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Introduction: Why Study Social Interactions in the Classroom? An Open Debate on International Research Experiences

Francesco Arcidiacono and Marcelo Giglio

This book stems from the observation that changes in school curricula in several countries that support the learning of new knowledge require innovative pedagogical activities. To conduct these activities, teachers and teacher educators need tools that enable them to better understand and act upon the socio-cognitive dynamics emerging from new activities (Giglio, Matthey & Melfi, 2014). Universities of teacher education face the challenge of preparing educational actors for new perspectives through pedagogical and policy measures that have been put in place at different times in most European countries (Arcidiacono & Baucal, 2020; Arcidiacono, Baucal, Pavlović Babić, Buđevac & Blagdanić, 2020; Arcidiacono & Veillette, 2022; European Commission, 2007; Kohler, Boissonnade, Padiglia, Meia & Arcidiacono, 2017; Wentzel, Felouzis, Akkari & Arcidiacono, 2021). One example of this is the harmonization of school structures in various cantons[1] in Switzerland, particularly in the French-speaking part of the country (cf. HarmoS: Intercantonal agreement on the harmonization of compulsory schooling). A *Plan d'études romand* (PER) was adopted on 27 May 2010 by the Intercantonal Conference of Public Education of French-speaking Switzerland and Ticino

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1   A Canton in Switzerland is an administrative and geographical region similar to a county in the United States (Translator's note).

and gradually introduced from the start of the 2011–2012 school year for all teachers and subjects in the cantons concerned. The PER prescribes the knowledge and competences to be learned during the three cycles of compulsory schooling in the various subject areas and general education, as well as transversal capacities. The PER constitutes a reference enabling teaching professionals to situate their work within the framework of the student's overall training project, to situate the place and role of school subjects in this overall project, to visualize learning objectives, to organize their teaching, and to have, for each cycle, fundamental expectations as an aid to the regulation of learning. However, several studies show the existence of a gap between teachers' adherence to a curriculum and their actual practices (Cattonar *et al.,* 2007; Giglio, Melfi & Matthey, 2012; Lenoir, 2006; Lenoir, Larose & Lessard, 2005; Tovote, Arcidiacono & Lahiani, 2022). Other investigations highlight the various discrepancies between teachers' representations of the activities to be conducted and the reality of daily classroom activity (Berman, Hultgren, Lee, Rivkin & Roderick, 1991; Giglio, Matthey & Melfi, 2014). What are these (sometimes hidden) 'realities' of the teaching profession? How can we equip teachers in their work and enable them to better analyze and understand the dynamics of social interactions that occur in the classroom? How to train teachers in professional 'acting' by mastering different socio-cognitive dynamics in new classroom activities?

From an international perspective, the aim of this book is to better understand, on the one hand, how students can learn to interact with the other, how they can interact with the other to learn and, on the other hand, how teachers organize different forms of interaction in discursive dynamics within their classes. In this sense, we have gathered here several scientific contributions from colleagues and researchers from different countries interested in social interactions within educational situations in the framework of compulsory education and higher education.

The project for this book was launched during a workshop we organized in June 2013 at the University of Teacher Education BEJUNE in Biel/Bienne (Switzerland) to discuss with several colleagues the following questions: How are social interactions experienced in the classroom in different school subjects? How do teachers interact with their students? How do students develop their knowledge through collaboration with others? What are the implications of past and current research for teaching and teacher education? The workshop gave us the opportunity

to open a space for discussion on our different research and teaching experiences, and – more globally – to reflect on social interactions at school. Subsequently, the guests at the workshop agreed to work with us between 2013 and 2016 to contribute to the realization of the French volume *Les interactions sociales en classe: réflexions et perspectives*, published by Peter Lang (Giglio & Arcidiacono, 2017). The present book is a revised version of it and its English translation.

The present work emerges from the combination of scientific approaches of studying social interactions in the classroom and teaching/learning perspectives in school. In addition, a few contributions offer reflections on initial and continuing teacher education. These different levels are presented through a plurality of methodologies, theories, and perspectives around learning processes, psychosocial, and cultural dimensions of education and especially social interactions in the classroom.

Our goal is to enable a new understanding of teaching/learning dynamics in their context of production and realization. The relationship between psychology, education sciences, and learning models in the humanities and social sciences is to be seen as an interconnected process of individual and social development: the proposed approaches give an important place to semiotic mediations (in particular, language and discourse) and cultural artefacts (e.g., study materials, tools, conditions, and situations) that are involved in learning and teaching processes.

In this volume, the role of the participation of different social actors (*in primis*, teachers and students) is considered primarily from a socio-cultural perspective. Since most learning theories recognize the centrality of the role played by the learner's active participation in an activity, the importance of cultural factors leads us to consider the organization of learning environments in terms of communities (Bruner, 1990; Lave & Wenger, 1991). They are learning communities made up of activities that include discourse and communities of learners linked by the knowledge at stake, by the tools used for learning procedures in an interpersonal communication network, and by their abilities to build relationships with others and their collaborative work practices (Heath & Nicholls, 1997). Adults and children, teachers and students do not develop in a social vacuum, but rather act in joint activities that confront them with different discourses, subjectivities, perspectives, and opinions. But how do they grow? Under what specific conditions

and situations? How do they manage to coordinate themselves in the variety of daily activities at school?

Several aspects come into play in this book. First, as already anticipated, communication and discourse play a fundamental role in the classroom. Thought can take shape through conversations and exchanges. Children can gradually learn certain complex patterns of relationships and uses of different language resources to 'live' in the school context. Secondly, development can be seen in terms of the appropriation of a set of cultural practices in which teachers and students are constantly engaged to orient themselves and participate more or less actively. The examples illustrated in this book draw on the many resources available to participants, resources that are embedded in the social and cultural context in which classroom interactions take place. It is for these reasons that social interactions, also mediated by language, are at the heart of this volume and constitute a common basis for the studies and reflections proposed by the different contributors.

Why this research on social interaction in the classroom?

The different ways in which social psychology has viewed the school have greatly contributed to creating a new image of classroom learning. However, in order to exploit and innovate view of the multiple interactive options in the classroom and to understand better the conditions that support teaching/learning processes, these social interactions deserve a constant re-examination. As for ways of learning, we can no longer underestimate in 'what' and 'how' the (social) contexts (as classrooms) regulate the processing of student and teacher information and the behaviors that may result from this processing.

Another aspect that characterizes this book is related to the finding that social interactions in the classroom are not neutral with respect to the competences proposed by school curricula and in the context of children's personal development. The student can always learn amid others, with others, thanks to others, in a space and context that can evoke other spaces and contexts in which individuals are constantly called upon to help, advise, collaborate, cooperate, negotiate, or oppose (Arcidiacono & Baucal, 2019). But how can we 'orchestrate' the conditions necessary to create social interactions leading to learning?

It would be too far removed from the aims of this volume to question social interactions either in the field of didactics, linguistics, or social psychology, or even in the frontier between two or more fields of research. It is not our aim to provide an exhaustive framework for studies in these fields of application. On the contrary, we have deliberately chosen to select scientific contributions that solicit the notion of social interactions in the broadest sense and allow us to understand the relationship between teacher and learner from different angles. From our perspective, this choice allows us to take both a micro-analytical and a more global look at the issues we discussed at the beginning of this introduction, without being limited to a single specific field of research.

ON THE DEFINITION OF SOCIAL INTERACTIONS IN THE FRAMEWORK OF HUMAN SCIENCES

Defining social interactions can be difficult. Several approaches, theories, and paradigms have focused on this notion with different, sometimes even contrasting, epistemological goals and presuppositions. In this introduction, we propose some benchmarks to guide the reader in the selection of several approaches around social interactions, without claiming to be exhaustive.

From a macro-analytical point of view, close to sociology, the notion of interaction in a broad sense (and social interactions, in particular) brings together research traditions such as the symbolic interactionism of Mead (1934) and Goffman (1974), and the ethnomethodology of Garfinkel (1967). Social interactions are seen as the places where the social order is ratified, transformed, and appropriated within a specific culture, group, and context. From a cognitivist perspective, interactions between individuals may concern a relationship between subjects as a relationship of interdependence (Perret-Clermont, 1996) between a knowing subject (the student, for example) and another knowing subject, or even other knowing subjects (other students, the teacher, etc.) in relation to the object that they intend to learn and know. The individual and collective relationships are therefore central to this type of approach. Within the framework of phenomenological works in education, strongly inspired by Schön (1983), the activity of teachers in the classroom is situated in the 'here and now' that is created in and by lived experience. It is therefore a set of interactive situations to be interpreted through a

reflection-in-action. In this framework, lived experiences lead to the production of circumstantial personal images that function as cognitive organizers of the activity (Casalfiore, 2000). Other approaches, such as the interactionist tradition, have emphasized the socially constructed character of human cognition where teaching includes activities organized by social interactions and knowledge. In this sense, teaching is a language-based interaction that takes place in a particular context that gives it meanings. Accordingly, social interactions cannot be dissociated from their contexts (Bressoux, 2002).

We would like to emphasize that in social interactions the participants (in this book, teachers and students) should make their understanding and interpretation of the activity in which they are jointly engaged mutually recognizable. It is the participants' organization of the interaction and its step-by-step construction that allows the establishment of a shared understanding, a reciprocity of perspectives, the achievement of an intersubjectivity, or the deployment of a socially shared cognition. In an interaction, therefore, each act, gesture, word, and expression exhibit an interpretation of the previous actions, the context, the nature of the interaction (and its purpose), and the respective positions of the participants (in terms of roles, identities, and emotional states). In this sense, the term 'interaction' refers to both a process and a product, and social interactions are, therefore, processes of reciprocal and simultaneous adjustments between individuals, through mechanisms of regulation and synchronization (Arcidiacono, 2013, 2021; Baucal, Arcidiacono & Budjevac, 2011; Fasel Lauzon, 2009; Kerbrat-Orecchioni, 2005; Linell, 1998; Pontecorvo & Arcidiacono, 2014).

This vision of social interactions is part of a socio-cultural approach. School discourses are not seen as tools that simply lead to a specific 'material' action. Rather, they are actions through discourse and their own results (the discourse itself) that promote the social construction of knowledge and that are subjects to negotiation during interactional processes. In this perspective, a qualitative approach is needed to understand 'how development-and-education in their social, cognitive, and linguistic features take place within a culture' (Pontecorvo & Arcidiacono, 2010, pp. 19–20). Indeed, considering the negotiation of meanings and meanings as practices that structure and transform the reality of the participants has a consequence in terms of analysis: the actions of teachers and students are not simply juxtaposed contributions, but rather 'rhetorically shaped' behaviors, i.e., actions in which the participants

use different strategies and abilities in defining the framework of the classroom participation (Orsolini & Pontecorvo, 1992). Students not only receive and reproduce data, but also mediate the selection, evaluation, and interpretation of information, making sense of their experiences. Therefore, a detailed analysis of classroom interactions seems to be a valuable modality for highlighting the role of action and conversation practices during school activities. This requires a specific attention for the activities implemented in the classroom, and for the interactions that derive from them in the way of appropriating, sharing, and building these practices with the other. By the term 'practice' we refer here to 'the whole process of transformation from one reality to another' (Barbier, 2000, p. 20), that is, a process that integrates functional but also intellectual and affective dimensions. A practice is therefore the result of an interaction between several dimensions related to the situation, participants, and processes involved.

From these perspectives, the study of cognitive and reflective aspects of collective activities, which also utilize language as a means of doing, communicating, and thinking together in an educational setting, will be central to the contributions of this book.

Organization of the book: Perspectives and contributions

The chapters[2] of this book present different levels of analysis and reflection on social interactions related to scientific or pedagogical perspectives on the classroom teaching/learning processes or in the framework of initial and continuing teacher education. Multiple spaces of social interactions (in terms of situations, scenarios, scenes, practices, gestures, and roles in their communicational and discursive dimension) are presented and discussed, with special attention to tools and instruments, to relations with the other, to symbolic, cultural, and material objects (transformable and transformed), as well as to the dynamics of transformation and creativity.

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2   Apart from the structure and certain formal aspects standardized by the publishers of the book, the responsibility for each chapter, its content and its scientific and literary property remains with the authors of the contributions.

In the first part of the book, we have grouped together four contributions that provide a comprehensive overview of the state of research on social interactions and on aspects related to teaching/learning processes in the classroom. The study proposed by Nathalie Muller Mirza and Michèle Grossen focuses on classroom learning and the nature of students' emotions, which are rarely considered in scientific investigations. The authors start from the observation that one of the specificities of the school is the fact that it requires students to emancipate from their immediate ordinary experiences in order to build a second-order relationship to the experiences of the world, to the tools that allow one to act on these experiences, to language, and to oneself. Muller Mirza and Grossen invite us to discover how this second-order relationship to the object being taught is realized, with what effects and in what interactive dynamics in the classroom.

Margarida César's chapter focuses on the importance of inter- and intra-empowerment mechanisms within collaborative work situations and teaching/learning processes in mathematics. Her study is contextualized in relation to the reality of Portugal, a country in which educational policy documents emphasize the importance of social interactions in learning processes in mathematics. César presents us with an innovative approach, set up to deal with the underachievement linked to mathematics and the negative social representations of this discipline.

Chapter 3 focuses on cultural tools and socio-cognitive dynamics at work in science learning in schools. The author, Valérie Tartas, shows how important is to be able to reiterate interactive situations and to be equipped with tools promoting learning in the classroom. She presents a new 'didactic micro-history' type device to enable students to build a better understanding of the phenomenon of seasons and the day-night cycle in the context of science learning in primary school. The analysis of different 'child-child-adult-tool-object-to-learn' interactions helps to understand how students can transform knowledge into a mediated tool for solving scientific problems.

The first part of the book is completed by the contribution of Tania Zittoun and Michèle Grossen on the heterogeneity of classroom interactions within philosophy and literature classes in high school. From a dialogical perspective, the authors propose to consider classroom exchanges as resonating with the experience of the protagonists outside the situation. More particularly, they show how classroom interactions

in literature and philosophy relate to the experiences and representations of students and teachers.

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The second part of the book deals with classroom teaching/learning processes from a pedagogical and didactic point of view. Antonio Iannaccone's chapter opens the section by proposing some reflections on the notion of materiality in education. Within the debate on social interactions in the classroom, Iannaccone highlights two aspects that are not well clarified in previous studies: the socio-cognitive processes involved in elementary 'socialized' engineering activities with children and the function of objects (and their integration into cognition) in these socio-cultural spaces for carrying out scientific activities. The study opens useful avenues for reflection to clarify the stakes of certain types of socio-cognitive interactions in educational contexts and contributes to rethinking the function of objects in teaching/learning processes.

The chapter proposed by Christine Riat and Patricia Groothuis around the written production of 4-year-olds as a lever for transforming teaching practices allows for the transition to a key aspect of teaching activity in primary school. Indeed, in the context of the introduction of a new curriculum in the field of reading and writing in French-speaking Switzerland, the authors propose ideas to transform teachers' practices. In their contribution, the proposed changes are seen as ways to qualify mechanisms of resistance, adjustment, and redefinition of tasks.

The second part of the book is completed by the contribution of Britt-Mari Barth on the role of the teacher-mediator. The author proposes a path of reflection based on the observation that, through adult mediation, children can acquire a framework for interpreting their experience and learning, as a common language that they can use to negotiate the meaning of their activities. Through the presentation of the results of her research, Barth shows how learning becomes learning to use intellectual tools together, including ways of thinking, procedures, and key concepts in each discipline.

<div align="center">***</div>

The final part of the book opens a reflection on some perspectives for initial and continuing teacher education. The chapter proposed by Franca

Rossi, Clotilde Pontecorvo and Francesco Arcidiacono focuses on the role of peer interactions in early literacy. The authors present a reflection on the different phases of writing acquisition in groups of children aged 4–6 years from a socio-constructivist perspective. The results of their study are discussed in terms of effects on child development and the role of social interactions in the teaching/learning process of writing literacy.

The role of the collective dimension in learning is also highlighted in Céline Buchs' chapter. The author presents and discusses a teaching/learning framework for many contexts (from primary school to university), based on experimental and correlational empirical research. Buchs offers a reading of cooperative learning in terms of group work structured by the teacher in such a way as to ensure both good social functioning and effective cognitive work through interactions between participants.

In the last chapter, Anne-Nelly Perret-Clermont and Marcelo Giglio present the results of an innovative pedagogical and observational device implemented to reflect on the process of creating a new object in classroom. In their contribution, the authors point out how the scientific view of skill development and learning has changed. In their chapter, Perret-Clermont and Giglio focus on the creative and reflective collaboration between students and teachers, and observe the diversification of roles in which students are placed as producers of new ideas or new cross-curricular objects, inevitably leading to certain teacher's actions that can be decisive for students' learning.

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We are convinced that all the chapters of this volume contribute to the study of social interactions in the classroom in its multiple and rich dimensions, always linked to the contexts of application and the available tools. Moreover, the various contributions have several implications for school structures and teaching practices and, *ipso facto*, for the content to be addressed in initial and continuing teacher education. We believe that this book achieves its goal of not proposing just a sequence of several contributions, but rather of addressing, from different research perspectives, multiple ways in which students and teachers can learn to interact with each other, acquire knowledge by interacting, and the teaching practices needed to 'orchestrate' the different forms of social interactions within the classroom.

Enjoy your reading!

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Part I

Scientific Perspectives on the Study of Social Interactions in the Classroom

Chapter 1
Learning in the Classroom: When Emotions Get in the Way

Nathalie Muller Mirza and Michèle Grossen

Personal experiences and verbalization of emotions at school: The case of education for cultural diversity

According to the sociocultural approach adopted in this chapter, learning is not a strictly cognitive process but an activity involving the persons in their various social, relational, identity and emotional facets (Grossen, 2021; Muller Mirza & Tartas, 2023). In schools, however, while teachers generally have no doubt that students' personal lives cannot be cut off from school learning and experience, they wonder how to work on them in class. Hence, one of the issues for the research in education regards the place to be given to students' emotions and experiences outside the school. It concerns in particular certain teaching contents, especially those falling within the scope of education and 'real world issues', such as education for cultural diversity (Åberg, Mäkitalo & Säljö, 2010; Audigier, Fink, Freudiger & Haeberli, 2011). Indeed, education for cultural diversity, or intercultural education, is linked to emotional dimensions in at least two ways: by the subjects to be taught and the sensitive topics to be tackled, as well as by the special importance it pays to the relationship to otherness. Let us explain.

The subjects to be taught in education for cultural diversity are heterogeneous as they integrate both topics related to disciplines such as geography or history, and topics discussed or experienced in the family sphere and the media, when it comes, for example, to themes

such as migration or the relationship to otherness (Meunier, 2007; Nicollin & Muller Mirza, 2013). Such topics bring into the classroom certain experiences that constitute facets of the students' identities (language, culture, gender, etc.) and can have important emotional resonances. In addition, in some pedagogical documents, teachers are encouraged to make explicit links between the students' different spheres of experience and to discuss their related emotions, representations and practices. More generally, enabling students to verbalize their emotions also aims at learning new objects of knowledge and developing self-reflection about their relationships to otherness (Lanfranchi, Perregaux & Thommen, 2000). Such emphasis puts the students' perceptions, representations, experiences, and verbalized emotions at the center of the teacher's attention.

Given these difficulties, the aim of this chapter is to examine the challenges and conditions for taking emotions and their verbalization into account in the school context: when the subjects to be taught strongly integrate the students' personal experiences and are emotionally charged, what type of learning is targeted? What difficulties do teachers encounter? Under what conditions can new bodies of knowledge be learned in such situations? By trying to answer these questions, we aim at contributing to a reflection on these highly topical and sensitive issues by analyzing teachers' concrete practices. To do so, we present and discuss some results of a study which focused on the verbalization of emotions and personal experiences in classes of education for cultural diversity. Before presenting this study, we briefly introduce our theoretical framework.

A socio-cultural and dialogical perspective on learning and emotions

Learning in a sociocultural approach in psychology

Our theoretical framework draws on sociocultural psychology, whose central feature is, according to Vygotsky (1934/2012), to focus on the relational and social dynamics at play in learning and development. Our own research in this very dynamic field concerned the role of social interactions in the development of thinking and learning in different

contexts (Grossen & Muller Mirza, 2019), for example communication in test situations (Grossen, 2021), teaching-learning situations at school or in adult education (Grossen, 2009; Muller Mirza & Perret-Clermont, 2009), or knowledge transmission outside of school (Muller Mirza & Perret-Clermont, 2016). Research in this field showed that learning or performing in a given task or test are closely linked to the social and situational conditions in which an object of knowledge is taught, or a skill assessed. It also underlined the centrality of the meaning-making processes that take place between individuals (students and teachers, children and adult experimenters, etc.), each seeking to understand the expectations of the other. Moreover, the meaning of the activity and of the objects of knowledge are not only related to the teaching-learning situation itself, but also to other social situations (Grossen, 2021; Grossen & Muller Mirza, 2019; Muller Mirza & dos Santos, 2021). In other words, every situation echoes other situations (Grossen, Zittoun & Ros, 2012; Zittoun & Grossen, in this volume). The relationships, or 'dialogue', between the present situation and other situations may help to interpret what is happening in the here and now, but can also be a source of tension or misunderstanding.

EMOTIONS: THE POINT OF VIEW OF SOCIOCULTURAL PSYCHOLOGY

The concept of emotion is particularly difficult to define. In general (Cosnier, 1994), three components of emotion are described: a subjective sensation (feeling, affect) that enables to identify different types of emotions (joy, fear, anger, etc.), physiological manifestations, and observable behavioral manifestations (gestures, postures, actions, and verbalizations). If the very term 'emotion' (from the Latin *ex-movere*) suggests a movement from the inside to the outside and highlights the physiological anchorage of emotions, today the interpersonal dimensions of emotions are associated with social and cultural dimensions, and so that the opposite movement, from the outside to the inside, is taken into consideration (Leont'ev, 1978; Ratner, 2000; Roth, 2008; van der Veer & Valsiner, 1989; Veresov, 2017; Zittoun & Grossen, in this volume). This is precisely the perspective from which Vygotsky (1933/1999) investigated emotions. Examining the relationships between emotions and cognitive processes, he undertook the study of emotions from a developmental point of view and relied on a general assumption of his

theory: development as a sign-mediated process. According to Vygotsky, culturally constructed signs (e.g., language) mediate the relationship between the person and the world, and make it possible to coordinate not only actions between people, but also to develop individual thinking. Therefore, emotions, like other psychological processes, originate in interpersonal relationships and are then internalized. Consequently, personal emotions result from a process of internalizing experiences with others (Vygotsky, 1925/1971). Hence, the relationship between emotion and learning in schools becomes an important issue in sociocultural psychology (Nonnon, 2008; Roth & Jornet, 2014), and this is so in many ways. First, on a relational level, the emergence of emotions in the classroom may be sensitive for teachers because the students who express their emotions are under their classmates' gaze. Moreover, when these emotions involve an aspect of the students' personal life, the latter becomes public and can be judged or even mocked. Second, we can wonder whether emotions can be part of a teaching-learning process. If so, under what conditions? More specifically, can we transform the students' relationship to their emotions in the same way as we transform their relationship to language or mathematics? Put differently, is it possible to secondarize emotions, that is, to apprehend them, not only as a personal experience but as an experience that goes beyond one's own experience, becomes an object of (self)reflection, is put into words and relate to experiences shared by others? Let us take a closer look at this issue.

Is secondarization of emotions possible?

The main role of school is to foster the development and learning of scientific thinking and specific forms of language. Thence, according to Vygotsky (1934/2012), learning at school necessarily introduces a gap between everyday and scientific concepts, and questions the relationship between these two forms of thinking. Discussing the concept of 'brother', Vygotsky (1934/2012) showed that the students' personal experience of brotherhood can be an obstacle to their understanding of the concept as part of a kinship system. Such an example contradicts the intuition that a direct experience of a phenomenon necessarily facilitates learning; it questions the emotional dimension and personal resonance of subjects taught at school, especially when they are explicitly linked to everyday experiences (Bonnéry, 2015).

Vygotsky brought another interesting idea, namely that personal experience can be transformed through teaching. Indeed, in a school situation, students are confronted with objects of knowledge which they may have experienced in their daily life, but which, within the school framework, are worked on at a different level. For example, in French class, children learn to consider everyday language as a complex language system and are expected to develop a reflection on the properties of language. This work requires the students to become aware of what they do in everyday situations without paying attention to it. The notion of secondarization (Bautier, 2005; Bonnéry, 2015; Jaubert, Rebière & Bernié, 2004) describes precisely the process through which a lived experience becomes an object of reflection, enables a person to distance his- or herself from his or her experience, to look at it with the eyes of others. From lived experience, emotion can take on the status of an object of reflection, as well as an object shared by others and shareable with others (de Diesbach-Dolder & Muller Mirza, 2022; Muller Mirza, 2012; Muller Mirza, Grossen, de Diesbach-Dolder & Nicollin, 2014).

This theoretical framework, briefly described, guided the methodological procedure of the research project 'Transformation of Emotions and Knowledge Construction' (TECS). It prompted us to analyze in detail the interactions that take place in concrete situations, to consider the institutional environment of these interactions, and to examine how teachers and students make sense of the situation, the task and the subjects to be taught or learned, in particular those related to students' emotional experiences.

