed to study how teachers use the textbook and prepare their lessons which is an “invisible” part of the teachers’ practices. In addition, we wanted to observe ordinary practices, with all the complexity implied. Therefore, to build our theoretical framework and our methodology we lean on two theoretical approaches: Margolinas’ model (2005) and the model of Robert and Rogalski (cross-analysis of the teacher’s activity). We did not combine this two framework, instead we asked different independent questions relating to these two theoretical frameworks which we study using tools and methodology from the relevant framework. In this presentation, we will focus on the second model and the results related to it.

The model of Robert and Rogalski: Cross-analysis of the teacher’s activity

This model combines two different approaches. Firstly, a didactic approach: teacher’s practices are linked with the learning objectives. In this sense, the knowledge content of the teaching and the way the teacher organizes his teaching are analyzed using a didactic theoretical framework. Secondly, a psychological approach from cognitive ergonomics: the teacher is considered as a professional whose practices are subject to a professional contract, with particular goals, repertoires of action, representations of mathematical objects and their learning, and, more generally, personal competencies which determine his activity.

Robert and Rogalski (2002) determined five dimensions to analyze teacher’s activity.

- The cognitive and mediation dimensions which concern the set of teacher’s choices about the content and the organization of the knowledge before (cognitive dimension) and during the class-time (mediation dimension).

The combination of this two dimensions allows us to trace what “kind” of mathematics is proposed in the class « la fréquentation des mathématiques qui est installée, ce qui est valorisé par les scénarios et leur accompagnement et ce qui pourrait manquer » (Robert & Rogalski, 2002, p. 514).

This first part relates to the description of the teacher activity, then we would like to interpret and highlight what determines these practices. We refer to three dimensions:

- The social, the personal and the institutional dimensions which permit to define the constraints and the personal aspects of each teaching project.

These three dimensions are studied based on interviews, deduced from the observed teaching sequence and also from the study of the institutional and local context.

This brings us the following research questions:

- What type of mathematics is promoted by various teachers, according to different scenarios and their execution in different contexts? Which kind of logic of action can we observe? Are these practices compatible with the didactic and pedagogical choices of the MERM resource designers?
- What hypotheses can be formulated concerning the dimensions (social, personal, institutional) that determine the teachers' practices of our study? How do the MERM influence the observed practices?

Method of analysis

The analysis was realised according to the following stages:

- A transcription of the lessons we observed was made using Transana, a software which allowed us to have permanently the video and the transcription on the same screen and give the possibility to introduce time codes and keywords. Referring to methodology used in various research using the double approach framework, we divide each lesson in temporal phases, which we call an episode and corresponds to a content unity.
- The scenario of the whole teaching sequence was then reconstituted and analysed to clarify on the one hand what kind of mathematical content is presented during the teaching (cognitive dimension) and, on the other hand, the dynamics in which the content appear during the classes (mediation dimension). The episodes we defined in the first stage of the analysis were coded according to the mathematical content and the teaching strategies (for more details, see Daina 2013).
- we wrote a report based on the interviews with teachers which allowed us to define the "profile" of each teacher, a synthesis of all the information we collected, which give information, among other aspects, on social, personal, institutional dimensions.

Selected results

French speaking Switzerland context and pedagogical resources

Switzerland has a highly decentralized system with no federal or national Ministry of Education. Each of the 26 cantons which composes the country has its own education legislation. However, four Regional Conferences, including French-speaking Switzerland which is represented by the CIIP (<http://www.ciip.ch>), have led to some effective coordination since the last five decades, drawing up common curricula, publishing material, jointly managing institutions and recognizing qualifications and admissions.

In the 1970s in all French speaking Switzerland a common official set of pedagogical resources, the *MERM*, was designed by the CIIP appointed group of experts and teachers from the different cantons. This first edition originates from a double necessity: a will of « inter-cantonal » coordination of

education (mathematics but more widely all the disciplines) and the introduction of a new curricula (CIRCE I), linked with the reform of the "modern mathematics ". In the 1990s, modern mathematics were abandoned and the pedagogical resources have been renewed in the 1990s according to a new educational paradigm based on problem solving, strongly influenced by the socio-constructivist approach.