The research project 'Transformation of emotions and construction of knowledge' (TECS)

The aim of the research project TECS was to describe the institutional and political context in which education for cultural diversity takes place in French-speaking part of Switzerland, to analyze the teachers-students' interactions during lessons, and to document the way in which the teachers deal with situations related to students' emotional experiences. To do so, we used a methodology consisting of recordings of classroom interactions, interviews, focus groups and document analysis (Edwards, Fleer & Bøttcher, 2019).

Working with teachers

Our study required the collaboration of 12 volunteer teachers (11 women and one man) from the seven cantons or regions of French-speaking Switzerland, i.e., six primary level classes (7th and 8th grades, 11–13 years old) and six classes of secondary level I (10th and 11th grades, 14–17 years old).

Teachers were invited to use two teaching materials distributed by the 'Education and Development Foundation' (www.globaleducat ion.ch): a 'Photolanguage Humanity on the Move' which consisted of a set of 50 photos related to migration and cultural diversity, and a comic strip without text entitled 'Where are our fathers going?' recounting the story of a father forced to leave his country and his family. According to the teaching instructions, these two documents aim at expressing and analyzing the students' emotions and personal experiences related to themes broadly associated with migration. Proposed in the context of our study, they enabled us to compare the way in which, beyond the teaching instructions, each teacher interpreted the pedagogical goal of these activities and actually used them.

The design of the study consisted of five main stages: (1) pre-interview with the teachers about their conception of education for cultural diversity and the way in which they intended to use the two documents; (2) individual written production of the students about a photo taken from Photolangage; (3) observation and videorecording[1] of the lessons based on the two documents; (4) focus-groups of five to six students; (5) post-interviews with the teachers concerning the course of the lesson.

In this chapter, we will focus on the data produced in stage 3 in which we collected 83 lessons (between two and ten lessons per teacher) based on the two documents.

Data analysis

The first step of the analysis consisted of dividing the lessons into episodes, one episode corresponding to an action (for example, in

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1   The videos have been made with the written consent of the parents who
    received detailed information on the use of the collected data.

Photolanguage, 'choose a photograph'). This resulted in a synoptic view of each lesson (Schneuwly, Dolz & Ronveaux, 2006).

In a second step, we identified episodes in which a student (or the teacher, although it was less frequent) verbalized an emotion or recounted a personal experience, the two things often being linked. Examples include statements such as 'it makes me sad' or narratives of an event of the student's private life which is told with the expression of an emotion. 195 episodes which we called 'emotional episodes' have been identified. As we can see, the verbalization of emotions or personal experiences are quite frequent in these lessons.

In a third step, we focused on these 195 episodes and examined: (a) how the verbalization of emotions or personal experiences were introduced into the discursive space; (b) how these verbalizations circulated among the participants; (c) whether and how emotions were secondarized. Focusing on the processes of co-construction of discourse objects about emotions, we examined how these verbalizations of emotions or personal experiences (a knowledge, an element of experience) are likely to be transformed into objects of reflection and secondarized.

The entry of emotions on the classroom scene

Verbalization of emotions

How do emotions or personal experiences enter the classroom scene? We observed two main scenarios. In the first, the whole lesson, from the presentation of the activity (Photolanguage or comics) and the teacher's instructions to its end, was structured by the verbalization of emotions. The whole activity was focused on an explicit pedagogical goal: to give students an opportunity to express their emotions (to put them into words) and to encourage them to use a lexicon that refers as explicitly as possible to a personal emotion or experience. This type of episode could for example be initiated by a question from the teacher (Eleonore[2]):

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2   The teachers' pseudonyms all begin with the letter E.

Example 1   (Eleonore, 10–11th grade)

   Eleonore   you look at the image, you soak it up, you ask yourself the question… 'what does it awaken in me' what- what- what emotions they stir' what- what do I FEEL, does it make me think- does it make me think about what '/'[3]

In the second case, the verbalization of emotions emerged in a task that did not directly deal with emotions.

Example 2   (Edwige, 9th grade)

   Edwige   (…) there's the story of this woman called Rosa, and you also have a history, your parents they also have a history or your grandparents, then

   Nicolas   well, anyway, I think my mother, well, it would be uh: my grandfather, he lived in France and my mother, she lived in a village in Ivory Coast. (some students laugh) and uh: my grandfather he brought her here- first to France, and then I think she went to Switzerland and: I always stayed in the country=

   Edwige   =so, oh, yeah, you stayed in the country=

   Nicolas   =and I missed my mother, I missed her, I wanted to see her, I asked every time, then I came here on holiday, then I asked to stay and here it is

In these two cases, the students' verbalizations of emotions have different statuses: they are either a teaching object explicitly planned by the teacher, or an unforeseen reaction that results from a discussion about a different object. However, in both cases, teachers must deal with the effects that the verbalization of emotions has whether on the student who expressed them, or on the other students. In this regard, the teachers reported situations in which the expression of emotions or personal experiences had negative consequences. Therefore, at the end of a lesson, a teacher noted that it is necessary to 'set a framework to prevent overflowing, to prevent mockery […] it breaks up the class, it destroys the children' (Eva, 8th grade teacher).

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3   See transcription conventions in Appendix.

Once in the discursive space of the classroom, what happened to the verbalized emotions or personal experiences evoked and what were teachers' practices to address them? Among the specific case observed, two seemed of particular importance. In the first case, the emotion was only mentioned and did not open any dialogue with the teacher or the other students. Everything happens as if, in the teacher's eyes, putting an emotion into words was sufficient and a goal in itself. In the second case, teachers took up what a student said, either to lead him or her to place his or her personal experience in a more general context (i.e., to generalize), or on the contrary, to refer to a specific situation in order to understand his or her own personal experience (i.e., to particularize). Let us present these two cases in more details.

Verbalization of emotion as a goal in itself

Not every verbalization of emotions that entered the discursive space gave rise to lengthy discussion:

Example 3	(Eleonore, 10–11th grade)
Eleonore	do we agree with that' ((Mary nods her head)), you saw it too, and does it awaken something happy, sad, or: who's annoying you or what's:/how is it:/what's the best way?
Marie	sad
Eleonore	rather sad, okay, thank you. And Michel'
Michel	err that, […]

The emotion or personal experience reported here by a student is part of a 'Question-Response-Feedback' routine, where feedback is minimal ('rather sad, okay, thank you') and consists mainly of taking note of the student's response before giving the floor to another student. This routine can be repeated several times, resulting in a juxtaposition of verbalizations of emotions or personal experiences. This juxtaposition is close to what Mercer (2000) called 'cumulative talk'. In these exchanges, it is above all the sharing of personal experiences and emotions that prevails, with the teacher distributing the turns.

From this structure of exchanges, we can infer that the teachers' goal is to open a space in which students can speak and work on verbalizing emotions. This verbalization work, which was generally not followed by an evaluation or judgement on the content, can be considered as a first form of secondarization. We can also hypothesize that such a practice is based on a theory (more or less implicit, but relayed by the literature on emotions) according to which verbalizing emotions promotes interpersonal relationships and can prevent acts of violence (Zimmermann, Salamin & Reicherts, 2008).

THE ROUTINE UNICITY-GENERICITY

In this case, the verbalization of emotions leads the teacher to take up and develop the students' discourse. The analysis enabled us to identify what we have called '*unicity-genericity* routine' (Muller Mirza et al., 2014). This routine takes two forms. In the first, the verbalization of a personal emotion gives rise to a more or less important generalization to other people or situations. The student or teacher is thus led to concepts, encyclopedic bodies of knowledge, social knowledge, or collective practices. In other words, there is a discursive movement that starts from the description of a specific case (unicity) and leads to the identification of a more general case (genericity). In the second form, the movement is reverse: the teacher or student takes up an element related to the experience or emotion of a third party (individual or group) and contextualizes it to the personal situation of a student, and sometimes even of the teacher him- or herself. In the latter case, the movement goes from the general to the particular.

These two movements can be observed in the same emotional episode, as illustrated in example 4, taken from the observation of a lesson with 10th and 11th grade students (aged between 15 and 17). Eleonore, the teacher, leads a discussion on the interpretation of the drawings on a page of the comic strip. On this page, the main character is frightened by a small animal that looks like the monster that, at the beginning of the story, pushed him to leave his country and his family. In example 4, we note in the margin the type of movement performed.

Example 4 (Eleonore, 10–11th grade)

48	Eleonore	yes it's true it's his daddy, actually it's this daddy the man he's still scared he says but, 'ah: I really had a big memory' and then the daddy comes, how does he do to help him'	*Genericity: reference to the experience of a third party (the comic strip character)*
22	Manual	it reassures him	
49	Eleonore	co- but how does he reassure him' look at the picture	
10	Michel	by hitting him, uh:	
21	Martin	he puts his hand on his shoulder	
50	Eleonore	he's got a gesture/he's got a gesture and what's that gesture'	
22	Martin	'don't worry, I'm here if you need me'.	
51	Eloonore	yeah, look when I talk to you now/ I'm at: two meters, three meters, I'm not too far away because otherwise you can't hear me anymore	*Movement towards unicity: reference to the present experience between the teacher and the students ('I'/'you'')*
23	Manual	=it's close to him=	
52	Eleonore	=but I'm not too close either 'cause that would bother you, all right' there's a fair distance but when someone's very sad, what do you do automatically'	*Movement towards genericity: 'one', 'we'*
24	Manual	we're closing in on him/	
53	Eleonore	we're going to get close, we're going to get close to the person, and if she's is very sad we're going to hug her/so we're going to shorten the distance./ is this a cultural thing'	*Even more extreme movement towards genericity: 'cultural'*
1	Maxime	((overlapping Manual)) yes	
54	Eleonore	do you believe' isn't something that's in all the country the same'	*'in all countries'*

25	Manual	no=	
23	Martin	=err, in some countries you're not allowed, for	
55	Eleonore	ah ah so there=	
24	Martin	=for example here in Switzerland like this uh, yes: there's a girl who's sad or something, a guy can give her a hug or something=	*Movement towards unicity while remaining on the pole of genericity: the student takes a concrete example that applies to a set of generic individuals 'a girl', 'a guy'…*
56	Eleonore	=ok	

This dynamic interplay between unicity and genericity has at least two functions: by moving from the genericity to unicity, the teacher helps students understand the problem being discussed; she links the students' experience to new experiences or knowledge. By moving in the opposite direction, from unicity to genericity, she encourages students to distance themselves from their own point of view and to take that of others, which is precisely one of the aims of education for cultural diversity.

Taken together, these two movements are a professional practice aimed at secondarization, since they encourage students, on the one hand, to take into account elements that go beyond their immediate experience and, on the other hand, to reflect on their own experiences and emotions by considering those of others. As a result, the students (as well as the teacher!) come to question the specificity of their perception in relation to that of others. It should be noted, however, that our observations did not always make it possible to confirm that secondarization has been achieved.

Conclusion

Whether indirectly or explicitly, some subjects taught at school elicit the students' expression of emotions. Topics covered in lessons of education for cultural diversity certainly fall into this category, especially when teachers seek to take into account and value students' experiences of

migration or intercultural encounters. Faced with the difficulties raised by the emergence of emotions and personal experiences on the classroom scene, teachers develop specific professional practices. Based on observation of lessons in education for cultural diversity, this chapter aimed to highlight some of these practices and discussing their effects in terms of secondarization. The analysis has so far identified two main types of practices.

In a first type, the verbalization of emotions and personal experiences appeared to be an end in itself. It seemed to serve several goals, such as enabling the expression of emotions in a setting that ensures that everyone's words are heard and respected, encouraging the students to put emotions into words, and developing more personal relationships among the students as well as between the students and the teacher. While the purpose of these practices needs to be better understood, we may still wonder what meaning and what implications these activities have for students. Do they experience these lessons as an opportunity to assert their uniqueness in the more or less anonymous setting of the classroom? An opportunity to do something other than in usual lessons? An intrusion on privacy? An opportunity for learning? While these questions remain open, we found that some topics covered in these lessons sometimes elicited the expression of negative emotions: for example, some students refused to engage in an activity that dealt with their personal history, or were on the verge of tears when they recalled scenes of war or separation from their childhood. As topics for discussion in the classroom, the emergence of emotions may be difficult to control, a fact that the teachers we interviewed were fully aware of.

In a second type of practices, the verbalization of emotions appeared to be a teaching opportunity. The interactions that developed around these verbalizations gave rise to the development of new understandings, relating to objects both external to the students and to their own experience. In this case, emotions became objects of observation, discussion, and exchange of views in dialogue with other participants. The unicity-genericity routine we have observed, which is characterized by a discursive movement that oscillates between one's own, idiosyncratic, experience and a shared, collective, experience, describes a practice by which teachers promote the transformation of emotions, with a view to secondarization. The use of this practice also appears to be particularly relevant on a relational level, since the movement between unicity and genericity reduces the risks (which seem to be rather high in education

for cultural diversity) of overgeneralization, particularly through reference to stereotypes, national, or cultural categories, as well as the risks of overparticularization and overpersonalization of the students' experiences.

As a matter of fact, the problem is not so much whether it is important, or not, to let emotions and personal experiences enter the classroom, but rather to question the conditions under which they can become a resource for learning about cultural, historic and social facts, as well as learning self-reflexivity. With this close exploration of the teacher's practices, we were able to outline some of these conditions. Analyzes in progress will enable us to refine our understanding of the processes involved in the verbalization of emotions in classroom and their effects on the pedagogical dynamic.

Acknowledgments

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AQ: Please note that the reference 'Zittoun 2014' has not been cross-referred in the text. Please provide the same.

Transcription norms

=	very fast chaining between two speakers, at the end of A and the beginning of B
:::	vowel lengthening, depending on the length of the vowel lengthening
(whispering)	non-verbal behavior
(sighing)	non-verbal behavior
(laughing)	non-verbal behavior
(())	transcriber's comments
CAPITAL LETTERS	word or syllable emphasis
'	rising intonation (not necessarily a question)
,	descending intonation
.	descending intonation with short pause
///	breaks

Chapter 2
Collaborative Work and Teaching and Learning Processes in Mathematics: The Importance of Inter- and Intra-Empowerment Mechanisms

Margarida César

Introduction

In Portugal, educational policy guidelines emphasize the importance of social interactions in mathematics learning (Abrantes, Serrazina & Oliveira, 1999). Yet there is a huge difference between the discourse and the practice. According to a national study carried out by the Association of Mathematics Teachers (APM – *Associação de Professores de Matemática*), lecturing, followed by exercises, are the most frequently observed teaching strategies in mathematics classes and social interactions are often vertical – teacher/student(s). Peer interactions are less usual and if they are not forbidden, they are not encouraged (Precatado *et al.*, 1998). This study is supported by a more recent but smaller study (Leite & Delgado, 2012). Although educational policy documents suggest that teachers should use tasks from different natures, such as problem solving, research or projects, most teachers only use exercises (Precatado *et al.*, 1998). There are two possible reasons for this discrepancy between the research findings mentioned in educational policy documents and teachers' practices: (1) changes in educational policies often take place, but there is no serious evaluation; and (2) teacher education does not provide examples of practices adapted to students' characteristics, interests,

and needs. Thus, despite educational policy guidelines, most teachers end up repeating what they have experienced as students when they take on the role of teacher.

In Portugal students' underachievement in mathematics is high. Their social representations of mathematics, its knowledge, and themselves as mathematics learners are often quite negative (César, 2009, 2014; Machado, 2014; Machado & César, 2012, 2013). However, mathematics plays a very important role in the vocational choices that students can, or cannot, make. For many professional and university studies succeeding in Mathematics in high secondary schooling is mandatory. Underachievement is selective and cumulative. Thus, those whose parents are less literate and those who experience this underachievement as early as primary school are more likely to repeat grades and experience varying subtle forms of educational and social exclusion (César, 2009, 2013a). Underachievement in mathematics – and in school in general – is also a phenomenon linked to culture, particularly to the mother tongue. Empirical evidences show that students whose mother tongue is Creole (for example, those from Cape Verde), an ideographic language, prefer geometric reasoning and global approaches to problem solving, while those whose mother tongue is Portuguese, or another phonetic language, tend to feel more comfortable with analytical reasoning and step-by-step approaches, which are the most common and valued approaches in mathematics classes in Portugal (César, 2009, 2013a; Meyer, Prediger, César & Norén, 2016). A possible explanation is that most teachers speak a phonetic mother tongue and the language of instruction – Portuguese – is also phonetic.

We conceive contexts as macro-systems that change slowly and in which each of us participates (for example, the school context or the family context, among others). Scenarios are more restricted than contexts and, above all, as in the theatre, decided and constructed mainly by those who have the decision-making power. In a school context, teachers are the ones who first construct the formal learning scenarios. When they distribute their power by using *inter-empowerment* mechanisms, scenarios are also constructed by students. We consider the classroom as a scenario. During a lesson, there are several situations – work in dyads, general discussion, a particular conversation with a student asking a question, a comment made by the teacher, among others. In a context, there are several scenarios that coexist and in each scenario several situations that are experienced by the participants, in this case

by the teacher and the students. Students' mathematical performances are shaped by the context, scenario, and situation in which that performance takes place, and above all by students' interpretations of what is required of them and the expectations that teachers have of them as mathematics learners.

Several authors have stressed the fundamental role of communication in mathematics learning. Sfard (2008) states that learning is communicating, and that thinking is a form of communication. She underlines the importance of communication in learning, particularly in the most formal settings. We have studied the role of peer interactions in mathematics in formal education settings (César, 2009, 2013a, 2014; Machado, 2014; Machado & César, 2012, 2013). These interactions are shaped by interpretations made from what we listen to (Bakhtin, 1929/1981), by the meanings we attribute to the mathematical tasks suggested by the teachers, and by the intersubjectivity that we are – or are not – able to establish with those who develop mathematical activities with us, such as a group partners or a dyad. As Christiansen and Walther (1986), we use the designation *task* for work proposals suggested by teachers and *activities* for student actions as they engage in solving the tasks that teachers suggested.

However, social interactions are also related to power and voice (Apple, 1995; Wertsch, 1991), to the feeling of having the right to express oneself as a legitimate participant or only as a peripheral participant (César, 2009, 2013a, 2014; Lave & César, 2009, 2013a, 2014; Wenger, 1991), to the expectations we have of the others, and they have of us. All that shape our life trajectory of participation, particularly at school (César, 2013a, 2013b, 2014, 2017; Courela & César, 2012; Machado & César, 2013). When power is more distributed and students express their different voices, including those of their different *I-positions,* which are part of their *dialogical self* (Hermans, 2001), we are promoting equity and an education that facilitates the access to achievement. This plays an essential role in the construction of their identities (César, 2013a, 2014, 2017; Cobb & Hodge, 2007). Teachers' practices shape students' mathematical performances, particularly for those who need specialized educational support (César, 2014; César & Santos, 2006), or who participate in vulnerable cultures, which are socially undervalued (César & Kumpulainen, 2009; Ligorio & César, 2013; Marsico, Komatsu & Iannaccone, 2013).

Developing collaborative work among students, in dyads or groups, has proven to be a way of promoting a more inclusive and intercultural

education (César, 2009, 2013a, 2014, 2017; César & Santos, 2006). Collaborative work can be a way of giving voice(s) to students who usually remain silent because students decide the distribution of activities carried out by the dyad or the group. Collaborative work develops autonomy and responsibility because it is less focused on the teacher's role and power and it puts the focus of action on students (Machado, 2014; Ventura, 2012). It also helps to respect cultural diversity and the diversity of reasoning, solving strategies, and arguments used by different students who participate in highly diverse cultures. It allows for the creation of thinking spaces, which Perret-Clermont (2004) conceives of as spaces where students feel safe to ask questions, argue, or share their thoughts. However, in our opinion, these thinking spaces/times will not be possible if teachers do not use *inter-empowerment* mechanisms and if students are not able to internalize them, transforming them into *intra-empowerment* mechanisms (César, 2013a, 2014). In a similar way to that theorized by Vygotsky (1934/1962) regarding knowledge, empowerment mechanisms first exist in the social (inter-) and only afterwards in the individual (intra-). These mechanisms are particularly important for students who participate in vulnerable cultures, who often face underachievement and construct negative social representations about mathematics and about themselves as mathematics learners. Then they no longer believe they are capable of learning. Teachers' practices are essential to enable them to construct *intra-empowerment* mechanisms that later they will be able to use, autonomously, even in other contexts, scenarios, or situations (César, 2013a, 2013b, 2014, 2017; Machado & César, 2013).

These mechanisms also play a very important role in their life trajectories of participation, either at school or elsewhere. The importance of voice and power has long been emphasized. But the existence of *inter-* and *intra-empowerment* mechanisms was just theorized in 2013 (César, 2013a). It emerged when we analyzed in detail the empirical body of research of the 'Interaction and Knowledge' (IK) project, which included more than 12 years of research, and 10 years of *follow* up. These mechanisms can also be used with families, particularly those participating in vulnerable cultures, enabling them to become more legitimate participants at school, making further contributions to their children's life trajectories of participation (César, 2013b; César & Ventura, 2012). The richness of these concepts is illuminated by their use in the analysis of other empirical bodies of research, which were not collected by this

team. These two constructs, combined with the one of life trajectories of participation (César, 2013a), allow us to better answer the initial question we were addressed to: How can social interactions be defined, conceptualized, and experienced in the classroom according to our studies?

Method

The 'Interaction and Knowledge' (IK) project was developed in different regions of Portugal, including the Azores, over a period of 12 years (1994/95–2005/06). Since we wanted to know the long-term impact of this project, we set up a 10-year follow-up (more details in César, 2009, 2017; Machado, 2014; Ventura, 2012). The main goal of the IK was to study and promote social interactions in formal education scenarios. We also wanted to contribute to a more inclusive and intercultural education. This project was developed in mathematics, science, history, languages, and philosophy, from primary school to university classes. We are focusing on data concerning mathematics in secondary education (5th to 12th grades).

Members of the IK team assumed an interpretive approach (Denzin, 1998). We explored the research questions in three different designs: (1) *quasi-experimental* studies; (2) action research projects; and (3) case studies (more details in Hamido & César, 2009; Ventura, 2012). This chapter discusses the results of mathematics classrooms in action-research projects, since this research design directly concerns intervention and reflection on practices (Mason, 2002).

We have studied almost 600 classes and 67 teacher/researchers of mathematics. These students, their families, teacher/researchers, five psychologists, other educational agents, observers, and external evaluators participated in the IK. This allowed the triangulation of information sources. The IK research team worked collaboratively. Tasks and data were discussed by several researchers, which allowed for the triangulation of the researchers. Research decisions were made by members of this team. Thus, they are also considered participants.

The data collecting instruments were observation (recorded in the journals of each teacher/researcher and researchers, such as psychologists; sometimes these observations were recorded in photos, audio, or video), questionnaires, interviews, informal conversations, reports from teacher/researchers, researchers, external observers and evaluators,

documents, student protocols, an instrument to evaluate students' abilities and competences ([IACC] – for details see Machado, 2014), and a task inspired in projective techniques (TIP). The variety of instruments allowed for their triangulation.

Each class was observed for at least one school year. Some students were followed during a complete cycle, for example, from 7th to 9th grade, or from 10th to 12th grade. This depended on the professional position of the teacher/researchers, as some of them were still at the beginning of their careers and changed school every year, while others had been working in the same school for several years and could teach the same class the whole cycle. The data collection procedures included a first week devoted to getting to know the students better: their abilities and competences, needs and interests (see César, 2009, 2013a; Machado, 2014; Ventura, 2012). During this week, we used observation, a TIP, a questionnaire, and the IACC. The data collected with these instruments were used to make decisions about the first dyads, as this was one of the responsibilities of the teacher/researchers. Observation, students' protocols, and informal conversations were collected throughout the school year. The questionnaires and TIPs were used at the beginning of the school year (mid-September – first week of classes), at the beginning of the second semester (January) and at the end of the school year (June). Interviews took place at the end of the first period (mid-December) and at the end of the year (June). Follow-ups took place at the end of the year (June). The dates for collecting reports and documents were quite different in each school and class.

Data treatment and analysis procedures were based on narrative content analysis (Clandinin & Connelly, 1998), which allowed us to trace the students' life trajectories of participation. This analysis began with a fluid reading that became more focused and in-depth in subsequent readings, allowing us to identify patterns and differences between students' different pathways (see César, 2009, 2013a, 2017; Ventura, 2012). The categories of analysis are inductive, as are the constructs that have been theorized from the analysis of data in the IK empirical body of research (Caesar, 2013a, 2013b, 2014, 2017).

Results

Although focusing on mathematics classrooms, *inter-* and *intra-empowerment* mechanisms and life trajectories of participation play an

equally important role in other subjects (Courela & César, 2012) and in school/family relationships (César, 2013b; César & Ventura, 2012). In mathematics, in previous chapters we analyzed their roles in a dyad we studied during the follow-up (César, 2009, 2013a, 2013b, 2014). This dyad consisted of V (first letter of his first name, to guarantee his anonymity), a 16-year-old boy whose family was from Cape Verde who experienced underachievement in mathematics, and M, a 14-year-old girl, the age expected for a 9th grader, participating in the dominant culture and with great success in mathematics.

Mechanisms of *inter-empowerment* are used in teacher/researchers' practices since the first week of classes. We decided that during this first week we would not focus on teaching contents but on getting to know the students better to adapt the practices to their characteristics, interests, and needs (Machado, 2014; Ventura, 2012). Since many students have a very negative self-esteem, particularly regarding mathematics, we have put into practice a first week where the implicit plays a fundamental role to develop a positive self-esteem. Once students have answered to the IACC, teacher/researchers analyze their answers and decide which students will participate in the general discussion of this instrument. But teacher/researchers wanted all students to go to the blackboard to show the class how they had solved one of the tasks or part of a task. This implicit message – that all students are capable of learning mathematics and performing well enough to be recorded in writing by their peers – had huge impact, especially for students who were underachieving and those who had never been called to the blackboard in mathematics. This is a first *inter-empowerment* mechanism and one of the most mentioned by students in questionnaires, interviews, and informal conversations. It is also often reported in the teacher/researcher's journal.

> I used to go to the blackboard, especially when the exercises were more difficult. The class wasn't very good… I mean, it was just me and three other girls with Levels 4 or 5 [Level 5 is the highest possible]. There were quite a few students who had never had a positive score in math [This corresponds to Levels 1 and 2]. So, the teachers always called the same girls to solve the exercises. I remember that in the first week, when the teacher asked our classmates to go to the blackboard, I was laughing in one's sleeve, because I thought they were going to fail, behaving poorly, as usual. But then I was amazed: the teacher knew exactly how to do it… I mean, who to call… and my classmates… they did what he wanted… and they did it well… It was amazing! I started copying their solving strategies and thinking about how those guys who did nothing in math were able to go to the board and

explain how they had solved the problems. …and that's when I realized that these classes were going to be very different…! (M, Interview, December, 9th grade).

M illuminates the strength of this practice, either for those who usually underachieved or for those who succeeded. The former needed to have a voice and the opportunity to become legitimate participants because they were acting as peripheral participants (César, 2009, 2013a, 2014, 2017; Lave & Wenger, 1991). Sometimes they did not even try to solve the tasks because they were so convinced that they were a lost case they would rather do nothing at all than face another underachievement. The others needed to change their social representations of their classmates as mathematics learners. This corresponds, for Hermans (2001) and within the framework of the *dialogical self* theory, to changing their *Me-position* (the way M saw her classmates). Later, when it would be internalized, this change would allow them to work collaboratively and learn from each other. For V, it was even more difficult, because he had to change his *I-positions,* particularly those he assumed as a student, but also as a son, or as a friend of the people in his neighborhood – a very poor neighborhood where school was not valued.

This change is slow, but it is unlikely to happen without practices that enable students to see their own abilities and competences, and those of their classmates. The social interaction analyzed by César (2009) illuminates this, even when we focus just in the first lines. This dyad – V and M – is solving a problem. Since the 5th grade, V has always underachieved in mathematics. He had Level 1, the lowest possible, which is rare because it means that the student has problems in the way he acts in class and is not making any effort. Attitudes also count for the final mark. So, M was not at all happy to have this partner. But V was not happy either, because he had a very negative social representation of M and he saw her as a 'spoiled little girl, from a fancy family' (V, Interview, December, 9th grade). But as they were both astonished by this unusual teacher/researcher, they decided to work together, as foreseen in the didactic contract (Schubauer-Leoni, 1986), negotiated between the students and the teacher/researcher. But they sat as far away from each other as possible, while still sharing the same table.

[V starts drawing a circumference and then stops to reads the problem again.]

1 M – What's that?
2 V – It's a cheese…
3 M – A cheese…? What's it for?
4 V – Now, I'm going to draw what he sold…
5 M – But I think you do this with sums…
6 V – I don't know how to do it with sums… so I'm going to see if it works this way…
7 M – Then you do yours, I'll do mine and then we'll explain.

Several interesting aspects can be seen in this excerpt: (1) M is not at all convinced that she can learn mathematics with V. She believes that he is really poor in maths; (2) she tries to convince him to use her solving strategy, which is an arithmetic strategy, and to validate this strategy because in math we have to do sums; (3) V acknowledges that he does not know how to use an arithmetic strategy, but decides to try his own – a graphic representation strategy; (4) V's way of reacting illuminates the impacts of the *inter-empowerment* mechanisms used by their teacher/researcher during the first week and which he is internalizing; (5) these mechanisms have had an effect on his self-esteem as a mathematics learner, because he already believes that he has to try, that he is able to solve this problem with this geometric reasoning, the one he prefers and which he also used when he went to the blackboard during the first week; (6) since V does not want to follow her, M decides that each one of them will do as sh/e pleases and they will discuss their solving strategies later; and (7) during this excerpt, M assumes the role of leader because she is the one who asks questions and makes the final decision.

If we remember that V, in previous years, did nothing at all in math classes, this episode shows us a way of acting and reacting that is already quite different, especially if we realize that we were in the third week of the school year. But to get to this point, the teacher/researcher needed to have information about the abilities and competences of these students to adapt the mathematical tasks to their characteristics. Through an analysis of M's IACC solving strategies, he knew that M preferred a step-by-step approach to problems and analytical reasoning, while V felt more comfortable with a global approach and geometric reasoning. M was familiar with the contents of previous years and was very organized, while V ignored them, had no tools, but was very creative, was

able to mobilize mathematical intuition and critical sense. The teacher/
researcher believed – and observations throughout the year proved him
right – that V could progress well, from the point of view of mathemat-
ical knowledge, if he worked with M. But she could also learn with him
because she needed to develop her geometric reasoning, mathematical
intuition, critical sense, and creativity. So, what their teacher/researcher
did, respecting the contents provided for in the curriculum, was to take
advantage of the tasks he suggested them to enable V and M to play the
role of a more competent peer at different times and to work in their
zone of proximal development (ZPD), facilitating the transition of the
abilities and competences they were not yet able to mobilize into real
development (Vygotsky, 1934/1962).

To get there, he needed to use *inter-empowerment* mechanisms.
Without them, V would have continued to be convinced that he was
a lost case and that it was better to do nothing. To show him that his
performances were also based on mathematical reasoning and knowl-
edge, and therefore accepted in classes and examinations, one needed
to suggest tasks of different natures, open and challenging, but which
allowed them to learn the mathematical contents. That was the big-
gest challenge: choosing, adapting, or elaborating the tasks that were
needed. The other challenge was to convince 24 students who had
never been successful that this was possible – a process in which *inter-
empowerment* mechanisms played a fundamental role. However, since
9th grade led to a national final exam and these students would have
another teacher the following school year or would start working, they
had to be able to internalize them and turn them into *intra-empowerment*
mechanisms.

After the first lessons, M confided in an informal conversation: 'Now
I am happy to work with V. You were right: I can learn well with him!'
(reported by M, teacher/researcher journal, September, 9th grade). For
her, the process was simple: she quickly understood the advantages of
working with V – she would be able to get her very high marks (Level
5) and develop new abilities and competences. For V, this process was
more complicated because he was participating in a culture that was
very far away from that of school. His life trajectory of participation
did not include a long schooling but rather to start working and to earn
money as soon as he finished the 9th grade. Being successful at school
allowed him to enjoy school better because he was appreciated. But it
caused him problems in the neighborhood where he lived and with his

family, who did not want him to continue studying (see César, 2009, 2013a, 2013b). This illuminates that the *inter-empowerment* mechanisms used by teacher/researchers are more in line with the expectations of the dominant culture than those from socially undervalued minorities (César, 2013a, 2013b, 2017). For the latter students, internalizing *intra-empowerment* mechanisms is the cause of conflicts between the different *I-positions* they assume, such as that of mathematics students and sons of very poor parents, because it calls into question some of the decisions they had made about their life trajectory of participation.

If the 10-year *follow up* had not existed, one would have doubts about the benefits of either collaborative work or *inter-empowerment* mechanisms for students like V, who did not want to continue their studies. What allowed us to understand the role of these practices were the reports of these students about their own experiences much later. V and M, as well as other students from their 9th grade class, ended up in different 10th grade classes based on their vocational choices. But they continued to meet outside of class to study in dyads or groups, in a collaborative way. This finding was also shown in the other classes that participated in the IK. But, above all, in the face of unforeseen circumstances, or difficulties – for example, a mathematical content that was more difficult to learn – they told us that they used psychological resources that corresponded to the use of *intra-empowerment* mechanisms, as M told us:

> My classmates were completely panicked about statistics and, above all, probabilities. But I knew I could always think like V to approach this problem. I could also make diagrams, drawings, other solving ways that are not usually explored in math classes. And then, if all that failed, I could always call him and study with him. When it comes to probabilities, he's really good, you know? (M, Interview, 2nd year of university, June).

But V adds even more important information when he lets us know the following:

> The most important thing I learned at IK was not that I could be very good in math because I really believed it only afterwards, in 10th grade and above all after the 12th grade exam. The most important thing was to understand that there is always another way of looking at things, that we can always find a solution and that we have to believe that we will succeed. […] And I also understood that I couldn't use my abilities to attack others, I had to

> learn to work with them too […]. I learned to be, to see myself and to make the others see me in another way (V, Interview, 2nd year of university, June).

What he reports, although he does not use those words, is that he has internalized mechanisms of *inter-empowerment* which he has been able to transform into mechanisms of *intra-empowerment*. But above all, it has allowed him, as he says, to believe in himself, not to give up – as he did before – and to continue his life trajectory of participation in a different way. He decided and could trace a new path using the mechanisms of *intra-empowerment* that helped him, for example, to survive the early days at university, which he has described as very complex and difficult. So, the impacts of *inter-* and *intra-empowerment* mechanisms go far beyond learning mathematics, although they are essential to this process.

Final remarks

Several studies developed in the school context have highlighted the importance of social interactions in teaching and learning processes. It has been understood that interactive processes are complex and that the way in which teachers organize their practices shapes – and is shaped by – students' performances. These studies have also illuminated the importance of the cultures in which one participates, like families, in their expectations about the role of the school and that of the various educational agents in the (re)construction of life trajectories of participation (César, 2013a). These expectations also have an impact on students' engagement in school tasks, particularly in mathematics (César, 2009, 2014; César & Santos, 2006; Machado, 2014). To succeed at school, students need to feel that their family cultures are valued by the school (César & Kumpulainen, 2009; César & Ventura, 2012; Ligorio & César, 2013; Marsico *et al.*, 2013). Conflicts between their different *I-positions* should not cause them too much suffering, leading them to doubt the path they are taking when they start to succeed at school, but also feeling further away from their family culture (César, 2009, 2013a). If this is experienced as a betrayal of their roots, of their families, then academic success can become so painful that it is better to underachieve. Schools and the different educational agents have a decisive role in this process: that of enabling different cultures to meet, of valuing their respective ways of

living and understanding the world, to facilitate transitions between cultures and the intercultural dialogue. This is a fundamental aspect of enabling students to develop and assert themselves as legitimate participants in several cultures, such as that of the school and that of their families or neighborhoods. It corresponds to a whole work to learn who one is – to learn to be and to see oneself as one is, or to become aware of the different *I-positions* assumed – but also to learn how to be seen by the other, to get to know his/her own and their *Me-positions* (César, 2013a; Hermans, 2001).

For children whose cultures are socially undervalued and more distant from the dominant culture, that of the school, seeing their reasoning, solving strategies and answers accepted and respected by their teachers is a fundamental step to facilitate their access to school achievement. Used to acting/reacting and being seen as peripheral participants who have no voice (César, 2009; Lave & Wenger, 1991), the implicits of the interactive processes play an even more essential role for them, as illustrated in the case of V, than for their colleagues, who participate in the dominant culture. Students with a history of underachievement, who are poorly valued in school and by teachers in general, need *inter-empowerment* mechanisms to become legitimate participants, with the ability to express their voices and assume their different *I-positions* (César, 2013a, 2014, 2017; Hermans, 2001). In these cases, school/family interactions take on even greater importance. Thus, bi-univocal cultural mediation (César, 2017), as well as the development of regulatory dynamics between school and families (César, 2013b), play a fundamental role in the transition from peripheral participant to legitimate participant, an essential aspect in the promotion of intercultural and inclusive education that fosters access to school achievement (César, 2013b; César & Ventura, 2012).

In these schools, collaborative work between different educational agents, between researchers and these agents, as well as in the classroom, plays an essential mediating role for the appropriation of knowledge and the development of abilities and competences. This collaborative work is therefore fundamental at all three levels: the classroom, teacher education, and research. Teachers will not be able to benefit from it in the classroom – and neither will researchers in their research – if they do not have the opportunity to experience it during their pre-service education. It is also during teacher education that discussing real cases, analyzing videos, and developing projects can facilitate learning how

to use and participate in collaborative work. These learning experiences also provide a better understanding of how to use *inter-empowerment* mechanisms, how to infer the existence of *intra-empowerment* mechanisms and the role they play in life trajectories of participation, particularly in schools. This means that, even if teacher education cannot guarantee that teachers will implement practices that are more adapted to the characteristics, needs, and interests of the students, the lack of a teacher education adapted to the diversity of today's schools will not allow them to respond in an adequate way to the challenges they will face in their professional life. Above all, mere training will not help them to develop the epistemological awareness they will need to make decisions adapted to current needs.

But while many *inter-empowerment* mechanisms were observed in school practices, teacher education, and research, they were not theorized until César's conceptualization (2013a). They were seldom discussed in-depth. People did not realize they were using them, or avoiding them, in the case of teachers or researchers who had discriminatory stereotypes about certain students or cultures. A theorization of issues related to power and the possibility of participation is essential, especially in countries such as Portugal, where school underachievement is still very high, as about 1/3 of adolescents drop out of school without the 9th grade diploma (César, 2013a). Understanding how to promote social interactions, participation, and the internalization of *inter-empowerment* mechanisms into *intra-empowerment* mechanisms is very important for achieving quality education for all, including those who underachieve more often and whose families have fewer resources to help them developing life trajectories of participation without too many worries. Teacher education, both pre-service and in-service, can play a role in this. The collaborative discussion of successful cases, particularly if there is a follow up that allows us to realize the importance of *inter-* and *intra-empowerment* mechanisms in the long term, including in professional life, are also important in teacher education. The analysis of several empirical bodies of research and new research opens avenues for improved practices and for a more inclusive and intercultural education.

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Chapter 3
Cultural Tools and Socio-Cognitive Dynamics at Work for Learning Science at School: On the Importance of Repeating the Use of Tools and Interactive Situations

Valérie Tartas

In this chapter, we start from a twofold question: How can we enable students to transform their initial knowledge into future problem-solving tools[1] in interactive teacher-guided teaching-learning situations? Using examples of interactions defined as based on four poles (the student, the teacher and/or other students, the knowledge to be learned, and the sign systems and technologies used), the objective is to show that there are different ways of participating in a reasoned interaction in elementary school science. We will show that not all of them lead to a transformation of the student's relationship to the object of learning. Moreover, it is interesting from both the teacher's and the developmental psychology researcher's point of view to study the way ideas travel (Saxe *et al.*, 2009), are transmitted, or disappear during situations of equipped social interactions (notably via jointly developed external rating systems). We argue

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1 Instrument is here to be understood in the sense of Rabardel (1995), it is not a given, but a construct constructed by the subject who evolves in the course of situations of use. We will therefore use 'instrument' whenever the children or the teacher use an object or sign to solve a task.

in this chapter that a micro-history methodology of a learning situation[2] that we could call *didactic micro-history*[3] provides a useful methodological framework for trying to understand how students manage to develop new ideas together about a scientific phenomenon in the classroom.

We begin with a brief description and narration of the exchanges between students (10–11 years old) in a class of CM2 in France (grade 5) who are led by their teacher to answer the following question: 'Is it warmer in summer than in winter?' In order to enable them to answer this question, the teacher had them work on the temperature curves according to the months of the year. He then asked this question to the whole class and collected the students' main answers through a discussion with the class group. He then had them work in small groups[4], asking them to find a common answer and suggesting a resource that aims to introduce disturbance (since one of the most frequently stated answers is distance, e.g., 'the Sun is closer to the Earth in summer, so it is warmer'): a scientific diagram that shows the distances of the Earth and the Sun in the different seasons. The teacher moves through the different groups and invites them to exchange, reformulate and explain, and realizes that some will stick to their initial hypothesis while others will oppose their point of view. Some students even seem to change their

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2   Named experimental micro-histories in the context of work on quasi-experimental situations (Nicolet, 1995; Perret-Clermont, 1993; Perret-Clermont & Schubauer-Leoni, 1981; Tartas, Baucal & Perret-Clermont, 2010; Tartas & Perret-Clermont, 2012; Tartas, Perret-Clermont, Marro & Grossen, 2004).

3   With reference to experimental micro-histories as well as didactic microgeneses (Saada-Robert & Balslev, 2006) with the idea that here we insist more on the development of meanings elaborated by children in the sequence of child-adult and child-to-child social interactions than only in teacher-child interactions in order to trace within the interactions the sharing of meanings.

4   The situation described here was developed and filmed in the framework of a European ESCALATE project coordinated by B. Schwarz. The approach was to propose to elementary school teachers to work on the seasons (in accordance with the elementary school curriculum at the time) by introducing an *inquiry-based* approach and argumentation in science. The small groups were developed from a first pre-test phase in which the children had to explain different astronomical phenomena (day-night cycle, phases of the moon, seasons…) (cf. Tartas & Frède, 2007a) and are composed of students of heterogeneous levels of knowledge about astronomy.

point of view during the exchanges. Then, when each group presents its hypotheses, there may still be changes in the way of explaining the phenomenon: for example, in the small group described briefly below, only the hypothesis of distance will be proposed and discussed in class, whereas the hypothesis of inclination, which had been proposed, will hardly be mentioned at the end of the session, and will not be repeated at that time. The students will then work, starting from a hypothesis coming from another group, or on which they had not reached a consensus in their small group, via a software allowing them to argue by creating systems of external representation of their discussion or argumentative maps (the software is Digalo[5], see Muller Mirza, Tartas, Perret-Clermont & De Pietro, 2007 and Muller Mirza & Perret-Clermont, 2008 for a more detailed presentation of the tool). These maps represent proposals that the children write in pre-elaborated forms that aim to support the debate (the children are supported in their exchanges; here they have synchronous access to what is proposed by others and by them via the scoring systems developed via the computer). Following the numerous studies on argumentation at school, it has been shown that argumentation is a complex activity and not very frequent in everyday situations. It therefore seems important to build devices and instruments that can help children and adults alike to learn how to argue and to argue in order to learn (Andriessen, Baker & Suthers, 2003; Erduran & Jimenez-Aleixandre, 2008; Muller Mirza & Perret-Clermont, 2009). Thus, Schwarz and his colleagues showed that interactions between three children increased the quality of written arguments in CM2 and insist on the fact that knowledge about animal experimentation (theme of the debate) is co-constructed in the argumentative activities. Schwarz and his team (2009) therefore became interested in the design of argumentative pedagogical activities with the idea that certain pedagogical designs will be able to constrain interactions between peers in such a way that they are argumentative.

The teacher, in this type of device based on social interactions to learn and to enter into a scientific approach of investigation, does not

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5   Digalo was developed through the European project Dunes (Dialogical argUmentative Negotiation Educational Software) IST-2001–34153, coordinated by B. Schwarz; it allows the elaboration of argumentative maps, external representations of a discussion.

offer children an answer to the question of why the seasons, but invites them to participate in different situations during which they are supposed to act and build knowledge (to deepen, oppose, evaluate, justify…) within dialogical activities (Grossen, 2010). The teacher presents a problem and invites students to think about it in different ways using various resources (diagram, globe, argumentative maps being made, argumentative maps reconstructed afterwards, draft notebook, etc.) at different times. It allows them to make their points of view public at different times by presenting their proposals to the class for each group. It also tries to make them think about the relationships between these proposals and suggests that they evaluate the arguments (accept or reject them while justifying them). In this way, he organizes different activities based on dialogue and the exchange of ideas using different systems of signs in order to generate new ways of apprehending the scientific phenomenon under examination.

We propose to present in more detail the design of teaching-learning sessions developed in the framework of the ESCALATE project (Tartas & Frède, 2007a) based on a socio-constructivist approach to knowledge development. We hypothesize that allowing students to interact in small and large class groups and allowing them to reuse what they have previously developed to engage in a new activity is a source of transformations in participation in the activity, thus creating a potential conceptual development. In other words, as we have developed elsewhere based on Furberg and Arnseth (2009), we propose to reconsider conceptual change from a socio-historical perspective. This reconsideration leads us to take seriously not only the social situations of appropriation of scientific concepts but also the social and verbal interactions and the different instruments involved in the process of constructing meanings (Tartas, 2013). All too often, in fact, work on conceptual change focuses on individual representations of the child or adult to the detriment of collaborative and verbal meaning construction activities that make it possible to show both the role of the teacher, the role of resources and, more broadly, the role of the institution. Moreover, from a methodological point of view, it is also necessary to develop devices making it possible to study the processes of knowledge transformation. This is what we propose here through the *didactic micro-history* device, which is not limited to a pre- and post-test analysis that renders opaque the transformations that take place in the construction of meanings by students, but which makes it possible to analyze, during different collective and

individual phases of work, the way ideas evolve through the different sign systems used. A very similar approach can be found in Giglio's work on the teaching-learning of music (Giglio, 2013, in this book).

In other words, the present study on astronomy is quite in line with the work of Schoultz, Säljö and Wyndham (2001) who showed that one cannot account for children's knowledge of astronomy if one does not take into account the discourse and instruments in situation (the globe had been proposed to children to better build a common object of discussion when trying to understand how children conceive the Earth[6], which is the basis of their reasoning). This work thus contrasts with the work of Vosniadou and colleagues, who consider artefacts[7] and interactions only as developmental factors, but never as part of the conceptualization process itself, or late in the development process (Vosniadou & Brewer, 1992; Vosniadou, Skopeliti & Ikospentaki, 2004).

The design of the 'Teach/learn seasons' sequence

The design of the learning sequence is based on different assumptions from socio-constructivist approaches to learning: to encourage student action and engagement in teaching-learning situations, to provide individual and collective problem-solving situations, and to ensure that students can look back on what has been produced and engage in a new form of activity. Thus, the situation proposed by Vygotsky and taken up by Clot (2004), when he tries to understand how to re-engage a child in a drawing activity in which he has gradually become little involved, is highly relevant here in understanding the importance given to the problem-solving activity as being directed threefold: towards the immediate object of the action, towards others, and towards the subject itself. If we take Vygotsky's experience in a nutshell, an adult

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6   It is also important to note that in French we have the same word for the planet Earth and the earth, the soil. It is never certain when working on the first children representation of the Earth that the referent is always shared between the experimenter or the teacher and the child.

7   Vosniadou and colleagues (1992, 2004) use the term 'artefact' referring mainly to the cultural tools made available to children without distinguishing between tools made available, proposed, and instruments referring to tools in the process of being used to solve the task.

experimenter asks a child to draw, and when the child is saturated, Vygotsky's idea is to try to force the child to continue the activity. He shows that by asking him to explain to a partner (another child), the child starts a new activity in which the product of the initial activity (the drawing) becomes the instrument for carrying out this new activity. Clot (2004) emphasizes: 'the action does not acquire new technical instruments but is now also carried out through language, a psychological instrument that relays and supports the first ones: showing is doing and saying, drawing and commenting' (p. 6) and a little further, he specifies 'there is a development of the functioning thanks to the organization of a repetition without repetition within a new directed activity' (p. 6). Thus, creating conditions to enable students to be able to reuse their productions (for example, the argumentative map produced from Digalo's mediatized interactions) at another time to become a possible instrument and thus give new meaning to the activity for the student (without ever being certain that this is how it happens) directed the present approach. Moreover, it can be a good indicator for both the researcher and the teacher to observe that an individual or collective production of students becomes a sign in another activity or to create the conditions for this to be possible.

The sequence is organized in seven phases, described here very briefly (see Figure 3.1): the students are led to discuss the same problem to be solved several times during the sequence through individual situations, situations of interaction in small groups (the teacher intervenes little or not at all) as well as in large group discussions in class (presentation of hypotheses and debates) led by the teacher.
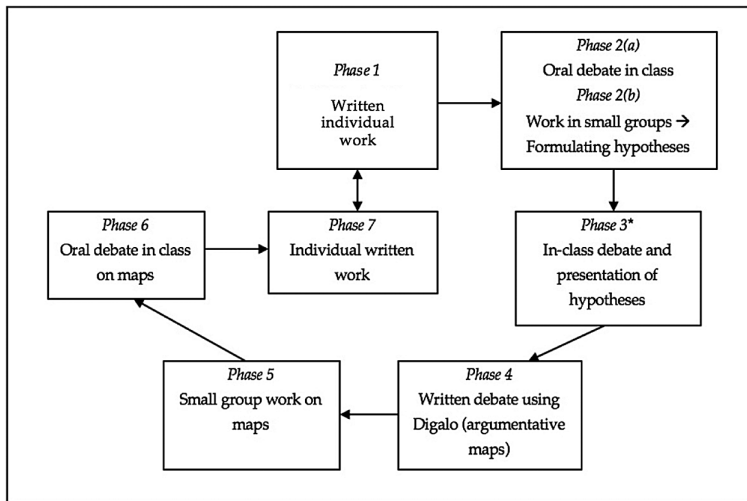
Figure 3.1. Example of a teaching-learning sequence based on the inquiry and argumentation approach in science

* There is also another phase before phase 3 which consists in familiarizing the students with Digalo, so there is a more specific teaching on argumentation and on the use of this tool, its functionalities. Digalo is not envisaged as a simple neutral tool that does not require any learning phase. The students, therefore, learn to use it to debate on a scientific subject other than astronomy.

Phase 1 and *phase 7.* This is individual work at the beginning and end of the sequence: the student has to answer small questions about different astronomical phenomena (seasons, day-night cycle, moon phases).