Switzerland has therefore a long tradition of diverse cantonal educational policies but also the willingness to coordinate the educational system in order to facilitate in particular communication and student mobility. The *MERM* are the "symbol" of this process, especially in mathematics because they were the first to be done. In fact, the *MERM* are the result of a long process of discussions and compromises because they have to be approved and accepted by all the cantons of the French speaking part of Switzerland. It is necessary to allow three or four years to realize the *MERM* for one degree. We have to take into account this complex context in our observation and analysis of this resource (institutional dimension). The *MERM* must for example be compatible with all the plans of studies. They cannot thus be too prescriptive and require an opening.

Besides, the pedagogical resources are central to the reforms and innovations regarding mathematics education and more than just simple resources, they have the role of promoting innovation, in particular thanks to the teacher's textbook which describes the didactic and educational choices. They have to introduce the changes and harmonize the practices. This is also a critical element we have to take into account in our analysis (institutional dimension).

The *MERM* have been thought as a set of resources, therefore they mostly consist of a succession of activities for class, regrouped in 6 to 8 main themes, without hierarchy. Contrarily to textbooks in other countries, they do not give a day-to-day organised plan for teaching, which remains the teachers' responsibility. To do this, the teacher must provide a considerable amount of preparation prior to the lesson and our PhD theses aimed to study the ordinary practices in connection with this resource in order to make visible this essential part of the work of the teacher.

Case study: Mathilde and Sophie

To exemplify our methodology and present some results of our research, we will now present two examples of our case study. We will first provide the chosen information about their "profile", which gives information about the personal and social dimensions. Then we will present and compare their teaching sequences.

Mathilde and Sophie were both young teachers (4 and 5 years of experience) and they worked in the same school. The year of our experiment, they taught the same degree (6P) and they met twice a month and collaborated to develop mathematics lesson plans. Looking at the exchanges between the teachers during this meeting, we saw that they spoke little about the teaching objectives which seemed to be implicitly known and shared.

Mathilde said that the textbook was the reference and did not feel the need to talk more about the objectives. She specified during the interview that her colleagues "trust" her concerning the choice of the activity because it's impossible, according to her, to choose the activities in the textbook without assistance. Sophie also speaks about "trust" during the interview what shows the importance of the collaboration in the preparation, by filling what is felt as a "lack" of the resource.

However, the study of Sophie’s and Mathilde’s profiles allows us to highlight that the objectives of both teachers are very different. For Sophie the calculating procedures in particular the introduction of the techniques of calculation of areas for triangles and parallelograms represent an important aim in the sequence. For her part, Mathilde considers that the main objective concerns the understanding of the notion of area and the formula to calculate the area of a square. Even though their objectives are different, this point remains implicit throughout their collaboration.

The scenarios analysis and their carrying out in class will allow to see how will evolve the educational projects of the two teachers whose starting point, by the way, is the same list of activities.

Figures 1 and 2 allow to have a global vision of Mathilde’s and Sophie’s scenarios. Mathilde provides a teaching sequence we analysed in three parts: an introductory session, three sessions dedicated to the area of square and rectangle and a session of introduction of the area of other polygons. This corresponds to what is proposed in the textbook.

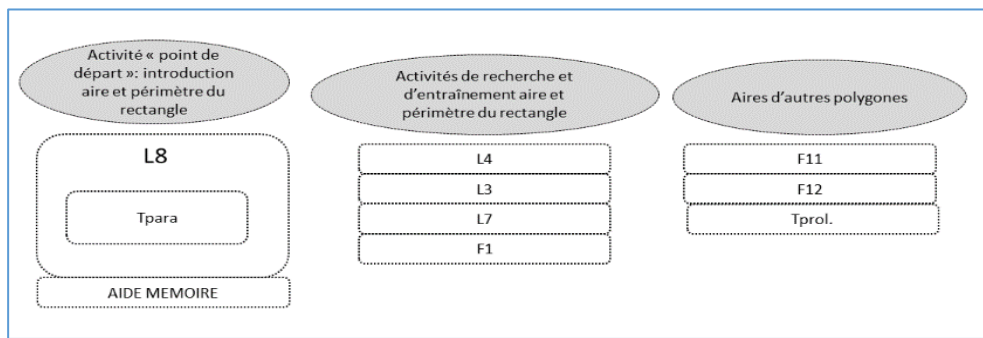


Figure 1 Mathilde’s scenarios

The analysis of the series of activities proposed in Sophie’s classroom show a split teaching sequence where activity from the official textbook are often mixed with improvised tasks on the blackboard.