Phase 2(a). The teacher presents the question that will be the focus of all the activities in the learning sequence to the large class group, invites some volunteer students to present their answers and then, based on these initial exchanges in the large group, proposes that the students work in small groups.

Phase 2(b). The students are led to work in groups of 4 (with heterogeneous levels established on the basis of the knowledge acquired during the writing of phase 1). They must propose a common solution and justify it.

Phase 3. The students present their proposal and justifications to the large class group, one after the other. The teacher proposes a large group discussion based on the presentations. This allows the group to agree on common knowledge that is recognized by all. For example, the students will first spend a lot of time discussing what moves versus what does not move (Sun/Earth) and agree that the Earth moves and not the Sun despite its apparent movement in the sky. This phase of hypothesis presentation and discussion resulted in the elimination of some proposals in large groups (e.g., 'the Sun moves').

Phase 4. The students are on the computer and discuss with two other children in their group (same group of 4 as before) via Digalo, i.e., by means of an argumentative map based on a hypothesis which was not theirs in phase 2 (b) or on which they had not agreed. Their discussion is organized by a mediator (an adult observer) who intervenes little essentially to relaunch or redirect the discussion if it no longer concerns the subject.

Phase 5. Based on the maps produced by the children and the arguments and justifications provided by the students, two maps were developed by the researchers and proposed to the class for evaluation. The teacher presents these two maps to the students in the large class group and then asks them to work on them in small groups to decide which arguments are valid and which are not, justifying their statements. This new map evaluation activity allows the map produced in phase 4 to be used in a new activity.

Phase 6. This is the final teacher-led group discussion, based on the previous work resulting from a review of the argument maps printed and distributed in each small group.

How do we proceed to understand what is being transformed in different phases?

Two temporal levels of analysis characterize our approach:

– Analyzes conducted at *a macro level*. The aim was to compare the different productions of the students according to three different school levels, particularly during phases 1 and 7 and during the phases of production of argumentative maps (Tartas & Frède, 2007a, 2007b). This made it possible to show great differences in the way of grasping

the problem according to the children's school level, the children's knowledge, and their development, as well as differences on the side of the teachers, as not all the teachers involved in the project were equally comfortable with the role of social interactions in learning science at school. Thus, we were able to highlight the organization of knowledge and argumentation in the analysis of exchanges and identifiable changes between the three school levels (juxtaposition of ideas, little justification, and coordination of points of view before grade 5) (for general results, cf. Tartas & Frède, 2007a, 2007b). Thus, it is only at the CM2 level that this phase of 'repetition without repetition' (working on the argumentative maps after the fact) seems to have allowed the students together to go beyond their initial level of reasoning.

– On the other hand, they are more detailed micro-historical didactic analyzes based on the fact that, at each stage, the child interprets and gives meaning to the social situations in which he or she is required to solve a problem proposed by the teacher (Tartas & Perret-Clermont, 2012). It is appropriate to situate these processes of meaning construction in a sequence of social situations likely to make knowledge and meanings evolve. At this level, case studies allow us to examine the processes involved in greater detail and to distinguish the different ideas proposed by students about themselves and their future in the classroom. The analyzes developed at this micro level are currently based on a fine-grained analysis of a few sessions transcribed from oral exchanges, exchanges via Digalo and the use of its argumentative tool – map – to produce new exchanges in small groups and in class. This work on developing empirical techniques (Saxe *et al*., 2009) is still in progress[8], based on the unit analysis of mediated action in context (as proposed by Cole, in 1996, 'mediated action in context'), including the use of external notations (such as drawings, different

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8   It is based both on the analysis of argumentative discourse, inspired by the pattern proposed by Leitão (2000), A-R-CA (argument-response-counter-argument), but also on a cross-analysis between didactics and psychology based on the theoretical model of joint didactic action (Sensevy, Mercier & Schubauer-Leoni, 2000; Sensevy, 2007) and the patterns of argumentative interactions from Leitão) of a session (phase 6) which made it possible to identify various epistemic obstacles during the final discussion phase (Tartas & Simonneaux, 2015).

draft notation systems; in documents proposed by the teacher, the student's notes from the course, the globe). The analysis of these actions concerns two levels: the communicative level with an analysis of the argumentative dynamics (Argument-Response-Counter-Argument) (Leitão, 2000; Muller Mirza *et al.*, 2007) and, on the knowledge level, the dimension of understanding, of making sense ('meaning-making') of the phenomenon 'the seasons'. We propose here a more specific analysis, based on the case of a small group of grade 5 children followed during the different phases, to show how ideas are proposed, contradicted, taken up and transformed, disappear for a while. and may reappear later. And we would particularly like to stress that the argumentative map becomes at a given moment, not in its synchronous use, but, afterwards, a 'real instrument for oneself' in the small group taken here as an example.

THE BECOMING OF IDEAS AND SIGNS TO EXPLAIN SEASONS WHILE USING TOOLS IN DIALOGIC ACTIVITIES

The distance hypothesis is therefore the one that was preferentially used by the students during the first oral debate in the class before the children worked in small groups. The teacher, aware that this hypothesis is the most frequent, proposes from the outset to put it in conflict with a resource that provides contrary proof, a scientific scheme with the Earth-Sun distances according to the seasons. However, the children do not really use this document as a tool at this stage of their approach. A small group of four 5th graders with different levels of astronomical knowledge (assessed in Phase 1) are asked 'Why is it warmer in summer than in winter?' This small group is composed of Bri. who, from the first phase, shows that he has good knowledge in the field of astronomy: he does not use the hypothesis of distance to explain the seasons but that of the inclination of the Earth, he knows that the Earth revolves around the Sun in one year and that there are not the same seasons for two countries that do not belong to the same hemisphere. Aud. and Lud. know the revolution of the Earth and the links between hemispheres and seasons but explain the seasons with the hypothesis of distance (the Earth is closer to the Sun in summer). Fra. gives rather inconsistent answers about distance and does not know the motion of the Earth's revolution.

In phase 2(b) of the work, it appears that only Bri. who already had a level of scientific conceptualization of the phenomenon of the seasons in phase 1 proposes an explanation of the phenomenon by evoking the hypothesis of the inclination of the rays (he does not clearly explain that the axis is inclined but the rays are). Lud. knows that the Sun does not rotate but that it is the Earth that rotates (she is the first to bring her idea to the discussions between children) and therefore corrects as soon as she can her partners on this precise point. Fra. proposes another hypothesis which is that of distance. Bri., on several occasions, will try to reformulate and propose a kind of synthesis between her own explanation and that provided by her partners as the exchanges go on. In terms of argumentation, the proposals follow one another in the first part of the exchanges without any link with one another. Then, Bri. proposes a synthesis of all the ideas. In the end, two hypotheses coexist in the group (the approach of the Earth and the Sun, and the inclination).

Excerpt 1. Phase 3 when Bri. reports the hypotheses of his group[9]

Bri.:	<Bri. looks at his paper> *I do because the Earth is in orbit around the Sun* < Bri. makes a circular sign with his hands> *there are times when it is closer to the Sun* <Bri. joins his thumb and index finger to represent the Sun> *than there are times then this is why it gets warmer!* (The distance hypothesis)
After Bri,	Mar. explains the hypothesis adopted by his group: <*Mar.* reads the hypotheses he wrote on his sheet> *because half of the Earth is often facing the Sun and often XXX[10] and when a part of the Earth is facing the Sun it is summer and often when it is not it is winter.* (The facing the Sun = summer hypothesis)
Teacher:	*What do you think of Mar's hypothesis?* (teacher's question on Mar.'s hypothesis).
Bri.	*No but the Earth turns on itself in one day the Earth turns on itself in one day so the Earth if you're on the dark side in one day… already a season lasts three months so in one day you're going to find yourself back in the summer even if…* (CA/ Mar.'s hypothesis.)

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9   Concerning the transcriptions, the code is as follows: the words in italics are the verbalizations, what is in the <…> corresponds to the gestures made, to the material used.

10   The XXX crosses indicate an inaudible part.

Later in the discussion the teacher points out that Bri. and Max. said that the Earth rotates on itself in one day and asks: *what phenomenon does that correspond to?* A student answers: *day and night*. The teacher rephrased what some students had said about the day-night cycle: *in twenty-four hours it means that in ten hours we will have the Sun on the other side of the Earth XXX of the Earth's rotation, so the question is: when it's night we are in winter, when it's day we are in summer?*

Afterwards a student will draw the Earth and the Sun on the blackboard and try to find an explanation, but the teacher will not accept it.

CLEM.   *The closer you get to a radiator, for example, the hotter you get* (proposal 1).
TEACHER: *Sounds fair…* (request for evaluation of proposal 1)
CHILDREN: *yes* (answer validates proposal 1)
TEACHER: *Can this apply to the Sun and the Earth?* (Teacher contextualization of proposal 1)
STUDENTS: *yes*
TEACHER: *Well, do you have any other interesting hypotheses?*

After several drawings and explanations, Bri.:*this is the Sun* <he shows the Sun> *and* the *rays arrive like this* <Bri. shows the path of the Sun's rays on the teacher's diagram> *and so in winter the rays arrive like this* <Bri. traces the path of the Sun's rays in the direction of autumn> *so it's less hot.*

In these exchanges, we find the hypothesis of the approach of the Earth to the Sun. This explanation was formulated in the class to explain the seasons from phase 1. This widely used intuitive answer refers, in terms of daily experience, to the often-accepted principle: the closer you get to a source of heat, the hotter you get, as Clem points out here. Towards the end of the pooling in the classroom group, Bri. presents the hypothesis of tilting, but this is not very explicit for the children in the class. Moreover, the teacher, at this point, tries to get the students to react to such a conception which applies in everyday life, but which might not apply to the phenomenon studied. The students seem to be convinced of this and Bri's proposal will not be taken up by the teacher or the students in this pooling of ideas.

In the next phase (phase 4), the children find themselves discussing two by two via Digalo on the computer, based on the hypothesis of distance which appeared in their exchanges from phase 2(b) mainly with the proposals of Fra. Fra and Bri are together exchanging with Lud. and Aud. Here is the map co-elaborated by the four children of CM2.
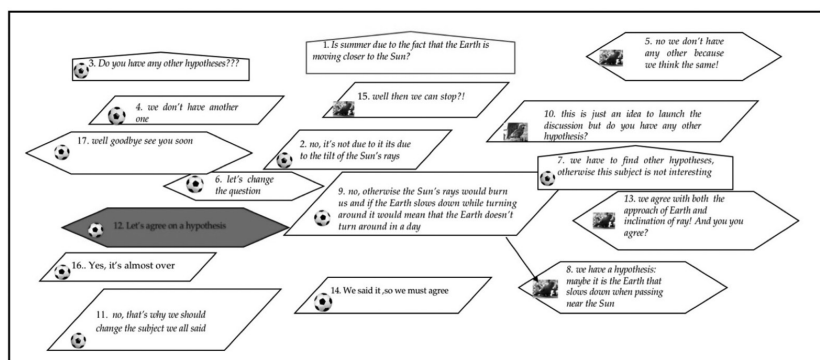
Figure 3.2. Example of an argumentative map in grade 5

Legend: The three forms used

The two boys (Bri. and Fra.) with opposite points of view are both facing the two girls (Aud. and Lud.) who had not clearly expressed their points of view during the small group work: their map (Figure 3.2) will start with the hypothesis of distance which is immediately contradicted by the boys who postulate the hypothesis of the inclination of the Sun's rays, the two girls write that they agree and then the boys ask them if they do not have another hypothesis. They end up proposing another hypothesis 'it could be the Earth slowing down as it passes close to the Sun' (bubble no. 8 in Figure 3.2), a totally new hypothesis that does not appear before. This is followed by a rejection of this proposal by the boys 'but not otherwise the Sun's rays would burn us and if the Earth slows down by turning around itself it would mean that it doesn't turn around in a day' (bubble n° 9, Figure 3.2). The girls reply that this was just an idea. The 'claim-counter-claim-reply' response pattern (Leitão, 2000) appears here in this example of a 5th grade map. Moreover, through this example, the CM2 students show that they are capable of invalidating a hypothesis through argumentation using the argumentative map and Digalo. In fact, this is the only time they used an arrow to show disagreement and explain it. On the argumentative level, there is thus an enrichment of exchanges and links between proposals via the in-the-making-argumentative-map.

Then the maps were taken up again and reconstructed from the students' proposals. Two maps were consequently created by the

researchers and the teacher with the aim of putting the children's knowledge in tension, focusing on both the quality of the arguments employed and the knowledge used to stimulate the discussion: a rather poor map, both in terms of argumentation (the proposals were never justified or coordinated with each other) and in terms of the knowledge applied, and a richer map on which contradictions and opposing arguments, justified and coordinated with each other, appeared.

The teacher will then introduce a new activity: work on two new argumentative maps to evaluate them. Before Phase 5, the teacher proposes a form of support based on reformulation and making explicit the discursive and conceptual work on the map by examining the first map (not very rich, not very argumentative) with the entire class. It thus enables the children in the class to build a common space for discussion. Once this intersubjective space has been co-elaborated, the teacher lets the students work in small groups with another form of support: work between students on printed maps. The small groups of four children (same groups as before) work on a new object: the reconstructed map, which is richer both in terms of argument and conceptual content. They should discuss the coherence of the maps both in terms of argumentation (is it well explained, coherent, are the examples relevant?) and conceptual (are the concepts and terms used the right ones, why, etc.).

In the group, they come to an agreement: in the proposal that is made, they reject the fact that the Sun moves, it is not the Sun that is making a trajectory but the Earth that is making a trajectory. Then they use the document given in phase 2 (the diagram of the Earth-Sun distance in the different seasons) and discuss the hypothesis of distance, rejecting it thanks to the scientific data proposed in this diagram, which they are going to reuse here as a resource to contradict this proposal of distance.

Excerpt 2. Phase 5b small group discussion on the printed argumentative map

BRI: *Is night **due to the tilt of the Sun's rays?** Well yeah that's what we said the*
          Sun's higher up <he makes a tilting motion with his hands> *that's due to*
          the tilt <he represents a tilting motion with his hands> *of the Sun's rays in*
          relation to the Earth well we said it the other time and after nine XXX hypothesis it's them maybe the Earth slows down when passing close to the Sun that's
          true on the other hand but not because otherwise the Sun's rays would burn us
          and if the Earth slows down when turning around, it means that it would be

> *contradictory to what we say* <he represents the Earth with his hands> *the Earth wouldn't turn around in twenty-four hours but less because if it slows down then that's why and after eleven* **we agree on the approach of the Earth and the inclination**…
>
> Fran.: *rays* (ends Bri.'s sentence)
> Lud.: *rays*
> Bri.: *well yes, here it is* <he shows a hypothesis on his sheet> *we said it's good, so we agree. In winter the* **Sun's rays come out** *XXX right*

The group will then examine each proposal read on the map (in bold) one by one and try to reason from it and evaluate it. This is also followed by reflective work: the students ask themselves whether the hypothesis proposed on the map comes at the right time, whether they can change it as a result of the teacher's intervention. This leads to a specific discussion about the exchanges externalized by the map, which will enable them to develop an explanation of the seasons as expected by the teacher (the inclination is proposed, but it is the inclination of the rays). This specific work on the map enabled the students in the small group to put at a distance their own level of explanation or understanding of the phenomenon and to come back to this level by evaluating it in the light of the point of view of others, which makes it possible to validate or not the proposal previously discussed. So, an option is offered in this phase – to evaluate their own proposals and other settings in a new map. This option of looking back on the proposals allows for a different understanding of the phenomenon being examined. They thus reach another level of explanation which is the one expected by the teacher when they all work together as a group. However, during the final phase of individual evaluation (phase 7), not everyone was able to use this knowledge, which was shared in the previous phase during the exchanges, to solve an individual task.

These few empirical illustrations relating to the different phases thus underline both the importance of exchanges between students and between students and teacher in the co-construction of the meanings of the phenomenon studied, and the central role played by the teacher when they decide or not to formalize knowledge at a given moment (cf. Tartas & Simonneaux, 2015). The guidance offered by the teacher (cf. Barth's chapter in this book) is central; it must be adjusted and must evolve during the different phases and activities proposed, as must the tools the teacher offers to students which, from the point of view of

both the researcher and the teacher, provide access to the notes of the students' conceptualization and argumentation activities.

Conclusion

The aim of this chapter was to show that it is possible to transform ways of thinking about a scientific phenomenon by practicing scientific argumentation and investigation (questioning a phenomenon, practicing activities mediated by different sources) and even to provoke a development of knowledge in elementary school. Our results at a micro-historical level developed here have made it possible to show the importance of knowledge already there (for the student but also within the group) to begin discussing seasons. Knowledge of the day-night cycle and the Earth's rotation, for example, are important prerequisites and, at different phases, it was necessary to repeat one or other of these phenomena for the students and the teacher, both in large and small groups, in order to rule out certain explanations given by the students (slowing down of the Earth; the Earth's rotation as an explanation of the seasons with confusion of the day-night cycle and the cycle of the seasons). This reminder of shared knowledge also functions as a prerequisite in the group so that a consensus can be reached to go further in the construction of meanings. The other element on which consensus was reached also concerns what moves or does not move: only the Earth moves, which is still prior knowledge. In order to build this agreement, the children were led to use the teacher-guided discourse, based on oral and written argumentation via the argumentative maps (in synchrony and after the fact) to resume their productions. This repetition or repetition without repetition seems to have enabled them to distance themselves from the phenomenon being studied. Indeed, it was during this phase of work in small groups that the children used the scientific scheme to dispel the hypothesis of distance, which until then had coexisted with that of inclination. The fact remains that sometimes what is agreed upon in the small or large class group is not knowledge from the point of view of the teacher and the scientist. It is therefore advisable for the teacher to relaunch the dialogical activities around this knowledge to be built.

In this chapter, we have shown the importance of studying a sequence of interactive situations in class within different types of groups using different tools (language and external written sign systems) in order to

better understand the changes in the way of saying and explaining the phenomenon studied in situation. In this chapter, the importance of providing opportunities for children to use their own written notes as a means of entering into a new relationship with the knowledge at stake has been stressed. Proposing this type of social situation reiteration (participation in a discussion and resuming this discussion afterwards to examine the phenomenon at stake in a different way) seems to us to be an interesting avenue, both from the teacher's and the researcher's point of view, to bring about a change in the learner.

In terms of research on social interactions, there appears to be a theoretical consensus among dialogical approaches to thinking that socio-cognitive activities should be conceived as involving at least four poles: the subject (student), the object, other subjects mediated by language, and various sign systems (including the notations here, which are argumentative); the unit of analysis is therefore fixed, but it seems that there is still a great deal of work to be done in terms of indicators to be considered in order to grasp the future of knowledge and meanings jointly developed by students and teachers, without forgetting the instruments that make them possible.

Acknowledgments

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Chapter 4
Heterogeneity of Classroom Interactions: Philosophy and Literature in High School

Tania Zittoun and Michèle Grossen

A dialogical approach to classroom interactions

There are many ways to describe and understand what a school class is. For example, it can be described as a mini-society, or as a social situation – materially defined by the four walls of a room, symbolically constituted by rules, school bells, social roles – framed by an institutional context, within which specific interactions take place. We can also examine how this social frame evolves over time, both as part of a broader history, and as a generator of micro-histories of learning (Carpendale & Müller, 2004; Goffman, 1974; Perret-Clermont, Carugati & Oates, 2004; Zittoun & Perret-Clermont, 2009). Such approaches, while they have the advantage of revealing some of the relational and social complexity involved, nevertheless tend to isolate the class from the rest of the world. Understanding the very great specificity of what takes place in the classroom tends to detach if from other social situations, and cut them from other aspects of the lives of the people involved. As a result, the interactions that take place there, the relational modalities that characterize them, as well as the school objects at play, appear to be detached or isolated from the wider social fabric. More recent approaches, generically called 'dialogical approach', have emphasized the relative flexibility of these social frames and referred to communities with softer, more permeable boundaries, which may be in communication with each other (Akkerman & Bakker, 2011; Kumpulainen & Mikkola, 2014; Tanggaard,

2008). A dialogical approach thus highlights the relation between the classroom and its interactions as dialogues related to other interactions, situations and social entities.

The dialogical approach in psychology has been inspired by the work of Bakhtin (1981, 1984), which focuses on the dialogical nature of language, notably through literature, and shows how discourse is made of a plurality of 'voices', how these voices echo other discourse related to different social situations, both in content (such as when quoting the words of others) and in speech genres, and how all discourse can be seen both as a response to a previous discourse and as an anticipation of another discourse. This approach has examined interactive modalities in dual or group situations and, more generally, in social exchanges, especially in school situations (Grossen & Muller Mirza, 2020a, 2020b; Grossen & Salazar Orvig, 2011; Ligorio, 2010; Linell, 2009; Marková, 2007; Marková, Linell, Grossen & Salazar Orvig, 2007; Merce, Wegerif & Major, 2019). It allows us to pay attention to different forms of dialogue: (1) dialogues between persons present, for example between two students; (2) distant dialogues with an absent person (ideal, remembered, etc.), for instance when a student imagines what their teacher might say to them; (3) dialogues between situations, for example, when a literature class situation echoes a similar situation earlier in time; (4) dialogues with cultural elements, such as books or films that themselves carry the voices of other people in crystallized form; and finally (5) the more global dialogue that can be generated by the plurality of these other dialogues – for example, when the dialogue with a teacher contradicts what emerges from the dialogue with a book (Zittoun & Grossen, 2012). As can be seen, such an approach highlights the dynamics of the circulation of meaning through people, situations, and time. It invites us to be attentive to what, in the here and now of the situation, refers to elsewhere and to other times.

Based on this principle, we propose to analyze an interaction taking place during a philosophy class through a dialogical lens. More specifically, we will highlight the heterogeneity inherent to this interaction – in other words, the fact that even when only one person is speaking, a diversity of dialogues simultaneously take place: what they say is liable to activate or include the five types of dialogue we have just presented. Thus, our aim is to show that classroom interactions entail a multiplicity of dialogues, and that such dialogical process activates various networks of meanings.

Research on classroom interactions in literature and philosophy classes

This chapter is based on data collected as part of the SYRES project ('Symbolic Resources in Secondary Schools')[1], whose methodology was aimed precisely at highlighting these dialogical dynamics. Indeed, the aim of the project was to examine whether, and under what conditions, students in high school could appropriate literary and philosophical texts studied in class and give them personal sense, so that they would be likely to use them outside school, when they are confronted with the typical everyday challenges of adolescence. In more technical terms, we therefore wondered whether these texts could become symbolic resources for these students, that is, cultural elements use to mediate developmental dynamics including learning, identity change and sense-making processes (Zittoun, 2006).

The project involved three secondary schools (two pre-university schools, school A and school B, and one vocational school – school C), in three disciplines (French, philosophy, general culture) and in 15 classes in a French-speaking canton of Switzerland[2]. Data were collected from 230 students aged 15 to 18 through questionnaires (n=205), interviews

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1 Project co-directed by Tania Zittoun and Michèle Grossen, with the collaboration of Olivia Lempen, Christophe Matthey, Sheila Padiglia, and Jenny Ros, financed by the Swiss National Science Foundation (SNSF) no. 100013-116040/1-2 (2007–10). The project examined the conditions under which young students can appropriate literary or philosophical texts so that they use them as symbolic resources outside the school to mediate their experiences as adolescents. It has been widely shown that adolescents make such uses of informally encountered films, novels, or songs (Zittoun, 2006); the question was therefore to what extent classroom interactions allow for similar dynamics.

2 We assumed that the degree of freedom and appropriation left to students depended on disciplinary traditions, as well as on the status of the schools. Indeed, research suggests that the teaching of French language, which is more 'didactic' than that of literature, prescribes more teachers' practices than that of philosophy. Let us also note that 'General culture' is the discipline in which literature is taught in vocational schools. Similarly, we had reason to believe that teachers in pre-university high school track would prescribe a more formal relationship to knowledge than high school career track (Rochex, 1998).

(n=20) and focus groups presenting vignettes of classroom interactions (6 groups). We also interviewed 16 teachers, and observed classroom interactions (56 lessons in five classrooms which included the entirety of pedagogical sequences taking place over two to six lessons, i.e., from the teacher's presentation of a text or author to the conclusion of the theme, through the work or the analysis of the text). Each corpus was analyzed separately; we then cross-referenced and combined these data, thus aiming at a double form of triangulation (Flick, 1992, 2007): we had two types of data on each actor (interviews and questionnaires with students, etc.), and we could also cross-reference the actors' perspectives on each situation (e.g., our observations of classroom interactions, with the students' representation of these via focus groups). In our analyzes, we identified 'school objects' – that is, books, knowledge or modes of reasoning that are more or less explicitly treated as objects to be taught, and that can become the subject of teachers' lessons. We speak of 'cultural elements' to refer more broadly to the books, novels, songs available in the cultural environment yet not treated as school objects[3].

Classroom interactions

We begin by describing the classroom interactions that we have analyzed in two ways: on the one hand, in terms of the frame created and the spaces of appropriation given to the students and, on the other hand, in terms of the relations that link the school objects under study and cultural elements or situations outside the school. Indeed, as already mentioned, according to a dialogical approach, all the elements of a situation are potentially 'in dialogue' with other situations. For example, the frame defined by teacher can echo their past experiences and trajectories;

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3   One of the results of our analysis shows that school curricula or disciplines may have different criteria for deciding which cultural element can become a school object: a general education teacher may use a hip-hop song to propose a poem analysis, while another teacher may only consider as artistic those works belonging to a certain 'classical' canon. The issue of cultural elements eligible for inclusion in school appears in the analysis presented here and plays a major role in creating or maintaining socio-cultural inequalities among students (Bonnéry, 2015; Bourdieu & Passeron, 1970; Rochex, 1998; Rochex & Bautier, 2005).

at any given time, the students as well as the teacher's discourse may refer to other occurrences of the same terms and ideas. Potentially, such an analysis is infinite. In order to make this possible, we focused on discourses or events that do not fall into the scope of the lesson, either because they explicitly refer to situations or experiences that are not related to the school object (e.g., a student's personal experience, a current event), or because they refer to cultural elements that are generally considered both by students and teachers irrelevant in the context of the school or the lesson, such as a mainstream film. We hence focused on the dynamics by which school objects and non-school elements are linked, considering them as a place for 'dialogue' between the current lesson and other personal or social situations. We thus coded the classroom interactions by identifying several types of links (see Table 4.1).

Table 4.1. Types of links identified in lessons of literature, philosophy and general culture linking the school object in play to…

A cultural element	**Example:** In a philosophy class, a teacher makes a link between Plato's concept of beauty and the Mona Lisa painting
An element of the teacher's private life	**Example:** In a general culture class, a teacher makes a link between racism and the fact that he is Italian and has himself been victim of racism
An element of the student's private life	**Example:** In a general culture class, a student makes a link between nail pulling as a torture technique and his own experience (he had to have some nails pulled out for medical reasons)
An element of social life	**Example:** In a philosophy class on racism, a student refers to racist articles in the daily press
An element of social life carried out by a generic enunciative positioning	**Example:** In a literature class, the teacher says: 'Reading a novel is a good way to spend time but it's also an opportunity to reflect on ourselves'
An element of social life carried out by a personal enunciative positioning of the addressee of the statement	**Example:** In a literature class, the teacher talks about Dostoyevsky's life and challenges her students by saying 'So, imagine that you're in love with someone and he doesn't know it'

We have described how and by whom these links are introduced and developed, and how such sequences are closed to return to the usual flow of school activity[4]. Overall, we have identified 144 'linking sequences'; half of them deal with social life (52 %), a quarter (28 %) with cultural elements, and a seventh (15 %) with the student's private life. There are very few links to the teacher's private life (4 %). In the absence of a comparison point, it is impossible to know whether these occurrences are rare or frequent; in any case, this analysis suggests that such dialogical incursions with other situations are commonplace in classroom interactions. The number of these links also varies from class to class (depending on the teachers, but also on the subjects and schools). However, this reference to non-academic content is only one of the ways in which this dialogue between different situations and discourses is played out.

To go further in capturing this heterogeneity of school discourse, let us examine an interaction sequence that took place in the classroom of Preston, a philosophy teacher in pre-academic school B[5]. Preston is a recent graduate in philosophy and is very keen to introduce his students to philosophical debate or the activity of philosophizing. In the following situation, a class discussion took place on the role of artwork: is art about representing beautiful things or is it about making a representation of something, whatever it may be? To illustrate his point, the teacher takes the example of a poem by Baudelaire, *La Charogne*, which does not evoke a 'beautiful thing'.

The teacher gives the floor to a student (Mara) who raised her hand[6]:

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4   The data were coded and verified using an inter-reliability method.
5   We choose this example because, in this case, the student taking part to the interaction was also interviewed. It allows us to exemplify the dialogical principles presented above; and as a case study, it highlights, like all the other cases, the dynamics we seek to account for on a theoretical level.
6   The excerpt is translated from French.

1	M[7]:	As regards the Benetton's advertisement ((which represents an anorexic woman and was previously introduced by a classmate)) I don't think it's really in the sense you just said
2	Preston:	Yeah
3	M:	But it's more for, uh, in the sense of a commitment, to change things, I mean…
4	Preston:	Ah but then the idea is that ok it's in a commitment I mean in this case the work of art has a meaning, it's a language somehow that is not political but is aesthetic, but can't we consider – since it's a provocative aesthetic language (…) It all depends on the type of reading we are engaging in, is it an aesthetic reading and:: I don't know if we take an anorexic woman, she doesn't look like the commonly accepted idea of a beautiful woman who would also be retouched, as is done today. This language is something that comes to us, if then one interprets it as a provocation as you interpret it, yes, but I think we can make a correspondence. It seems to me… why- then-
5	M:	Well, not always.
6	Preston:	Tell me why. Expand!
7	M:	Well, I don't know because there are some paintings that are how to say, almost purely aesthetic, while others (shrugging her shoulders)- it seems to me that the most important thing in art is still to study the paintings that have a deeper background, uh
8	Preston:	What do you mean by that?
9	M:	Uh for example that reflect injustices, or I don't know, I think of- some Mexican artists who have done some- just things against the walls just to show to the whole people
10	Preston:	Err
11	M:	To wake them up a little bit, it's a way to get into a fight or talk to people or-

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7   Transcription conventions::: stretched consonant; … silence; – syllable cut; [AA] [BB] overlap; […] unreported part; (non-verbal or para-verbal); ((xx)) researcher's commentary.

12   Preston: So when you say that in fact, you- I would say that you put
                 a little aside and you:: you take away I don't know from a
                 Rembrandt or Turner work a certain legitimacy as an artistic
                 expression. Since- can you say of a Turner representing a
                 sunset that it's a committed work (student tries to answer),
                 no, we're really in a purely contemplative relationship, I mean,
                 we're not in a political commitment […] in a certain way
                 [when you]=.

13   M: [But]

14   Preston: =Affirm that, you remove- you are in any case undermining
                 the legitimacy of works of art to an art, a more classical artistic
                 expression […] isn't it?

15   M: Maybe a little bit. (laughs)

16   Preston: Uh, was there a question? (turns to student two who
                 previously requested the floor)

17   Student   No
     2:

18   Preston: Well, no.

Let us comment on this exchange. Invited to explain his point of
view, the student (7) begins by making a distinction between paint-
ings that are 'almost purely aesthetic' and paintings 'that have a deeper
background'. At Preston's instigation, she illustrates this distinction by
making a link with Mexican artists (9): 'I think of– some Mexican artists
who have done– just things against the walls just to show to the whole
people').

Her linking constitutes an argument that the teacher has a right to
expect insofar as she has just expressed her disagreement. Preston (12)
then makes a one-sided development, after which he again offers the
student the opportunity to react (14). However, she responds minimally
with a slightly shy laugh. A possible interpretation of this sequence,
but which the transcription mistranslate, is that the teacher is trying to
open a philosophical discussion with the student, therefore expressing
himself in a certain speech genre specific to a philosophical activity (*dis-
putatio*), but that the student does not grasp it and/or she does not enter
into this game. The student's reserve could be due either to the fact that
she does not know the kind of discourse to which she is invited, or to
the teacher-student asymmetry: for the student, entering into a *disputatio*

would mean daring to oppose the teacher, which would be against the institutional roles that structure the situation.

Different forms of heterogeneity appear here. At first glance, the situation is a simple dialogue; each participant answers the other, repeats what is said (12) or anticipates responses (14); the teacher also invites the others to react to what is said (16). However, this dialogue *in situ* refers to places, actors, and temporalities that go beyond the current interaction.

First, the school object in question – a poem by Baudelaire – is immediately linked to other cultural elements beyond the classroom situation or even the school experience: murals, advertisements, or classical artworks. Through this dialogue, the participants try to make sense of this work, or perhaps, to put into words the reactions it provokes. Second, we may assume that the comments that arise from references to these cultural elements – the controversy over Benetton's advertisements (4), the value of a Turner painting (12) or a mural (9) – are themselves echoes of conversations in which the teacher and the student were previously involved. Hence, the present situation appears to be in dialogue with distant interactions. Thirdly, the speech genre to which the teacher's discourse pertains is also related to other situations in which it is relevant to use it. Thus, the teacher is trying to use a formal, or academic, speech genre (Rochex, 1998): the philosophical dispute (*disputatio*). Fourth, the participants' interactions also implicitly invoke norms and values that generally structure the context of interaction: the 'proper use' of discourse in philosophy class, legitimate art works to discuss in a classroom (Turner *versus* Mexican mural art), the 'proper way' to understanding the 'depth' of a work of art (as something political, or not). These more or less implicit values and norms are activated in a very specific way in class, and particularly in a philosophy class, and come to guide the discussion between teacher and students. As social representations, they are the echo, in the class, of the social world and the power dynamics that run through it (Marková, 2003): in concrete terms, they give some actors, rather than others, authority or comfort in the handling of certain arguments. As semiotic realities, they also have the power to guide the discourse, to incite actors to respond in one direction rather than another, etc. In this way, interaction becomes a *mise en abyme* of social dialogues, of ways of seeing the world, debated far beyond the classroom and in a much longer historicity. Thus, these different forms of dialogue create a field of dialogical tensions (Grossen & Muller Mirza, 2020a, 2020b): the student's attempt to put the school object – Baudelaire's

poem – into dialogue with Mexican murals is discredited by the power that the teacher wields through his mastery of this speech genre (that itself echoes other legitimate practices) and of the current norms beyond the classroom. In the end, the student's voice – who argues that art can have a value of political engagement – is simply shut down by all the echoes that reinforce and legitimize the teacher's voice.

Students' discourse

As we also interviewed some of the students in Preston's class, we now examine their discourse and ask whether the dialogues observed in class in turn become the dialogical horizon of the students' discourse. Sticking to a Vygotskian reading, we may assume that student learning depends on the internalization of social dialogues; hence, we expect the students' discourse on philosophy to bear, at least to a certain point, dialogical traces of the they experienced in the classroom.

Let us first examine Monica's discourse, a student who presents herself to the interviewer (I) as a great reader and loves to write; she is very invested in French, but less so in philosophy:

Monica 109

1	I	What do you think the purpose of teaching philosophy in high school is, from the school point of view?
2	M	First I think there is the historical side to… show how we got to where we are today, the whole evolution of thought… and also for ourselves, to help us evolve a little, philosophy can still be an enrichment… for oneself…
3	I	Do you have the impression that you yourself manage to see this enrichment or does it still remain something just like that, that one has to learn?
4	M	Sometimes, when you see the themes, I actually say to myself, ah, I hadn't thought about that, but it's true that he's right […] or no, I don't agree with him at all, then I wonder what my opinion is, why I agree with him […] then from time to time, I start thinking a little bit my own during the course.
5	I	On what theme for example?

6 M   Freedom… we had to write an essay on freedom and actually… it was a bit difficult, afterwards I started asking myself the question, but what is freedom, I started talking about it with my classmate… eventually we ended up not following the class discussion at all because we were talking about it ourselves

7 I   Because in philosophy you also write essays […] is it not the same pleasure as writing a text in French, is it different?

8 M   It's interesting but […] I'm not very good at argumentation and that was more of an argumentation problem, I'm really good at evocations, my specialty…

If Monica seems to have understood one aspect of the genre required by philosophy, namely argumentation, she seems to feel unable to practice it, as her 'specialty', she says, is evocation (another literary genre). Yet, when describing her classroom activities, Monica reports that she experiences an inner dialogue – or starts thinking – (4: 'I wonder what my opinion is', 'I start thinking on my own'), and that she also initiates a dialogue with a classmate (6: 'I started talking about it with my classmate', 'we were talking to each other'). Further on (not in the excerpt), Monica also explains that she thinks teachers 'tend to complicate things', but when a subject of interest to her is discussed, as Freud whom she had read for herself, she talks about it with her brother or friends but, she says, not with her parents 'because they've never studied philosophy'.

Therefore, Monica is ready to start a dialogue about the philosophical texts studied in class. While she tries to link them to other situations that interest her, or to resume classroom dialogues with partners outside the school, thus creating a dialogue between situations, she seems, however, to miss the specificity of the philosophy genre, i.e., the respect of the rules of the genre. Monica's experience in the classroom initiates a dialogue that, although generalized, misses the aspect that the teacher obviously wants to highlight. We may then ask what other voices oppose the teacher's voice or authority: the social origin of the parents who 'never studied philosophy', or Monica's involvement in her writing 'evocations' activities, which are valued by her family and other teachers, or other elements that are still out of our sight? In any case, we can see that echoing or choosing a 'voice' from a complex bundle of other voices is positioning oneself in relation to other people expressing different views, echoing different voices. It is therefore also the act of affirming – or resisting! – one or several facets of one's identity (Duveen, 2001).

In comparison, let us turn to Muriel's case. Muriel loves music and comics, interests that she shares with her close friends; she sees herself as a 'lazy' student.

Muriel 29:00

I   What do you think is the purpose of teaching philosophy at school?

M   Bah well::: to know how to ask the right questions too… to analyze the question, to dissect it and then uh::: (laughing) again to find another one, to ask questions again, yeah to have a: to raise the discussion a little bit, to do a little antithesis thesis too, yeah… it allows to ask questions even if there is no answer… but to have more relevant questions too.. it can help… and then there's the side: and then also for French it helps a lot because we raise interesting questions sometimes we have answers… and above all there's this very open side, so we can stand as much on one side as on the other… for… all the themes so I was very interested in it.

Although posing as 'less academic', Muriel seems to have grasped the specificity of philosophical genre, when she notes the importance of asking questions even if there are no answers, and stresses that the quality of the questions themselves is important. By noting that this approach can be useful in French class, Muriel also shows that she has sufficiently internalized the speech genre and its associated type of relationship to knowledge to be able to transfer it elsewhere and create a dialogue between school situations. Finally, it is interesting to note that Muriel is precisely the friend with whom Monica likes to talk about the themes covered in philosophy. Thus, the dialogue between these two young girls, as evoked by each of them, echoes the discussions in class, but does not prevent the fact that beyond a shared activity (asking questions), the sense that each of them makes of philosophy, as well as the teacher's aim, are different. These dialogues, which took place during a discussion on Freud's texts, reveal yet other characteristics:

Muriel 27:40

1   I   Did you like any [theme] in particular?

2   M   Well uh::: the theme… consciousness unconsciousness with dreams about Freud then… that interested me the most

3   I   Mm-hmm, and do you know why?

4   M   […] uh because he's […] we were […] taking it up with Monica (laughs) uh: for example, I never remember my dreams, she tells me all her dreams with the slightest details and then… all that side of knowing a little bit more about the conscious unconscious dream… and also what Freud thought… and also that in the class there are some… he integrated the stories… of the therapies Freud used to do with some patients so those little stories were also quite interesting

Apparently, for Monica and Muriel, the 'stories' of Freud's patients told or read by the teacher in class open up a narrative space; there, it seems, the girls dare to imagine the dialogues that took place between Freud and his patients (mostly female patients). Thus, the present dialogue between the two young women refers to other dialogues, in other times and places. On the other hand, these dialogues are an opportunity to initiate another dialogue, much more internal or intimate, since, stimulated by the class, the two girls start to tell each other their dreams. Hence, the content of school objects – not their form – feeds a double dialogue: a dialogue between close friends and an inner dialogue that questions less conscious and emotional experiences.

Thus, the analysis of the students' discourse unveils numerous traces and echoes of classroom interactions. The dialogical movement continues both as a private and shared dialogue; the themes treated in the class of philosophy are taken up in their dialogue and are also used to fuel other situations, such as the French class, or discussions with friends or a brother who has not been in class. However, this is not always enough to enable students to appropriate an important aspect of the teacher's discourse: the specific speech genre in which philosophy is rooted. In this specific case, only Muriel grasped it. Finally, as teenage girls curious to better understand each other, both Monica and Muriel initiate, through classroom interactions, an inner dialogue aimed at rethinking their own biography and experience as young girls. These two complementary aspects show the echoes and identity extensions of knowledge genres and contents: they are intriguing and touch when they make sense; they provoke reactions when, more or less explicitly, they question whom one thinks or wishes to be.

By way of conclusion

A dialogical approach invites us to consider what, in the situation of classroom interaction, echoes other dialogues, partners, or social debates. Such an approach shows that objects of school knowledge and their presentation (or framing) in class are never neutral; they are loaded with the weight and traces of past and future debates that are (or will be) held by the same or other actors.

As an illustration, our analysis of a philosophy lesson has highlighted the heterogeneity of the dialogues generated in this situation and, in so doing, the tensions it creates, particularly in the form of misunderstandings that go unnoticed or, even if they are perceived, are not resolved (Bonnéry, 2015). Moreover, what happens when differences emerge in the teacher-student dialogue? Which voices then predominate? These interrogations show that, insofar as they echo broader social discourses, classroom dialogues are underpinned by power issues.

Looking at the students' discourse, we also found that, here again, school objects or speech genre find echoes at the level of students' personal experiences: they touch upon affiliations and social relationships, and raise questions of personal sense, i.e., they resonate with the students' memories, projects, or imagination (Zittoun & Gillespie, 2016). Thus, a student can appropriate a certain school object through various dialogues that do not correspond to those valued by the teacher, and with him or her, the school institution. Therefore, such an approach invites us to pay attention to the plurality and heterogeneity of the dialogues to which a school object is liable to give rise, to the dialogical tensions between them, and to the way – whether public or private – in which students pursue them outside the classroom and the school (Muller Mirza & dos Santos Mamed, 2021).

More broadly, our research indicates that the notion of dialogue is not restricted to face-to-face interactions but entails various dialogues with present and absent people, with other pas or imagined situations, and with private dialogues that are not shared (inner dialogues). We have also shown that school objects are often brought into dialogue with other cultural elements (a text or a concept in the curriculum can be linked to films or texts in the news). When doing so, norms and values are also brought into dialogue and concern for example how to talk about a text properly, or, which artistic tastes are valued by

the school institution. Thus, a classroom situation concerning a given object of knowledge is in dialogue with other situations and these situations are not the same for all actors. For a teacher, the situation may refer to a previous lesson on the same pedagogical sequence, while for a student it may refer to a discussion with friends or to a sequence of school situations in which they have felt in difficulty or in confidence. In the end, these dialogues are all convened during classroom interactions; when they meet, they can create tensions, for instance when a dialogue about a school object brings together two opposite sets of values or question the legitimacy of students' social affiliation and family values. Thus, by considering classroom inter-actions as a situation made of heterogeneous dialogues, our study invites us to look for the distant and invisible partners who take part the dialogues and, specifically, to what extent these dialogues and the tensions they create enable both the students and teachers to make their voices heard and understood.

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Part II

Teaching/Learning Processes

Chapter 5
Educating Can Be Hard! Some Notes on the Notion of Materiality in Education

Antonio Iannaccone

You only have to speak with a puppeteer to know that he is surprised at every moment by his puppet. It makes him do things that can't be reduced to him, that he doesn't even have the competence to do. Is that a fetish? No, the simple acknowledgement that we are overwhelmed by what we make. To act is to make others act.

(Latour, 2007)

Introduction[1]

The majority of the chapters comprising this book effectively bear witness to the unavoidable role of social interactions in establishing the prerequisites for knowledge development in the classroom. By focusing on 'material' aspects of socio-educational interactions, this contribution is to be seen rather as a complementary and (perhaps) innovative look at

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1   I would like to thank Romain Boissonnade, who played a key role in the exploratory research presented in the final section of this chapter. The scientific discussions I had the pleasure of sharing with him also enriched my scientific conceptualization. In addition, he collaborated in the drafting of the section 'Solar toy workshops: an example of a learning space where materiality can play a fundamental role'. Of course, I take full responsibility for any errors and distortions that may be contained in the text.

this classic field of research. On the other hand, the style chosen for the writing of this chapter intentionally emphasizes the narrative dimension over a more orthodox scientific description, for two main reasons. The first is certainly linked to the relative scarcity of research that entrusts materiality with a specific function in learning processes, in particular by trying to go beyond the classic and still existing distinction between user and objects (Semprini, 1995). This scarcity requires an exploratory effort, here achieved, in part, through the metaphorical exercise.

At the same time, this contribution, which seeks to solicit teachers' reflections on certain 'material' components of teaching-learning processes, uses the narrative approach to solicit a more immediate – and preparatory – awareness as the reader enters a tighter empirical and theoretical discourse that is being developed.

A little story about materiality in the classroom

When you enter a school classroom, especially in a preschool or primary school class, the eye is quickly attracted by the quantity of objects that occupy a large part of the available space. These objects are often very colorful, and above all very heterogeneous. The immediate reaction of a naïve observer will probably be to place them in the category of 'playful' elements. These are – the observer will think – objects that are likely to be used during school breaks. On closer inspection, he will probably discover that within the multitude of objects, there is at least one important distinction to be made. Some elements do indeed show an obvious 'playful' destination (small cars, construction parts, water paint tubes, and modelling clay) and others, more difficult to classify immediately in the category of games, appear as 'pure' geometric shapes (plastic or wooden rulers, decanting glasses, small weights, etc.). In short, the observer seems to uncover before his eyes two categories of objects (according to the logic of perceived use). These are, of course, two categories with many points of contact and several overlaps that make them intertwined and interdependent depending on the activities to which individuals summon them.

If the objects attributed by the observer to the first category clearly demonstrate their playful affordance[2] and a clearer relationship to

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2   The idea of affordances was proposed in the 1970s by Gibson. In his book, *The Ecological Approach to Visual Perception* (1979), he presents the most solid

systems of meaning (a small car immediately evokes stories of races, fake accidents, imaginary journeys), those belonging to the second category seem – at first glance – to resist attempts to attribute meaning to them almost automatically. They seem to have an area more detached from reality, a major degree of abstraction, in short, they seem more serious!

In this case, for our observer, the insertion of these latter objects into a system of meaning will not be so immediate as with toys but will depend on the interpretative framework in which he will position them. If, for example, he is familiar with their pedagogical use (or at least if he has heard of them), he will quickly be able to classify these objects as

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and mature version of his theory, which made a strong contribution, with consequences in psychology that can be defined as revolutionary, to the re-conceptualization of the relationship between the cognitive functioning of the individual and his environment. Gibson's ecological approach "… emphasizes the mutuality of the perceiving organism and environment, the reciprocity of perception and action, and a form of 'direct perception' in which suitably equipped perceivers pick up information specific to its source (i.e., objects and events can be perceived without mediation in terms of internal mental representations) … Gibson's use of the term 'direct perception' is still controversial and has attracted much critical scrutiny. As Alan Costall (1981) pointed out, Gibson used the term in a variety of ways and for different purposes. Central to the ecological approach, however, is the idea that humans can directly perceive objects in the world on the basis of the pickup of information specific to its source (Gibson, 1966, 1979)" (Good, 2007, p. 269). In this rich and interesting theoretical framework, the notion of *affordance* occupies a central place. For Gibson, 'affordances' are opportunities for action that depend on certain characteristics of the environment. Indeed, according to Gibson, the activity (of perception but also of perception of the social world) does not depend on the organism or its environment: there is a complementarity between the two (Good, 2007, p. 270). This is a theoretical position that represents a real break with the classical paradigm of the separation between the organism and its environment. Gibson's proposal of the concept of affordance fueled a very broad scientific debate in the years that followed (and therefore impossible to summarize in the limited space of this chapter). In order to remain close to our scientific concerns, we must nevertheless consider that researchers are increasingly questioning the *social dimensions of affordances* (Borghi & Riggio, 2009; Borghi, Gianelli & Lugli, 2011), the *interactional* predisposition of certain affordances (Kaufmann & Clément, 2007), and the *function of the social in regulating the way objects are viewed* (Tomasello, Hare, Lehmann & Call, 2007).

material that helps in the development of logic, or more simply of certain basic arithmetic skills. The colorful series of sticks in different lengths (elements that children would rather use to build imaginary fortified castles!) will probably be perceived by our observer as useful entities for teaching children the logic of seriation.

As the gaze becomes sharper, there is likely to be a third element that will strike our observer: as soon as he arrives in the classroom, he will certainly have noticed that the human beings present (and more obviously the little humans) have closer relationships with some of these objects than with others. Our observer sometimes has the impression of being able to distinguish between certain objects that he considers 'private' and others that appear to him as 'public'. Specifically, private objects seem to belong to one or other of the students, while public objects seem to belong to 'everyone'.

From this last observation, positioning in one of the two categories will be – for our naïve ethnologist – a question of proximity, but one could also say at a different level of analysis, a question of the *quality and density of the psychological relationship* (interaction) that humans seem to have established between themselves and with certain material entities that surround them.

In the meantime, he will have observed the difficult separation of a child from his toy and the many ceremonies, sometimes 'maniacal', that can take place in the process of adjusting this relationship. Imagine also all the subtle transactions that shift an object from a 'private' status when it is 'lent', 'given away', 'subtracted', when it is subject to complex forms of emotional blackmail or – more broadly – when it becomes the focus of social inclusion/exclusion strategies that children use admirably, and which are well described in the work of Corsaro (1990).

At this point, if our observer's curiosity for materiality has not been fully satisfied, he will likely start pondering, with a growing reflective attitude, the actual role that this material complexity of reality plays in the process of learning and psychological development. At this stage, he will realize that materiality has a strong presence in thought mediation activities. Writing, reading, calculating, drawing, etc., always require material support[3]. At times, these supports are merely designed to

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3   Of interest in this regard are the classical research on writing acquisition in school by Ferreiro and Teberosky (1979), Ferreiro and Pontecorvo (1993),

facilitate the recording of thoughts in the form of writing or a visual depiction of the world (drawing sheets, notebooks, etc.). On other occasions, they contain remnants of knowledge waiting to be deciphered (as in the typical case of written texts to be read or completed, or in the use of the multiplication table as an external support for the calculation activity). In conventional didactic situations, the two aspects are often implicitly articulated, making the relationship of small humans with the mediating reality very complex.