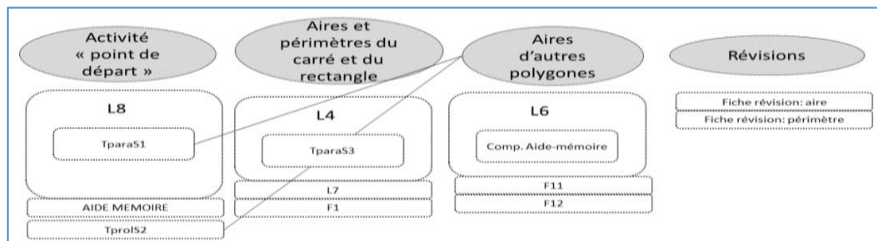
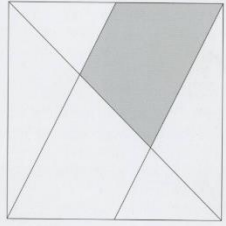


Figure 2 Sophie’s scenarios

We represented a structure in four parts: an introductory activity, a series of activities on the area of square and rectangle, an introduction in the measure of areas of the other regular polygons and a session of revision.

Although Sophie and Mathilde based there teaching sequence on the same common project, we see well how both scenarios evolved. While the starting point is almost identical, the gap is widening in the course of the sessions, leading to different mathematics promoted in each class (considering the cognitive dimension, Daina 2013). It is nevertheless interesting to note that in the interviews, Mathilde and Sophie did not seem conscious of these differences.

The analysis of the first session, while Sophie and Mathilde proposed the same activity, “Fraction of a field”, allowed to see more in details this difference.

<p>8. Fraction of a field</p> <p>Father Joseph has a square field. He splits it using three ropes passing through the vertices or the midpoints of the sides. One of his sons, Francis, will inherit the grey part of the field.</p> <p>What fraction of the field will he receive?</p>	<p>8. Fraction de terrain</p> <p>Le père Joseph a un terrain carré. Il le partage par trois cordes tendues passant par des sommets ou des milieux de côtés.</p> <p>Un de ses fils, François, héritera de la partie grise du terrain.</p> <p>Quelle fraction du terrain recevra-t-il?</p> 
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The table below synthesizes the succession of the phases during the carrying out of the activity in Sophie's and Mathilde's class.

Sophie		Mathilde	
Phases	Duration	Phases	Duration
Instruction	7 minutes	Instruction	3 minutes
Pupils work on the activity	6 minutes	Pupils work on the activity	10 minutes
Pooling	3 minutes	Pooling	7 minutes
Pupils work on the activity	3 minutes	Aide mémoire	19 minutes
Pooling	8 minutes	Pupils work on the activity	39 minutes
Parallel task on white board (interruption)	5 minutes		
pooling (reprise)	8 minutes		
Aide mémoire	4 minutes		
Parallel task on the white board (interruption)	8 minutes		

Here we see very clearly that, although the same activity was proposed to the pupils, its management in class is totally different between the two teachers (mediation dimension).

In the class of Mathilde the number of phases is limited. The instruction is very short. During the pooling, the interactions testify of a discussion between the teacher and the pupils who have an active participation in advancing the discussion. Corrections are made individually.

In the class of Sophie we observe at first a longer instruction time. Sophie testifies of a will to make sure that the pupils understand well « what they have to do ». The progression of the project is managed collectively. Sophie makes regular pooling in the course of which, she directs the pupils on a strategy of resolution which is going to become common. However, the task is also diverted on secondary tasks which are in connection with knowledge bound to calculate the area of parallelograms or triangles which are central objectives for her. Sophie's more personal project enters thus in tension with the progress of the main activity which becomes a material medium to introduce new knowledge in a lecture style of teaching on whiteboard.

We can thus observe a big variability in the practices of these two teachers. What is really questioning is that these differences do not seem to worry them and in spite of their various ways of functioning, the teachers find an interest to prepare together the teaching sequences.

The space provided in this paper only allows to give a limited insight into our research result but some analysis made permit to identify tensions bound to the use of MER. The first cause of tension results from the "shape" of this resource. Indeed, the quantity of the activity proposed is too important and a novice teacher can't know them all and make a real choice. As said in the introduction, there is no supplied sequence and not much piece of information given about each activity. This leads the teachers to follow what make other colleagues, even if sometimes they did not share the same objective and teaching strategy. Furthermore, as we show in the first part, the specific status of this resource will act as a strong constraint on the teacher who will use it to be in "conformity", even if

they do not follow the socio-constructivist approach and will finally distract from the goal of the activities.

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