Our observer will still be surprised to observe the great variability of children's behavior in this material universe. Some people seem to engage in these activities with pleasure and constancy, others seem to become disengaged and disoriented when it comes to the use of physical media. Writing and drawing activities, for example, which seem to be an obvious source of pleasure for some, are for others difficult and frustrating. In the latter case, the use of material support seems to play the role of obstacle rather than facilitator of cognitive activity.

Having reached the conclusion of his quasi-ethnographic approach, our observer is now struck by the revelation of the significance of materiality within the realms of educational activities.

The materiality of immateriality

Before he leaves the classroom with a new baggage of questions that will occupy his thoughts, he hears the mobile phone vibrating in his pocket… Another kind of materiality then attracts his attention: technology. Born in the middle of the Gutenberg Galaxy[4] (and gradually immersed in the technological contexts of contemporary life), until his mobile phone started to vibrate (reminding him of his belonging to a sophisticated communication network), our observer had remained anchored in a more 'traditional' representation of information and its educational manipulations. As soon as his mobile phone shows its presence and promises him calls, text messages or e-mails, he realizes that, today, 'learning' is something that necessarily incorporates technology

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and the research conducted in a socio-cultural framework by Alcorta (2001) on the function of the draft in certain learning activities. More recently, see also the excellent thesis of Perdicakis (2013).

4   McLuhan (1962).

(and this irrespective of the varying degrees of positive or negative comments made by teachers regarding the presence of technology in schools). He realizes that since getting up at seven in the morning, he has been continuously using technology. The ATM clock radio helped him to leave Morpheus' arms smoothly, then he did a first quick morning reading of e-mails, consulted the news on a specialized website, and did a quick check of his financial situation to book his next holidays. Soon after, he read a text message to confirm a future appointment, he bought a bus ticket at the vending machine, consulted his GPS to find the school address, etc. In short, He realized that a significant portion of his activities were supported by (or carried out through) technological media. Now he is wondering where he learned to do so many things that previous generations completely ignored. What has been (and what is) the role of the school in this process of access to what is now more clearly seen as a kind of new culture? Can technology be considered in the sphere of materiality and under what conditions?

The term 'culture', which has just crossed his mind, presents another challenge. He appears to have reached a conclusion that demands further contemplation. He becomes aware that the stance of students (and humans in general) regarding materiality is fundamentally intricate, shaped as much by the physical characteristics of the activity settings – and the elements that make them up – as by the dynamics of the social relationships established within these environments. In turn, these activity frameworks seem to be affected as much by the representations that participants make of them as by the logics of materiality that these participants adopt. His first spontaneous observations therefore raise a real epistemological problem.

Has psychology forgotten the objects in education?

In short, a school classroom, a tiny portion of reality as a whole contains a multitude of heterogeneous objects that regulate (favor, hinder, direct, etc.) the behavior of students and their teachers and all interpersonal relationships. In relation to this emphasis on materiality[5] in the

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5   The definition of materiality refers here to the character of what is material…
    Material is to be understood as 'that which is formed of matter, as opposed

classroom, scientific work has focused on the *function and effectiveness of teaching materials and their uses*. Less attention has been paid to the status of objects as *elements potentially integrated in cognitive activity*, in learning processes[6] and, more broadly, in the processes of 'meaning construction'. Those should especially be considered from an interactionist and cultural perspective of education as basic dynamics that enable any activity of knowledge and learning development (Barth, 2012; Bruner, 1991; Iannaccone, 2013a, 2013b).

To argue in favor of the 'integrated' status of objects, it may be useful to begin by highlighting, based on the fictitious reasoning on the previous pages, their 'presence' in daily life and their function of regulating human activity. Indeed, despite the amplitude and persistence of philosophical debates on the status of reality, it is clear – as our observer has well understood – that part of psychology (and of the human and social sciences) has underestimated the 'cognitive' and 'developmental' presence of objects in daily activities (and in teaching and learning contexts).

On the other hand, aside from their symbolic aspects, eco-cultural niches do indeed seem to consist predominantly of 'material' elements, engaging human beings in constant interaction (Rogoff, 2003). These are tools, objects, or complexes of objects whose characteristics sometimes remain relatively unchanged as in the case of a landscape or the walls of an old house. At other times, these characteristics are undergoing important adaptations: see, for example, the working tools and leisure objects that are changing in the different phases of cultural history and

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to spirit, the soul; that which is tangible, concrete; that which relates to the concrete realization of something; that which concerns objects and not persons; that which relates to living conditions, to the concrete necessities of existence; that which is considered from a purely concrete point of view, without any subjectivity; that which relates to the content of juridical acts' (English translation of the French definition found in *Larousse online*). In short, the category 'materiality' includes rather heterogeneous elements whose common feature seems to be in opposition to spirituality, abstraction, and subjectivity.

6 A special case, which – for obvious reasons of space (and choice of depth) – has been intentionally excluded from our reflection, is that of corporeality. Unlike other forms of materiality, the body has been the object of vast interest in practically all fields of the human sciences and, of course, in education.

the technologies that today play an integral part in the functioning of daily life (Bruschi, Iannaccone & Quaglia, 2011).

To get an idea of the importance of materiality in our daily lives, all we have to do is start counting the objects that surround us (for example in our apartment or along the path that covers the space between home and the workplace) to suddenly arrive at shocking quantities of elements. Ergonomics experts have taught us to take into account the presence, in our daily lives, of hundreds and hundreds of 'things' that come into contact with our sensory systems, prompting us to acknowledge their existence and often to act on these multiple realities to try to subject them to our needs or intentions.[7]

On the other hand, anthropologists, archaeologists, and historians of science and technology have repeatedly noted how in the development of the human species at the phylogenetic and ontogenetic level, objects – and in particular artefacts – have always occupied an important place. The integration of 'complex' objects into human activities has undoubtedly enhanced the efficiency of certain actions on the physical world while simultaneously managing social interactions. (Latour, 2007; Semprini, 1995). For instance, in the form of work tools, motor aids, etc., these act as multipliers of the power of certain perceptual and cognitive capacities (optical instruments, navigation tools, calculators, computers, etc.), enabling an enhancement of both pre-symbolic and symbolic aspects of playful situations (playful situations that, in the animal world, seem to be primarily limited to interactions with the body, interindividual motor behaviors, or objects seen as basic elements of the environment).

In a well-known contribution, *A Sociology without Purpose? Remark on Intersubjectivity*, Latour (2007) argues in favor of the usefulness (or even necessity) of profoundly revisiting the place of objects in the sociology of humans:

> If we want to restore the role of objects in the weaving of the social fabric, we must obviously abandon anti-fetish reflexes, but we must also abandon the other role given to objects by social sciences: the objectivity of the forces of nature (p. 49).

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7   Norman (2002). See also note 2 (p. 88) for a short definition of affordance.

Thus, Latour (2007) highlights the limits in the social quest for a representation of objects that feeds on the one hand on reductionism, a 'forced objectivity', and on the other hand on the consideration of objects as accessory elements, manufactured by an 'all-powerful' actor (p. 50). He considers them to be true actors: 'Objects are not means, but mediators, just like all other actors' (p. 56). The scope of these considerations is remarkable for a sociology of interactions from Latour's perspective. The intricate issue of objects (and thus inter-objectivity) cannot be bypassed without the risk of failing to grasp the nature of human activities.

Materiality in education: An epistemological problem?

This contribution looks first and foremost at a question that has emerged, with some urgency, in the preceding pages: in education, can one also question the 'epistemological' status of materiality (and specifically material objects) that fills the spaces devoted to the development of thought, without trivializing its functions?

The answer to such a question should argue for a new awareness of the function of materiality in education, starting from the assumption that 'acting' materiality has been largely underestimated and almost always subordinated to the partly false representation of learning as a trajectory oriented solely towards management and towards the understanding of abstract logical forms widely regarded as the basis of human thought.

It is obvious that all this is also the result of a tradition of ideas that identified cognitive development only with the conquest of abstract abilities and the progressive emancipation of the human mind from the constraints of the real world. This tradition has led a large part of psychology to consider human thought as detached from the conditions of use, from its nesting in systems of activities and from the material conditions in which it is exercised. At the same time, other epistemological perspectives have obtained empirical results that point in the opposite direction[8].

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8   In the last 30 years, the scientific framework known as 'Cultural contextual psychology' (Cole, 1996; Varisco, 2009; Iannaccone, 2010) has highlighted the inescapable importance of culture and context in cognitive activity and

In the representations of human thought, perceived as detached from contextual conditions, we frequently find the idea of an ontogenesis of thought that is characterized almost exclusively by the conquest of the sophisticated tools of logic (Iannaccone, 2010) and a 'monological' vision of psychological activities. Linell (2009), in his book *Rethinking Language, Mind, and World Dialogically* (see p. 390), presents some of the basic elements of these so-called 'monological' visions: the perspective of a universal reading of human psychology that does not admit distinctions between its 'natural' and 'cultural' dimensions, a tendency to privilege universalism over historical and constructive dimensions in the understanding of human activities, and an 'individual' unit of analysis that largely rejects interactional theories.

In short, according to Linell, monological approaches favor a vision that draws on the 'dualism' of psychological phenomena rather than a focus on 'dualities'. In this sense, dualism sees any dichotomy as composed of separate entities, while any duality is composed of interdependent parts. Depending on one's position from a dualistic rather than a dualist perspective, the status of materiality can change radically. In this sense, dualism can contribute to a certain neglect of materiality, a consequence of the resistance to considering tools and users in an integrated vision.

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learning processes. Simultaneously and stemming from a largely shared epistemological foundation, Cognitive Anthropology has been able to elucidate the role of mediation in cognitive activity and the situated nature of this activity. Varisco (2009), in his excellent review of theoretical positions and research conducted in this perspective, underlines the essential role of the work of several great scholars. He presents Scribner and Cole's (1981) investigation of language and cognitive abilities of illiterate populations. He summarizes the findings of Lave, Murtaugh and De La Rocha (1984), Carraher and Schliemann (2002), Lave (1988, 1992), and Saxony (1999), dedicated to the field of formal and informal mathematical skills. Finally, he synthesizes the well-known work of Rogoff (2003) and Lave and Wenger (1991) on the function of communities in teaching and learning processes. The broad scientific production triggered by this 'classic' literature has provided a remarkable amount of data supporting a 'situated' perspective of human psychological activities, especially cognitive activities. For obvious reasons of space, it is not possible to develop them in this article.

Without wishing to be exhaustive, a few examples may help to understand better the most important terms of the scientific debate regarding the relationship between objects and humans. Greek philosophers have already raised this question. Plato in his dialogue between Socrates and Alcibiades addresses the problem, still partly open, of the relationship between the tool and the user[9].

SOCRATE:	Now, is not he who uses a thing different from the thing he uses?
ALCIBIADE:	What do you mean? […]
SOCRATE:	Well, isn't the one who cuts and uses tools different from the tools he uses to cut?
ALCIBIADE:	How could it not? […]
SOCRATE:	But what about the shoemaker? Does he trim his leather with tools only or with his hands?
ALCIBIADE:	With his hands too. […]
SOCRATE:	Tell me now: Doesn't man use his whole body?
ALCIBIADE:	Absolutely.
SOCRATE:	And we've established that, who uses a thing is different from the thing they use.
ALCIBIADE:	Yes.
	(Plato, 1980)

Plato's conclusion highlights a fundamental separation between the biological apparatus, the user's body, and the instrument. This separation will continue to be used in most subsequent explanations used in the history of thought to account (seemingly unsatisfactorily) for the epistemological status of the vast quantity of objects used and created by humans in everyday life. It is a separation that has also been reinforced in

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9   The example has been mentioned by a psychology historian (Mecacci, 2000), among others, to underline the existence of a very old tradition of separation between tools and humans. Separation that has been profoundly revisited with the seminal contribution of Soviet Psychology of the 1930s and especially with the paradigm of the Psychology of Activity (Cole & Engeström, 1993; Engeström 1987; Leont'ev, 1979, 1984; Roth & Lee, 2007).

the framework of certain epistemological postures that have defended a clear separation between body and mind (Cartesian positions), therefore monological, leaving psychology grappling with a question that remains open today.

And in the classroom?

This dualist tradition has also had a significant impact on the development of pedagogical models in most programs responsible for the education of the new generation of teachers (especially in the West). Without going too deep into such a complex debate, one can nevertheless get an idea of the type of use of objects that takes place in educational contexts by considering a few examples. When we focus on the function of the materials used in many pedagogical devices, it is easy to see how objects are often exclusively summoned in teaching-learning situations as elements of 'simplification' of learning processes or ways of presenting complexity at different logical levels (Bateson, 1979).

If we consider, for example, some of the best-known pedagogical methods, such as the Montessori method, we easily come to the conclusion that objects – from this and many other pedagogical perspectives – constitute elements that seem to be designed to a large extent to simplify students' access to the complexity of reality. In short, to give them effective keys to access the world, by promoting a formalized representation of reality. In a certain way one could say that the teaching material symbolizes the journey of the spirit towards the conquest of a necessarily logical and formal vision of the world. Little space is given to the process of attribution of meaning that probably permeates any use of these materials. However, each student will still develop their own interpretation of the situation, and this interpretation only occasionally aligns with those of the material's designer and the creator of the setup[10].

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10 Many elements are involved in determining a style of interaction with reality that is more or less congruent with the school's pedagogical requirements and presuppositions. Certainly, a central role is given to family socialization practices (Iannaccone, 2013b; Iannaccone & Smorti, 2013) and to social practices in the informal contexts that children experience before (and during) schooling.

This is also the case of the famous graduated rules and other objects inspired by the research and theories of Jean Piaget, which have enjoyed enormous success in the didactics of mathematics and in familiarizing learners with the logical structures of reality since the 1960s (Dienès, 1961). These are always simplified and predetermined forms of the more abstract logical-mathematical relationships that are in principle considered more difficult to understand. On the face of it, the handling of these objects and materials does not imply free do-it-yourself, except for noncanonical (frequent) uses by the end users (children) for purposes that differ greatly from those of teachers. The degree of freedom of action with this kind of material seems enormous (indeed, a multitude of impressive things can be accomplished with it). In reality, the constraints imposed by the theoretical preconceptions of these materials and the necessary reference to specific pedagogical models restrict the potential actions within predetermined activity frameworks[11]. This has advantages in the planning of the activity (and partly in its effectiveness), but also enormous disadvantages, caused by the limitation of the students' ability to see their personal creative potential. It seems obvious from a more ecological perspective of development that making and realizing objects without excessive methodological constraints is an indispensable activity for the development of thought. This freedom of action, which obviously can amplify the problems of didactic organization, nevertheless seems to open important possibilities for exploring the characteristics of reality and their operationalization in the classroom in the form of scientific knowledge.

When children or students are faced with problems to be solved for which solutions are not given or predetermined by methodological planning (e.g., making a 'solar' boat from recycled materials), they must constantly solve *real*[12] problems and find *real* solutions. Cognitive

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11 These are elements that represent logical and mathematical entities and cannot be subjected to physical changes (children are not asked to saw rulers or to check their resistance to pressure or bending). These materials, in general, once again represent a well-organized reality, purified but independent of the students' personal perception. In a way, this is a kind of significant lack of recognition of a basic element in the process of making meaning.

12 'Real' refers, in the specific case, to a perception of the activities, on the part of the students, as more congruent with what they do in the daily context of life.

activity engaged in this kind of activity is not oriented towards a simple recognition of the right solution but towards exploration and invention. In these exploratory situations, there will inevitably be more obstacles and unforeseen events determined by the unformalized and unplanned nature of the activities. These will be obstacles that quite frequently create tensions and lead to contradictions in children's plans of action. In the following pages, we will see how these dissonances between the 'internal' learner's project of wanting to achieve something and the 'external' difficulties or resistance posed by the 'material' tasks to be carried out can become real opportunities for learning and for questioning the individual and collaborative organization.

'Solar toys workshops': An example of a learning space where materials can play a fundamental role

In 2010 the Photovoltaic Laboratory – Institute of Microtechnology (IMT-PVLab) and the Institute of Psychology and Education of the University of Neuchâtel (IPE) collaborated to study, from an interdisciplinary perspective, the dynamics of collaboration and learning in workshops organized to enable children to build solar toys. The ITM-PVLab team regularly organizes workshops in Neuchâtel for children between 7 and 14 years of age. The children are accompanied to make a toy that runs on solar energy. In each session, about a dozen children are able to complete complex activities from which they generally report a great deal of satisfaction. These sessions, lasting about 3 hours, are supervised by adults belonging to the research team organizing the event (young researchers and PhD students), but also by adults learning the engineering profession (advanced physics students). From this standpoint, it does not appear insignificant to emphasize that the workshop serves as an environment where adults are not in a teaching role, and where children's primary goal is not to understand or conceptualize, but rather *to create a toy* by employing numerous physical objects and tools.

Researchers in psychology have been interested initially in children's learning about the material universe, about physics, and

ultimately about the complex interactions between children and the material environment. The aim was to understand whether the 'products' of the children's activity (i.e., problem-solving activities) can indeed be considered as the result of an integration (or even interdependence) between the material dimensions of the workshop (objects and tools made available to the young handymen) and the prior knowledge available to the participants.

Thinking in action: Planning and manufacturing

Planning

In the solar toy workshops, once the organizers and participants have been introduced, the children are asked to imagine which *toy they would like to make and to draw it*. At this stage of the workshop, some children notice photographs on the walls of the workshop room. These photos represent previously built toys. Children decide to reproduce these toys or on the contrary to make something more original, or even completely new. Depending on this, some children have chosen to make toys that are congruent with the possibilities of the workshop (a flower that turns, a boat, a mill…). Others aim to make something else. In these cases, they propose an original project. Without further information on the means given by the workshop, some children envisage sophisticated toys, whose functioning may not be very congruent with the possibilities of manipulation and creation offered by the workshop. Thus, making a cat that walks from a single small motor is a delicate task to be carried out with the materials available, the limited time, and the skills of the participants, children and adults alike.

The result of this psychological activity, which first explores the very broad space of the imagination to gradually become aware of the possibilities and limits of materiality, is an object that carries within itself all the tensions of this confrontation with its multiple implications (Boissonnade, Kohler, Foudon & Iannaccone, 2013; Kohler, Boissonnade, Foudon & Iannaccone, 2013). It is an object which, for the little handyman, can become an important opportunity to understand the challenges of reality through the consideration of its constraints explored in an imaginary dimension.

Follow-up of two young teenagers during the conception phase of the toy to be built

Da (11 years old) and Ma (13 years old) talk to each other during this initial phase. With exaltation, they evoke the objects they are thinking about while drawing:

Ma: *I made a car.*
Da: *Me too* (laughing)
Ma: *It's… it's a car and you get the wings to open… the wings…*
Da: *I'm a car*
(inaudible)…
Da: *Or a rocket… Wooaaaaaa…*
(Children then mention an airplane)

Finally, the two young teenagers will each build a boat, a toy initially proposed by the workshop through photographs and suggestions from the organizers, but each child chooses a different propulsion system. In this case, they will do so with little help from adults.
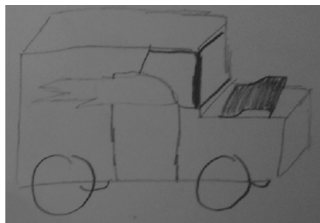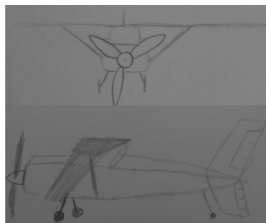
Drawing by Ma   Drawing by Da

This is why this initial phase is presented by the organizers as being very free: children can consider various toy possibilities. And it is not long before the child becomes aware of the extreme flexibility of the space created by the workshop: there is an almost infinite spectrum of potential creations – only some of which will take into account the use of solar energy – but all of them will establish a relationship of pleasure with a reality that will first be manipulated by the imagination and then, when it comes time to tinker, will show potential resistance to transformations, but which, under the right conditions, will become an exciting challenge to the child's imagination.

Interaction

In such situations, the workshop can lead to an intriguing architecture of peer-to-peer and adult-child assistance relationships. For instance, a phase of renegotiating the projected object may occur when children do not align with adults' expectations or with physical principles of efficiency in creating a toy that utilizes solar energy.

It is interesting to observe how, among the organizers, some are more accustomed to the constraints of these workshops and the sometimes-surprising choices of the children. They can encourage children to make modifications to their initial project (for example, adding a propeller to a house to make a mill), or to change their project more radically (building a boat instead of a car).

Finally, some children make a toy choice that has a more collective meaning. For example, some boys get together to build boats, perhaps because they will be able to compare or distinguish between them. In this case, the ideas of some may be taken up or, on the contrary, rejected by others. One child wants to build a kind of paddlewheel boat while the other one seems to stand out by choosing a kind of hydrofoil, etc. Or they choose mechanical systems that are quite similar but differ in the size or design of the object (flags of different nationalities), etc.

Follow-up of a child during the conception/projection phase

Cé (9 years old) decided to build a cat. At first, she just draws a cat and tells the adult who asks her that this cat could walk. The adult points out to him that he also has to draw a solar panel and that this is not going to be easy to do. She suggests that the cat could then roll and makes a new drawing showing the cat with a solar panel on its back and small wheels under its paws, connected to each other. Finally, the adult coming back to the child and noticing one of his last drawings of a cat notices that he has a big head; he draws more precisely the cat in front of the child's eyes, still with a big head, and finally suggests that the motor could make the cat's eyes turn, which would be fun. The child is keenly interested, although this is not his original idea.
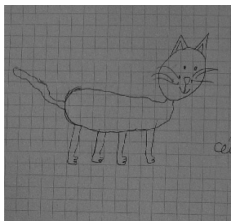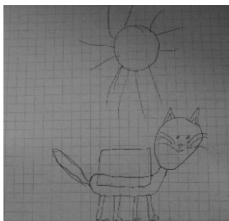
| First drawing by Cé | Second drawing by Cé | Third drawing of the adult and Cé |

In the end, the cat that is built does indeed have its eyes spinning.

Can you describe what you did?

Cé: *A cat on a boat? And then when you put on… the solar pliers and then well there he turns his eyes. Then when he stops, well, sometimes there's one student like this and the other student like this [she points in different directions with her fingers].*

[…]
Adult: *Did you manage to do what you wanted to do in the beginning?*
Cé: *Yes.*
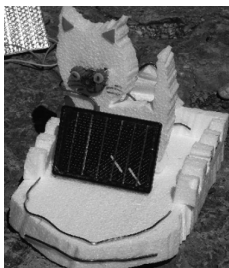
Toy finally made by Cé

The workshop: Classical framework of human activity and a pedagogical resource for further reflection

The concept of workshop usually refers to spaces for manual work, groups working in the field of teaching or scientific reflection, groups

of collaborators of an artist, etc. The concept of workshop usually refers to spaces for manual work, groups working in the field of teaching or scientific reflection, sets of collaborators around an artist, etc. These are therefore usual contexts in several areas that, in one way or another, involve forms of human activity. However, the previous short observations made in 'solar toy'[13] workshops (Boissonnade, Iannaccone & Foudon, 2012; Boissonnade, Tartas & Iannaccone, 2013; Boissonnade, Kohler, Foudon & Iannaccone, 2013) allow us to go partially beyond the numerous knowledge already acquired about the virtues of workshops in the field of work and education. In the course of these 'free' fabrications, they agree to highlight the role, partly neglected by developmental and educational psychology, of materiality as a potential trigger for creative exploration and restructuring of social interactions. Perhaps it is important to remember that, at its core, the research design refers to activities that children perform very frequently in their daily lives. Indeed, throughout psychological development, they practice a real *elementary engineering*[14] which seems to play an important function in defining the relationship between cognitive activity and reality (see also the long tradition of research including Piaget's classic work on the exploratory activity of babies and children in the sensorimotor stage).

In this perspective, an exploratory study has pointed out one of the material characteristics of the object (Boissonnade, Kohler, Foudon & Iannaccone, 2013; Kohler *et al.*, 2013) which seems to call for a reconsideration of the relationship between cognitive activity and materiality. These are the material resistances of the object[15]. This notion already used by Piaget in his book *Réussir et comprendre* (1974a) shows that children often manage to do things with objects before constructing knowledge (causal explanation, creation, or use of conceptual schemes, etc.).

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13 The previous paragraph refers (partially) to some 'idiographic' and episodic forays into the complex world of children's workshops. More systematic investigations and further analyzes are being carried out at the Institute of Psychology and Education of the University of Neuchâtel.

14 The definition is by Anne-Nelly Perret-Clermont (personal communication).

15 For example, the fact that cardboard offers little resistance to scissor cuts compared to wire, but offers greater resistance to the conduction of electricity, may play a key role in do-it-yourself work. These resistances are not necessarily always consciously perceived by the child, but can also, on the contrary, be intentionally invoked in the construction.

These achievements are closely associated with the physical characteristics of the objects. Piaget occasionally uses the notion of resistance, but without conceptualizing it deeply. On the other hand, in the conclusion, he points out that this resistance leads him to study contradictions, i.e., the birth of certain cognitive imbalances (Piaget, 1974a). This is a question that Piaget will take up again in his *Recherches sur les contradictions* (Piaget, 1974b). The notion of resistance has also been invoked in activity theory. Leont'ev (1984), when speaking about the role of objects in the external dimension of activities, indicates that certain resistances of the object are likely to constrain or even deviate the activities and even trigger processes of attribution of meaning (Kohler *et al.*, 2013).

   In conclusion, a conception of materiality in education that intersects the paths outlined by activity psychologists (notably Leont'ev) with those that led to the discovery of the essential pragmatic components of language and objects (Moro & Rodriguez, 2005), as well as their uses (Tartas & Duvignau, 2008), appears reasonably promising. In this sense, a better understanding of the complex interrelationships between materiality and cognitive activity can only effectively nourish research on learning processes and in particular on the function of creativity in teaching and psychological development.

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Chapter 6
Written Production by Four-Year-Old Students: A Lever for Transforming Teaching Practices?

Christine Riat and Patricia Groothuis

The purpose of this chapter is to present the declared practices of teachers regarding the entry into emergent writing production with 4–6-year-old students in the cantons of Bern-Jura-Neuchâtel (Switzerland). The choice of both the public concerned and the subject of knowledge is decisive. In a context of structural change, new requirements, and the introduction of new teaching methods in the field of reading and writing, where the school status of the levels examined is changing from optional to compulsory, teachers are being led to reconsider their teaching practices both in terms of the objects being taught and the teacher-student interactions that result from that teaching. Analysis of the results shows that teachers overcome obstacles by various strategies (approach or avoidance): either by embarking on innovative actions, or by adapting the prescribed system, or by bypassing it to return to previous uses, sometimes arguing that the four-year-old student is too young to carry out the task requested, and taking his or her place; in other words, by sharing the topogenetic[1] space or not.

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1   We take the gamble of articulating the theories of activity (Leont'ev, 1984; Engeström, 1987) with that of joint teacher-student action (Schubauer-Leoni, Leutenegger, Ligozat & Fluckiger, 2007; Sensevy & Mercier, 2007) because of the presence of a motive, associated with a goal and means to achieve it, that crosses these two theoretical frameworks.

Introduction

One of the societal challenges in which schools make a strong contribution is the mastery of the written language. From the semantic evolution of the terms illiterate and illiteracy (Barré de Miniac, 2003), we retain the importance of a positive definition with the adoption of the term literacy. Appropriation of the written word must therefore occupy an important place in schooling, from the earliest stages. But what do teachers say about this teaching-learning with students aged 4 to 6? We address the issue of teacher-student interactions through the discourse of teaching experience. Without neglecting the contribution of teacher-student interactions *in situ,* we postulate that access to the discourse of experience[2], and especially of experience in transformation in a context of change, can give rise to reasons for action. We hypothesize[3] a dialectic between this other form of interaction, teacher-to-teacher, where they share their experiences, and future interactions within the classroom itself regarding the teaching and learning of reading and writing.

On the side of the object of knowledge studied: The links between reading and writing

Mastery of the written language is built up gradually. Learning to read and write is no longer considered as separate activities, but complementary. Written production combines two components, reading and writing, in other words, identification and production (both serving text comprehension in parallel, a dimension not specifically addressed in this chapter). Under the pen of Fayol and Morais (2004), the French National Reading Observatory recognizes that 'the practice of writing words is a good way of forcing children to segment their sound forms, and thus to become aware of phonemes' (p. 29). According to some authors (Frith, 1985; Seymour, 1997, cited in Saada-Robert, Auvergne,

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2   The discourse on declared practices gives access to a form of intelligibility, to 'a motive, in the sense of a reason to act, [to] attempt to give a meaning that can be communicated to and understood by others' (Ricœur, 1998, cited in Bourgeois, 2006, p. 89).

3   Without any intention to verify it in this analysis.

Balslev, Claret-Girard, Marzurczak & Veuthey, 2003), young children first go through a logographic stage (immediate recognition of a word as a whole; acquisition of information from salient clues). This logographic process of word recognition is essentially visual and does not involve processing sublexical and phonological units. However, it enables memorization and subsequent retrieval of the initial words stored in memory, through direct pathway (or addressing pathway). Other authors (Gombert, Bryant & Warrick, 1997) add an extra dimension. Logographic identification would not only be done by visual access and retrieval of the mental lexicon of whole words by direct means, but by processing various units (word length, accents, certain known letters, etc.). Nevertheless, and from both perspectives, young children produce writing by considering words as a whole, without phonological processing, whereas awareness of the sound realities of language is essential. Furthermore, in order to be able to read/write, logographic, alphabetic, orthographic, and later morphological processing will be essential. Some authors have highlighted non-simultaneous strategies in reading and writing; others emphasize the simultaneity of reading and writing, with reading and writing influencing each other. Similarly, Rieben and Saada-Robert (1997) have shown that reader-scribers, even experts, will use dominant strategies, i.e., the strategy or strategies that best suit them when producing and reading either a known word or an irregular or unknown word, thus using the direct (or addressing) or indirect (or assembly) route. Finally, Saada-Robert and Hoefflin (2000) introduced the concepts of semiopicturality (search for meaning through the image) and semiography (search for meaning through the text), their thesis being based on a passage first through the image before analyzing the text. How does a very young child handle this?

The young child uses drawing very frequently, a practice that is also common in the early stages of schooling. It is also not uncommon for it to produce traces (pictorial traces, pictograms, and other pseudo-letters, even letters) when it wants to communicate in ways other than oral language. And there is no lack of supports: traces in the sand, on a fogged window, on a piece of paper. In the early grades of schooling, it is quite common for students, even in a spontaneous manner and without specific request from the teacher, in other words, without a formalized didactic contract, to create a production and seek the teacher's assistance in having it 'read' to them. This posture does not seem to bother parents

or even teachers, who rather perceive in this act an appropriation of a social practice.

The actions[4] undertaken by the teacher in terms of guidance and through interactions will be important with this child gradually becoming a student (Amigues & Zerbato-Poudou, 2007; Bautier, 2006). As we will see in the results, once the request is formalized within a segment of a didactic sequence, teachers begin to question the attitudes to adopt or even the relevance of the prescribed request. And yet, research conducted for over 20 years demonstrates the ability of young students to distinguish between drawing and writing and to produce written work.

How does the teacher handle this? How much do they know about student strategies? How much space, or topogenetic space[5], is she willing to give the student to take on the role of reader-writer?

This leads us to rely on the work of Ferreiro (1988), Saada-Robert *et al.* (2003), Montesinos-Gelet and Morin (2006) and David and Morin (2008), who show close links between learning to read and write, as these activities are complementary. Whether it is a matter of conceptualizing and phonetizing writing (Ferreiro, 1988), provisional emergent writing (Saada-Robert *et al.*, 2003), approximate spelling (Montésinos-Gelet & Morin, 2006), or autographs (David & Morin, 2008), it is therefore important, in class, to propose situations in order to articulate reading and writing simultaneously. The passage to the written word becomes a task, an object of teaching. How does this passage take place? How does the teacher support and guide the student? Does it promote metagraphic explanations (David, 2006)? This term, borrowed from Jaffré (1992), refers to 'the set of mental activities designed to understand and explain the purpose of graphic traces, whether they correspond to phonic, morphological, or lexical segments, to stick to activities centered on written words' (p. 108). This autograph practice tends to ensure that

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4   Actions are understood here in the sense of attitudes to student activity and awareness of new obstacles (younger students; new curriculum requirements accompanied by a new teaching aid or manual). The teacher feels tensions between different instances of the Self (Dubar, 1998; Carver & Schreier, 2000; Higgins, 1989). This results in 'approach' or 'avoidance' attitudes (Bourgeois, 2006; Markus & Nurius, 1986; Rousseau & Potvin, 1993).

5   The concept of 'topogenesis' (studied, following Chevallard, by Sensevy, Mercier and Schubauer-Leoni, 2000) is convened here as a place occupied by each of the partners (teacher/students).

students understand 'the functions of writing, its role or power in social exchanges, and appropriate the specific procedures that make it possible to practice it' (David & Fraquet, 2011, p. 4).

When structural changes force us to question our practices

The particularity of this research lies in the visibility among teachers of two strategies (*approach or avoidance*) to resolve tensions that arise in their classroom work. Deliberately borrowing from two different research fields (medicine and social psychology)[6], we will use the term 'pedagogical distensions' to characterize and describe the pedagogical and didactic action that is pulled between new prescriptions and the state of discomfort and questioning expressed by the teachers.

We postulate the idea of a transformation of practices to strive to regulate tensions. Bourgeois (2006) proposes and explores tensions in the instances of the Self, the teacher navigating between what they are/do, what they would like to be/would like to do, and what they should be/should do. Regulating these tensions will be important in daily practice with the students. Teachers must manage tensions between a wide variety of principles of fairness and find in their daily activities 'balances with others and with themselves' (Dubet, 2002, cited by Goigoux, 2007, p. 50).

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6   Two terms from different scientific fields are available: distension (in medicine) and dissonance (in social psychology; cognitive dissonance, Festinger, 1957). In medicine, the term distension defines an increase in surface area or volume under the effect of tension in various directions. According to Vaidis and Halimi-Falcowickz (2007), who adopt Festinger's (1957) theories, dissonance is an uncomfortable state that a person feels when they are led to act in disagreement with their beliefs; this tension is reduced when beliefs are changed.
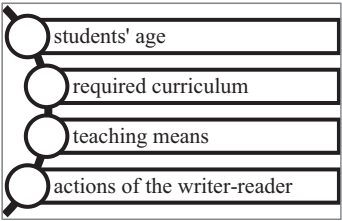
Figure 6.1. Four pedagogical distensions to consider in the teacher-student topogenetic sharing

Indeed, until 2011 and in the area concerned, the first two grade levels of schooling were optional. Regarding French-speaking Switzerland, cantonal differences show that in some cantons, school attendance from the age of 4 could reach more than 95%, while in other cantons this optional attendance only began at the age of 5, since the school system does not provide pre-school facilities for 4-year-olds. The advent of the school harmonization concordat (hereafter HarmoS) changes the situation. School becomes compulsory from the age of 4. Ansen Zeder and Joye-Wicki (2012) speak of a true 'educational innovation'. A first *pedagogical distension* then appears for some teachers: the school public is at least a year younger.

Another change resulting from the first is the introduction of a new education plan (hereafter PER; CIIP, 2010) common to all levels of education. Whereas teachers used to rely on a master plan specifically designed for preschool levels (CDIP, 1992), it is now up to them to share a common reference tool. This second *pedagogical distension* is not without raising questions, if not legitimate, at least relevant. The curriculum, which has prevailed since 1992, tended towards a child-centered approach to teaching, with the exclusion of objects of knowledge. They spoke in general terms: language activities, entry into the written word (for the field we are interested in here). In addition, the teacher was given a great deal of freedom of action in terms of the organization and the specific knowledge objects to be worked on. Not to mention that earlier conceptions linked to traces of the school's official mission (CIRCE, 1970) can still guide the functioning of teachers. In our research, we must keep in mind the idea that the 'recommended method [was] based on the child's deepest motivations, with activities [being] discreetly encouraged by the teacher' (Périsset Bagnoud, 2007). As of 2011, with HarmoS

and the introduction of the PER, students from the age of 4 years will be trained in three areas: disciplinary, cross-curricular activities, and general education. Similarly, knowledge objects are specified. The change from the 1992 master plan is considerable, at least in the wording; we shall come back to this point later, as many teachers will embark on the activity recognizing similar aspects.

A third *pedagogical distension is* added. Whereas no teaching materials were prescribed until then, since teachers had a very wide freedom at this level, the CIIP publishes and proposes a specific teaching resource for the teaching of French (as a vehicular language of the regions studied). Named *Des albums pour Dire-écrire-lire* [*Illustrated Stories* (albums) *to Say-Write-Read*] (hereafter DEL) (Auvergne, Jaquier, Lathion, Rouèche, Richoz & Saada-Robert, 2011a), it is specific for teachers of grades 1 and 2 of primary school (students aged 4 to 6). It is accompanied by a teacher's guide intended for all teachers of grades 1 to 4 in primary schools (1st cycle of elementary schools corresponding to students aged 4 to 8).

Finally, a last *pedagogical distension* complicates the first three: whereas previously the role of scriptwriter, or in other words 'producer of written material', was assigned only to the teacher, the new teaching method, supported by research in psycholinguistics and the didactics of French, gives this role to students from the age of four. How can a child who has just become a student, and moreover who knows neither the alphabetical principle (or at least very partially) nor the process of phonographic correspondence, take on the role of script-reader? The teacher has so far held the position of reader/writer. Will they give up this topogenetic space and how will they accompany the student?

Managing tensions to be able to interact with students

According to Schneuwly (2002), 'teaching consists in transforming ways of thinking, speaking, and doing with the help of semiotic tools' (p. 2). He talks about the specific character of the tool: 'double semiotization'. Because the teacher wants to 'convey something about the object and draw the students' attention to certain of its characteristics', they 'must use tools to both present the object, bring it into contact with the students (first semiotization), and designate some of its dimensions (second semiotization)' (Wirthner, 2006, p. 166). The tools are therefore to be

considered as 'mediators to convey the object of teaching and learning' (p. 167). Based on Wirthner, we are convinced that the tools become important clues to the way teachers work. By their choices, the teacher signifies the importance of certain aspects of the objects to be taught and therefore to be learned by their students. The teacher makes the learning object visible; they shape it and personalize it.

Thus, the four *pedagogical distensions* noted above inevitably lead to modifications, adjustments, and action by the teacher *in situ* with the students. According to Moro and Wirthner (2002), the task 'creates a dynamic tension between the dimensions of the staged object (by the task itself) and the abilities of the students' (p. 2). The task, they continue, can 'mediate meanings via the teacher between the student and the teaching/learning object and thus enable the emergence of new development in the students. In this sense, the task lies within the theoretical space defined by Vygotsky as the proximal zone of development' (p. 2). But beforehand, and in order to act with them, the teacher adjusts, complements, 'customizes' (Margolinas & Wozniak, 2012), and transforms (Wirthner, 2006) a given teaching device.

Who from the teacher or student plays the role of reader/scriber?

Let us consider the interactions within the class and the place that each one occupies in the action through the declared practices. Indeed, the place occupied by the teacher and/or the students will depend on whether or not the *pedagogical distensions* are resolved. Part of the modelling of joint teacher-student action[7] (Ligozat & Leutenegger, 2008;

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7   The joint teacher-student action, along with the constituent categories of the model through the triplet of genesis (mesogenesis, topogenesis, and chronogenesis), postulate the inseparability of the instances of the didactic system (teacher action, student action, knowledge issue). Very briefly, the dynamics of objects (linguistic, physical, scriptural) define mesogenesis. The evolution of the sharing of responsibilities (between teacher and students, or between students) defines topogenesis. The temporality of knowledge objects defines chronogenesis. Schubauer-Leoni *et al.* (2007) underline the notion of 'agency' proposed by Bruner to signify an action directed towards a goal, controlled by agents. These agents have actions to take, and sometimes to share.

Sensevy & Mercier, 2007) will help us understand the construction of this emerging knowledge among teachers. In other words, we are going to study topogenesis in the teaching-learning process, and in particular here, the place occupied by and according to teachers. To this end, we postulate the need for discursive spaces to engage in exchange about practices. And from the results, we will observe a divergence: allowing students to engage in emergent provisional writing, thus letting them take on the role of novice reader-writer, or taking on this role on their behalf?

The DEL training device in a nutshell

The procedure proposed in the DEL didactic device is composed of 4 steps: literary discovery of the album, passage to writing, systematization activities, and return to the literary component. The results focus on step 2 relating to the transition to writing, i.e., the moment during which the topogenetic space can be attributed to the student, *vs.* is assumed by the teacher with regard to the *pedagogical tensions and distensions* that the latter feels. These different tensions and the way in which teachers discuss them in exchanges can have an influence on the topogenetic sharing.

Methodology employed

We seized the opportunity of a compulsory in-service education program for elementary teachers of grades 1–2, a three-phase program (Figure 6.2), to collect data.

At the end of the first training session[8] dedicated to the presentation of the theoretical aspects and the teaching method (phase 1), the teachers of grades 1–2 were given a task to perform in their class, which was recorded during phase 3 of the course, approximately three months later. The instructions to be implemented during phase 2 consisted of three elements: selecting one of the 10 proposed sequences from the teaching resources, implementing two of the four proposed steps (literary

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8   Our results are based on the implementation of nine compulsory training session (phases 1 and 3) involving between 35 and 60 teachers each time.

discovery of the album and the transition to writing), and collecting and preserving the students' productions for discussion during the third phase of the training program. Using their students' productions as a training tool was not part of a desire to control the teaching activity actually carried out.
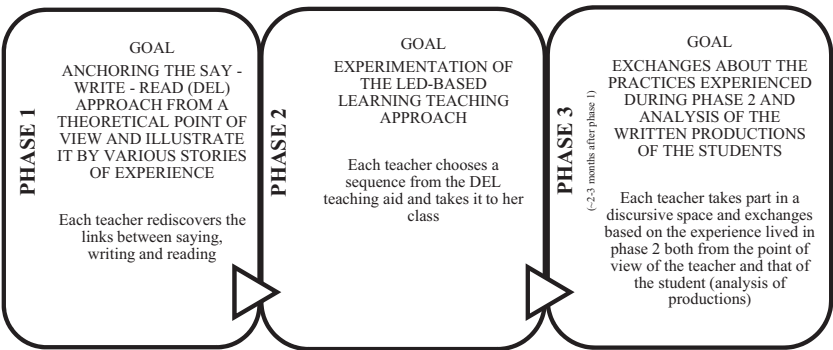
Figure 6.2. The three phases of the in-service training program

We hypothesized that engaging teachers in analyzing their students' productions would lead them to discuss their own practice. The productions of students, as mediators, would act as a revealer of their *pedagogical distensions* in the activity and their identity-related tensions (Bourgeois, 2006).
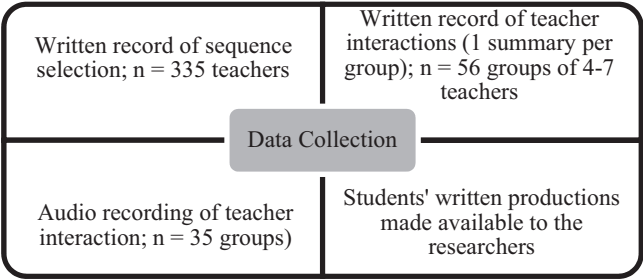
Figure 6.3. Data collection during phase 3 of the in-service training program

A few days before the third phase of the training program, the teachers were required to announce via e-mail the sequence they had

explored in their classrooms. A total of 335 teachers were involved. They declared their choice by announcing the use of a teaching sequence taken from the new teaching resource *Des albums pour dire-écrire-lire* (Auvergne *et al.*, 2011a). Some provided additional details, while others did not announce anything. These initial data collected through e-mail, in an individualized approach, and sometimes through a single message for a pair of teachers, allows for both quantitative analysis (distribution of chosen sequences) and qualitative analysis (argumentative discourse). The data will inform us about a declaration of participation in the implementation of the new teaching resource. The *mentioned* data (Van der Maren, 2007) 'pre-exist' (p. 138): they are gathered in the *archives* and have not been created for research purposes.

From the 'saying about doing'

In order to access another form of declared practices, in the second meeting we opted for a collection of *prompted* data (Van Der Maren, 2007) in the form of a *practice narrative,* in other words the 'saying about doing' as defined by Lahire (1998). We generated interactions around the practices by asking them to tell each other about their experience. Groups were formed and for about an hour, the teachers discussed among themselves the sequence chosen and carried out, using a grid that included the following items: benefits, obstacles encountered (general, more specific), similarity/divergence from regular practice, special needs, other. Each group filled in a grid – or roadmap – allowing us, through the *written records, to* have access to 56 collective discourses (each group being composed of 4 to 7 teachers).

In addition, 35 groups agreed to have these *practice narrative* moments, their interactions recorded. These *audio recordings* therefore constitute a third type of data, which are also *prompted.* The use of *practice narratives* among teachers, without a facilitator, enables us to grasp mainly what they say they do, what they question themselves about, what they discover, their state of understanding of the knowledge at stake, but also their conception of teaching-learning how to read & write, and their 'collective identity practices' (Lahire, 1998, p. 26): in short, the position from where they speak.

From the written records and some audio recordings[9], we highlight the *pedagogical distensions*[10] related to (1) the age of the students (according to the grade level), (2) a curriculum whose prescription modifies the forms of freedom of action, (3) a teaching resource that must be appropriated and adjusted and, finally, (4) the role of writer-reader that the teacher, despite being an expert and hitherto holder of this power, must 'give up' to the student.

This visibility thus enables us to clarify the topogenetic space occupied by each of the partners (teacher-students) during the written production activity and whether space is granted or not to the student according to action-related or identity-related-tensions, in order to shed light on strategies of 'approach' or 'avoidance' type.

Presentation of some quantitative data

The announced use of the new teaching resource DEL partly demonstrates engagement through an 'approach' strategy. Out of a total of 335 teachers, 79 % of the e-mail messages announced a chosen sequence, while 21 % did not announce the chosen sequence (Figure 6.4).

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9 The corpus of audio recordings represents about 30 hours of recording. Their analysis is in progress. We have selected some of them that reinforce or support the written records.

10 Initially, the following indicators were used to categorize the distensions: (1) Institutional: relation to the prescription, choice, and freedom; (2) Organizational: workshops, grouping, group management, and noise; (3) Didactics: progression, knowledge of the object to be taught, evaluation, and differentiation (4 year old/5 year old/non-native speakers); (4) Teacher's posture: guidance, representations, conceptions, and affective involvement; (5) Material: cosmetic aspect, photocopies, ink, illustration formats, albums, and printing errors; (6) Staff: daring, fear, change, and desire.

Selected sequences
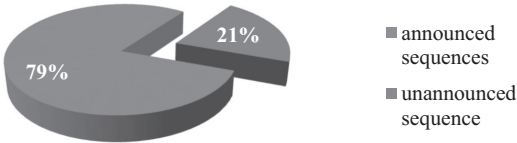
Figure 6.4. Declaration of selected sequences

The distribution between the chosen sequences shows that Sequence #1 (intended more particularly at the beginning of the school year in relation to the theme addressed in the album *Je veux pas aller à l'école [I Don't Want to Go to School]*) is in great demand. This choice is not surprising inasmuch as the vast majority of teachers will explore this teaching resource at the beginning of the school year.
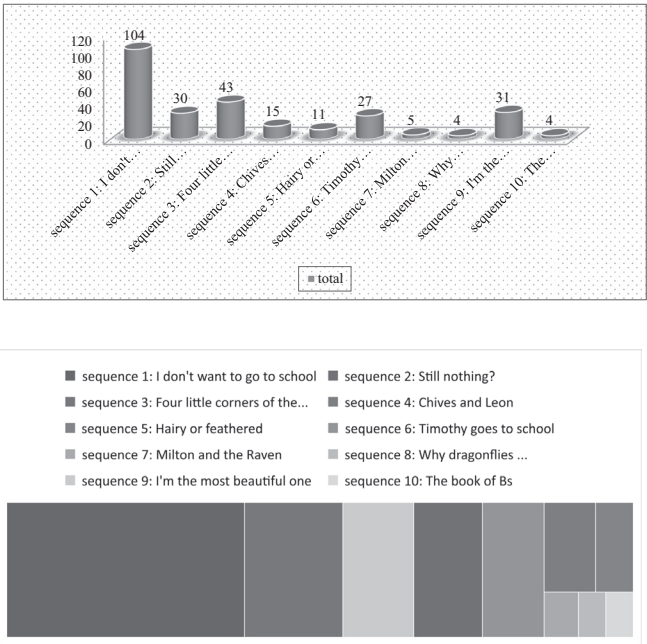
Figure 6.5. Declaration of the title of the sequence worked on in class

And of the 21 % who do not announce a chosen sequence (Figure 6.4), 46 teachers do not respond by e-mail. It is important to note that the absence of an e-mail response does not imply that the teachers did not engage in the task. Some will specify during the second training session that they did not check their mailbox; others will announce their chosen sequence at that time. However, another variable may have influenced either a non-response to the e-mail or a non-entry into the task related to the planning sessions 1 and 2. Indeed, for a third of the participants (and it is in this third that we find the most non-response), session 1 was given in May, session 2 in September, about 2 to 3 weeks after the start of the school year. For the other two thirds, session 1 was provided in September and session 2 between the end of October and November. The argument put forward, either orally or through the written records (cf. on this subject the section on qualitative results, collective written records, and audio recordings), will be based mainly on the need to work on more targeted concerns such as 'socialization' without, however, giving us access to a more precise definition of the related content. 24 teachers (34 %, Figure 6.6) indicated that they did not choose a sequence by giving an argument. Figure 6.7 gives an overview of the arguments using illustrative verbatim.

I haven't chosen a DEL sequence yet because:
  – *I haven't introduced the activity yet.*
  – *I did another emerging writing activity.*
  – *I used another album.*
  – *I haven't introduced it yet because it is necessary to work on socialization.*
  – *I only have two teaching periods in the second grade.*
  – *I have changed my grade level since pre-kindergarten.*
  – *I was/ am on maternity leave.*

Figure 6.6. Non-declaration of the chosen sequence (argument *vs.* no answer)

I haven't chosen a DEL sequence yet because:
   I haven't introduced the activity yet.
   I did another emerging writing activity.
   I used another album.
   I haven't introduced it yet because it is necessary to work on socialization.
   I only have two teaching periods in the second grade.
   I have changed my grade level since pre-kindergarten.
   I was/am on maternity leave.

Figure 6.7. Sequence not chosen, rationale, illustrative verbatims

Qualitative results

The transition to writing has been proposed to the students

Through the discourses (collective written records and audio recordings), we can perceive that the teachers attribute the topogenetic space to the students, thus letting them produce or proposing to them to produce a text in provisional emergent writing when they specify:

– the refusal or apprehension of students to produce
– a blockage of students when confronted with demand
– a lack of interest when confronted with demand
– the students' speech (I can't write)
– students' apprehension to produce right *vs.* wrong
– the proposal to allow them to copy following a conventional format
– disparities in production (production of traces, letters, words) (Figure 6.8)
– disparities in the explanations given by students (reading one's production without graphophonological correspondence, not remembering, not wanting to read)

Figure 6.8. Some examples of student productions

TOPOGENETIC SPACE ASSUMED BY THE TEACHER

We observe that the topogenetic space is assumed by the adult and/or shared with the students when the teachers, in the creative writing assignments, specify, either in the form of affirmation or questioning, the following elements:

Table 6.1. Temporal topogenetic space (before, during, after)
assumed by the teacher

Before implementation	*During* the Provisional Emerging Written Production Activity		*After* implementation
	While they produce	*Right after its production*	
The need for appropriation of the means and its different stages	Giving permission to produce 'their way'	Correcting students' texts	Management of student texts ('What to do with the texts produced? To include them in the personal binder or not?')

*Choosing/deciding to defer the use of the medium to a more favorable period than the beginning of the year (something else to work on: rituals, simple little games, socialization, and rules of life)[11]		Translating Emerging Writing	Explanation to be provided to parents at a later date
*Choose to propose the step 'passage to writing' at either grade level	Observe student reactions	Use adult dictation instead	Check with teacher-trainers
Accepting or *not to let students move to the writing stage	To be surprised, to discover with surprise the children's skills	Propose templates for copying	Need for more knowledge about child development
Convince yourself and allow yourself to enter the process	Using motivational reminders for recalcitrant students		Need for additional knowledge about the development of the student's language skills.
Organizing the same type of activity several times			

In Table 6.1 we can observe the temporality of the topogenetic space assumed by the teacher.

Before implementation, the topogenetic space is entirely assumed by the teacher when she refrains from engaging with the subject matter. In this sense, the strategy in relation to this new knowledge object is of the 'avoidance' type.

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11 *The shaded area shows a topogenetic space occupied by the teacher reflecting an avoidance strategy.

Before and after implementation, the topogenetic space shall be assumed entirely by the teacher. They appropriate the prescriptions and the teaching resource; they plan their action. In this sense, we can say that they use approach strategies, notably through a propensity to convince themselves and to embark on the process, illustrated in the following verbatims:

> *'As long as I was clear with/with this emerging writing, well I didn't feel it and at the same time I had to take a risk by deciding to go for it///I told myself by going for it I'm taking a risk, but it's by going for it that yes'. 'Yes, I wasn't sure what they were asking for, and then as the morning went on, well, finally I said yes, …if I'm clear and I'm convinced that whatever they're doing is some kind of written production, then I'm convinced that whatever they're doing is a written production, then I'm convinced it was good'. Katia*[12]

> *'but I had to walk that road all morning with them// and I think the safer I felt, the safer they felt too/ seeing guys and girls who put out some of these productions (she shows the student written productions to her colleagues)'. Marie-France*

During implementation, the topogenetic space is shared. The student is allowed to produce, the teacher observes, sees varied productions ('Then there are big differences. I don't have anyone who wrote like that//in zigzag' Fabienne). Several teachers, in the audio recordings express their great astonishment ('it's incredible what they can do' Erica).

After implementation, the topogenetic space assumed by the teacher sometimes results in a rewriting according to the standard code. In the audio recordings, we perceive that the teachers have made this 'standardized retranslation' either because they cannot integrate the idea of non-conforming writing, or only with a view to discussing it in the collective (during the second part of the training program), or again with a view to transmitting it to the parents. Figure 6.9 illustrates this adult assumed space following the student assumed space.

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12 Illustrative verbatims; first names are fictitious.
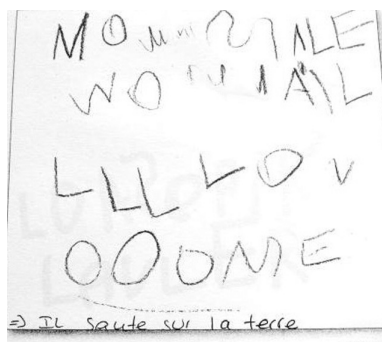
Figure 6.9. Production of a student then teacher's contribution according to the standard code, as well as the illustrative verbatim

'So I rewrote ["il saute sur la terre"] here because I wanted to photocopy and take it with me/so that's why'

DISCUSSION

As we have shown recently (Groothuis, 2013), when we talk about written production with grade 1 and 2 teachers, the majority of them give definitions close to motor skill education, with the question of the writing gesture referring to the teaching of writing technique, whereas research in French language didactics is oriented towards the conception of written production. A gap between empirical knowledge and research is therefore proven. So how do teachers integrate the transition to the written word as advocated by the new DEL teaching/learning medium? How are they transforming their teaching practices? We have observed what they say about the process of teaching and learning through the prism of topogenesis: transactions 'are organically based on an activity shared between teacher and student' (Sensevy & Mercier, 2007, p. 31). Upon whom do they rely most *strongly?* How do the actors share the transaction? We concur with the authors when they consider topogenesis as a 'privileged analyzer of the "joint" nature of transactions' (p. 32). By using a written production task as a lever to observe the disrupted and transforming teaching practices, we seek to determine whether the transactions rely more *strongly* on the student or the teacher, according to the teacher's perspective. In the same way, it is possible to qualify

the strategy undertaken by the teacher to regulate the pedagogical distensions mentioned earlier and to which we return. Either They use an approach type strategy (they convince themselves beforehand, they prepare for it, they propose to the student to produce, and they observe him), or they use an avoidance type strategy (they postpone the use of the teaching medium, they set aside a grade level, or they propose activities that they consider to be a priority, for example socialization).

The age of the students?

The teacher's argument about the age of the students reveals the fragility of the student confronted with this task of written production. However, numerous studies have demonstrated (Pontecorvo, Ferreiro, Morin, David, Saada-Robert) that a 4-year-old student is capable of performing this task. What about the students described by the teachers? We hypothesize that some of them, being older, have a beginning of awareness of the spelling norm and fear 'doing wrong', implying a form of refusal or resistance to produce. The teachers then occupy a topogenetic space by taking charge of the written production, or even by proposing to the students a model to be copied instead of proposing a complexification as proposed in the didactic tool (dictation to the adult). In this sense, if initially the strategy for regulating tensions (Bourgeois, 2006) is of the 'approach' type, it becomes an avoidance type.

The teaching tool?

We then ask the question of the suitability of the task chosen by the teachers for the transition to writing. Should not these students, who are struggling with the activity because they know there is a spelling standard, work from adult dictation? Do not teachers make students take on a role because they do not know the progression of problem situations in order to work on the transition to writing? It should be remembered that not long ago, writing was very unwelcome in preschool classes[13]. Might

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13 A similar observation is made by Chauveau (2003): in France, there are tensions in the school's mission. Indeed, until the years 1975–1980, the debates converged on the idea that learning to read was the responsibility of elementary school (from 6–7 years old), and therefore beyond K.

there not be, in the choice made by many teachers to work on emergent provisional writing with 5-year-old students instead of 4-year-olds as planned in the in-service teaching program, the belief that writing a sentence or a word is not possible before the age of 6?

The prescribed curriculum?

To dare to take the plunge is to dare to discover the knowledge and skills of your students; it is also to take responsibility for these discoveries! How then can we accompany our students in their appropriation? Teachers become engaged (outreach strategy) when they ask 'What do I say to a recalcitrant child? Should I correct students' texts? What about the written production? Do I dare leave the book with them?' There are as many reactions as there are teachers! Several hypotheses in this topogenetic space assumed by the teacher point to missing knowledge about child development in general and more specifically about the development of the student's language skills. In the term prescriptions, the wording or content between 1992 and 2010 is sometimes perceived as similar ('the basic work is the same, no novelty' group K6[14]). Are they then ready to share the topogenetic space during written production? The tension, in Bourgeois' sense, seems palpable: how to act between what I used to do, what I must do, and what I would like to do? And would not the consequence of this topogenetic sharing emancipate the student from the nurturing dependence of the teacher, who until then held the power of the reader-scriber? The issue gives a new dimension to the concept of autonomy, one of the founding principles aimed at from the earliest stages of schooling. We will not develop it further in this contribution.

Perception of their teaching activity?

Teaching practices rooted in Fröbel's or Piaget's approaches remain alive at these levels of schooling, thus joining one of the parameters described by Engeström (1987) (a community of practice that has or had specific approaches, the latter being in a state of change). From the

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14 Written productions extracted from the synthesis of one of the 56 groups (see methodology section).

child at the center of the teaching system, the teachers are led to make a shift towards knowledge. Could one anticipate an 'avoidance' strategy in order to return to previous practices, those that did not primarily focus on knowledge objects? Their profession, sometimes experienced as a 'side job' (Baillif, 2008), is questioned, and so are their teaching practices. These teachers speak from where they are in this time and space of training, and they reveal fragments of their 'collective identity practices' (Lahire, 1998) being disrupted. Let's wager that these spaces of practice exchange have led the teachers to perceive their actions in transformation. Like this teacher recounting their experience: 'They looked at me with big eyes. But I wasn't clear, convinced. And as the day went on… if I was convinced that whatever they did, it was a written trace… but I had to go through that process…'

In the end, what changes? A few days after the students put into practice transition situations in provisional emergent writing, teachers discover and update a new joint action. This joint action (in the sense of Sensevy, Mercier & Schubauer-Leoni, 2000) distributes the forces of transactions in a way that is new to their usual practices. The action of the teacher changes and therefore that of the student also in this teaching/learning process, provided that the strategy used here by the teacher in the topogenetic space (shared but also assumed by the student) is of the 'approach' type and that the teacher can manage the different tensions that inhabit it. At the time of the closure of this contribution, one of them is certainly not resolved: that related to temporality. Many of the teachers expressed the need 'to have time to explore, to appropriate, and to experiment'. Admittedly, upheaval there has been. How will these impulses be sustained? Are these new practices going to be part of the didactic tools present in the classroom on a long-term basis?

The mechanisms of appropriation are varied and suggest the attribution of these regulations of multiple identity or action tensions. Teachers must manage tensions between diverse principles of action and justice, finding in their daily activity 'balances and ways of arrangement with others and with themselves' (Dubet, 2002, p. 129, cited by Goigoux, 2007, p. 50).

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Chapter 7
The Teacher-Mediator: What New Paradigms to Guide the Teaching-Learning Process?

Britt-Mari Barth

In its cultural approach, cognitive psychology is concerned with the relationship between human cognitive functioning and its historical, institutional, and social context. Rather than conceiving of learning as an individual process of information processing, it emphasizes the importance of social and cultural mediation in the teaching-learning process. It is through the cultural context that the activity takes on meaning, by placing the intention to learn within a precise interpretative framework.

Bruner's (1983, 1987) research on language acquisition provides a better understanding of the function of *mediation* in knowledge acquisition. He observes how mothers provide all kinds of activities to promote language contact with their young children. He refers to these activities as *scenarios* or *formats* to describe the structure of interaction that takes place between an adult and a small child, which repeats itself in a ritualistic way and thus becomes familiar to the child. This interaction creates a *shared attention*, a framework in which the understanding of a communication is established. Through adult mediation, the child thus acquires a framework for interpreting his or her experience and learns a common language to 'negotiate' meaning.

This theoretical framework is fertile for thinking about social and semiotic interactions at school and invites the teachers to revisit their role, their conception of knowledge and the way in which they support and equip students so that they can give meaning to school knowledge.

Learning becomes learning how to use a set of cultural tools[1], including ways of thinking, procedures, and key concepts in each discipline. Teaching begins with identifying the common *analytical tools* that students need, creating *intersubjectivity* to ensure that mutual expectations are well understood, and designing scenarios that allow students to *negotiate meaning* and contribute to the evolution of the teaching-learning process.

These forms of interaction, which also involve the professional instructor, are diverse and need to be concretely specified: how to organize the 'encounters' with knowledge? The following example takes place within the classroom; it simultaneously illustrates the impact of a training approach consistent with the pursued goal[2].

A SCENARIO EXPERIMENTED WITH IN TEACHER EDUCATION

This contribution is the result of the training of pedagogical counsellors[3] who have in turn trained teachers in their classes. The training program implemented in the three situations (teacher-researcher/pedagogical counsellors, pedagogical counsellors/teachers, teacher/students) follows the same principles and emphasizes the necessary emotional, cognitive, and social involvement of the learners, whoever they are. Presented as

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1 Vygotsky speaks of 'psychological instruments', Bruner of 'cultural tools'. The terms 'intellectual tools', 'cognitive tools' or 'thinking tools' are also used. In this text, these different terms, used as synonyms, refer to the theoretical frameworks of Vygotsky and Bruner.

2 For more information, see Barth (2013, p. 159 ff.), 'Scenario 4, The process portfolio: individualized evaluation in the service of student diversity at the university'.

3 A seminar was held in July 2007 under the aegis of the *Ministère de l'Éducation, du Loisir et du Sport du Québec* with B.-M. Barth in order to allow pedagogical counsellors, already initiated in the conceptualization approach, to plan a training session allowing teachers to appropriate this approach and then experiment it in the classroom. Sessions experienced by the teachers during the appropriation and experimentation in class were filmed and subsequently presented as part of the in-service education of Quebec's pedagogical counsellors in French language and literature.

an example, the following sequence allows us to observe the means that have been employed for this purpose.

First, we will observe what happened in the classroom at the end of this training program. This is followed by an analysis of the challenges and issues involved in such a pedagogical approach.

The class

We are in a French class in Quebec. The students are 9 to 10 years old. Their teacher tries to teach them how better to read a text to really understand it and derive personal benefit from it. The class work was based on an album that the students are already familiar with, *Ami-Ami* (Rascal & Girel, 2002). It is the story of a rabbit and a wolf who both dream of having a friend. The rabbit imagines a friend, a vegetarian like him, who would share the same passions. For his part, the wolf wishes to have a friend whom he promises to love deeply. Teachers had noticed that students were not very proficient at *justifying their answers* when asked a comprehension question about a text. This linguistic process was considered important to work on, in order to equip the students better to seek the meaning of a text and to know how to *formulate a well-founded interpretation*. The students are familiar with the term 'justify', but knowing the word is not enough; each one needs to know how to 'accurately distinguish' what *justifying* the answer entails.

The following are the *essential attributes* that were selected by the teachers to define what a 'good' justification could be, taking into account the current level of acquisition of these students and their needs.

JUSTIFICATION
Answer the question asked
Provide a personal explanation (because)
Give an example of the text (quote)

To make this definition accessible to students, the teacher proceeded as follows. In previous sessions, students were asked the question *Will the wolf and the rabbit become friends? Justify your answer.*

– The students' answers were collected and classified into examples (correct answers) and counterexamples (partial or irrelevant answers) to serve as a support for the next learning sequence in another class.
– Here is the 'scenario' used by the teacher and presented as a 'guide-line' with which students are already familiar[4].

What is a 'good justification?' You will try to find it…
– *The 'yes examples' contain everything you need to understand.*
– *You have to compare the 'yes examples' to find out what they have in common.*
– *The 'no examples' help us to limit the meaning.*
– *All your answers are noted on the board.*
– *No need to be afraid of wrong answers.*
– *We check the responses together, we cross out if it is no longer valid.*
– *You have to justify your answers.*
– *The teacher gives all the examples that are needed.*
– *Then you find your own examples, and you explain why.*

First 'scene'

Through this presentation, the teacher invites the students to an activity in which they are all invited to participate. The teacher asks them a question; then, presents them with a problem to solve: 'Among the answers that will be displayed on the board, which ones are justifications? Why?' In order to enable them to answer these questions, the teacher suggests a (thinking) method: if the proposed answer does not appear *again* in the following examples, it means that it is not to be retained.

Here is the first *yes example*.

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4   Here presented in schematic form. For more on this, see Barth (2013, p. 76 and subseq.). The term 'scenario' is used here in the sense of 'pedagogical design'.

> **Will the wolf and the rabbit become friends? Justify your answer.**
> *Yeah, I think the wolf will convince the rabbit to become his friend.*
> *The wolf says nice words to him, like at the end of the story when he says: 'I*
> *love you as you are!'*

At first, the students seem hesitant. They are watching the sentences. They say nothing and do not raise their hands to answer. The teacher then asks them to say what they notice, what they observe: *What is essential?* He reminds that all answers are accepted. Then, students quickly raise their hands: the idea that nothing is at risk frees their voices. Pierre-Olivier speaks, looking very serious and thoughtful: 'Well, what I notice at the end, when he says 'Well, I love you as you are', I would not have put a comma in that sentence, because it is not essential'. The other students listen to this remark and reread the sentence. The teacher repeats what the student says, without the slightest expression of astonishment or criticism, and notes on the board: 'The comma is not essential'. The answer is accepted, it is a possible remark. Disregarding a wrong or off-topic comment, or worse, mocking, would lead to an inevitable inhibition: students no longer venture to make assumptions; they allow themselves to speak only when they are sure they have the right answer. It also induces the idea that exploring and making mistakes is not really accepted, that learning consists only of one question necessarily followed by one correct answer. The learning situation then becomes an evaluation situation where one risks being prematurely and perhaps definitively judged. In that case, there is no learning situation, but a seamless transition from question to evaluation. The most fragile students may therefore withdraw and no longer participate. This highlights how this listening attitude and consideration of the students' voices are important factors.

Second scene

The teacher then gives the floor to the other children. Léa answers, by situating the characters: 'There's a wolf and a rabbit'. The teacher notes and comments, 'Here are some possible answers' and pauses. This second remark has the merit of refocusing attention on the understanding of the text rather than on the analysis of punctuation. Mégane quickly bounces

back: 'In the last sentence, there is an explanation'. Ginette picks up on this lead and notices that 'it says something that happens in the book'. Everybody's attention is now turning to what 'it' is trying to express. The teacher then repeats the Ginette's words and asks why she is making the connection to the book, allowing time for her to find the words to express herself. It leads to the idea that the students who responded in the previous class, 'took the sentence from the book to give an example of the explanation'. She therefore takes up what the previous student had answered and, creating a chain of ideas, she links the 'explanation' to the illustration of this explanation by a sentence taken from the book.

It is by 'thinking together' that these links appear. Not all students might have noticed these connections, but, witnessing the interaction between the two students, aided by the selected words noted on the board and visible to all, they too can 'enter the discussion'. Thanks to the teacher's social mediation, attentive to the dynamics of interaction, a common reflection takes place in the classroom. Without students being aware of it yet, two of the three essential attributes ('give an explanation', 'illustrate with an example of the text') are already noted on the board. The teacher reminds students that they will now need to pay attention to what will *come up* in the following examples to determine the essential attributes. In this way, he directs the students' attention, without giving them the answer.

The second example invites students to look for *similarities*. Aware of what they are looking for, students observe it carefully.

Here is the second *yes example*:

Will the wolf and the rabbit become friends? Justify your answer.
– *In my opinion, the wolf and the rabbit will not become friends because they are not looking for the same kind of friends.*
– *In the text, the rabbit wants a vegetarian friend and wolves usually eat meat.*

Following the teacher's remark, yet another student quickly finds a resemblance: 'there is still an explanation'. Without this guidance, she probably would not have had the idea to compare the examples against this criterion and make this suggestion. The teacher then asks to identify the explanation in the text. Other students raise their hands, and the teacher gives the floor to Pascal: 'It's about friendship…' He searches, reflects… conscious that something is missing, his expression testifies to it; the teacher remains silent. After reviewing the two posted examples,

he goes on to explain that he had not looked at the second example properly, but that there is 'because…' The teacher notes the word on the blackboard. Everyone can then make the link between 'the explanation' (as a separate sentence in the first example) and the 'because' (in the second example), which is an indicator of an explanation to follow. It thus confirms that there is indeed an *explanation* in both examples. Students become aware that 'explanation' can take different forms.

A student then draws attention to something else: 'I notice that there is no example taken from the book'. In fact, he noticed the difference between the quote (a term that the students do not yet use) at the end of the first example ('Well, I love you the way you are!') and the last sentence that illustrates the point in the second example ('In the text, the rabbit wants a vegetarian friend and wolves usually eat meat'). The teacher immediately bounces back to clarify: 'Is that sentence from the text? Yes. So, this is also an example that reinforces the explanation? Yes'. These 'eliciting questions' encourage comparison; they aim to compare interpretations with the real thing, i.e., the example, in order to find reference points to confirm or invalidate it.

Work's progressing. A first *no example* is presented:

Will the wolf and the rabbit become friends? Justify your answer.
No, because they're going to stay in their house.

This first *no example,* with only one sentence, helps to focus attention on the three elements that should be present and that are missing here. By this sought-after contrast, we can therefore immediately understand that this is not a *yes example*. The teacher confirms it. But why exactly? A first student notices that there is no explanation, another that there is no example taken from the book. The teacher asks if they notice anything else. On closer inspection, Dominique observes that the 'because' in this example does not explain why the wolf and the rabbit will become friends. The teacher bounces back on this observation and draws attention to the fact that in the *yes examples,* the reason for answering yes or no to the question asked is well explained. What is the difference?

The students compare the explanation in the *yes examples* and notice that even when the three elements are not presented separately, on three lines, they can find what identifies them: they make the connection

between words like 'because', 'like', and 'as', which are indicators of the *explanation*. But the explanation can also be present without these indicators, and it is important to understand this. Pascal strives to find words to express such subtle links; the teacher listens and rephrases, while checking with the student that he does not betray his thoughts. His 'partner' attitude is appreciated; this can be seen in the quick smile that lights up the student's face, who feels recognized in his reformulations, despite his difficulty in finding the right words. There is a complicity that develops, evident in the video.

Observations and analyzes are being refined. Students now begin to differentiate between an explanation that has a logical connection to the original question and an explanation that does not answer that question (which should be kept in mind as the teacher constantly reminds them):

> **Will the wolf and the rabbit become friends? Justify your answer.**
> *No, because they're going to stay in their house.*

In his further analysis of this example, the student feels that it is not a good explanation, despite its form and its introduction by 'because': 'There is an explanation except that it does not make sense, it does not answer the question at the beginning'. The other students check and understand that the presence of an explanation alone is not enough; the explanation must also answer the original question consistently. The term 'because' is therefore not enough to judge this, it is necessary to check the linking and contextualization of the information. The students themselves add an attribute which the teacher had not foreseen: *the explanation must be 'related' to the question*. These comments on the 'quality' of the explanations (and not only on their *presence* as a sought-after attribute) even amaze the teacher.

A new *yes example* is presented:

> *No, because the rabbit doesn't want to be friends with the wolf, because he doesn't have the same taste.*
> *For example, rabbits like to eat vegetables.*

The student who was looking only at commas and verbal forms at the beginning is now on the trail of meaning and confirms that there is indeed an answer to the question and an explanation introduced by 'because' He then gives a 'scholarly' explanation (based on his personal knowledge) that the rabbit is a rodent, so it does not eat meat, and this is a good reason not to be friends. This is followed by a discussion, initiated by the teacher, to differentiate between a 'quotation' and an argument that is not taken directly from the text ('Rabbit does not have the same tastes, he likes to eat vegetables') – but inferred by the student who is at the origin of the example – and which may not be convincing for everyone. The concept of friendship must already be sufficiently circumscribed to express one's thoughts on the *merits* of the arguments; but the class is beginning to become aware of these subtle differences and the students are well on their way to an interpretive thought process that can differentiate and judge the 'quality' of the 'evidence'. They agree to accept this as an example *yes,* despite the absence of a quote. The important thing here is not the 'right answer', but the logic of the argument, even if it can sometimes be debated.

We now find the students later in the lesson, near the end, when the essential attributes of justification have been highlighted. What was no longer valid has been erased from the white board and we move to the next step of checking whether everyone has understood and can find the characteristics retained in the new examples, without the teacher's specifying whether it is a *yes* or *no example.*

Third scene

Observations and analyzes are being refined. When the teacher judges that time is ready, he no longer presents the examples as *yes* or *no examples*; it is now up to the students to judge and justify their answers. It's time for everyone to adjust their answers, to check their understanding. Faced with this new challenge, participation is increasing. Even students who had not yet expressed themselves directly jump in. Others, who may have disconnected at times, can 'reconnect'. They listen to each other, we can observe this *shared attention:* crossed glances, smiles. Students are not able to engage in a real argumentation yet, but they are listening to the arguments of others and becoming aware of them. This, in turn, will allow them to possibly agree or disagree, which constitutes

the first step of argumentation. Students become faster at distinguishing the presence (or absence) of the essential attributes of 'justification' in unknown examples. When the teacher confirms the accurate analysis, pride and pleasure are visible on the face of the concerned student; you can even hear a little exclamation. When students make a mistake, the teacher does not judge them but asks if someone else can help.

This phase prepares them for self-evaluation. It is no longer only the teacher who 'controls' the correct answer, students become more and more capable of judging for themselves. This is the beginning of a certain mastery over their own success.

Let's stop the analysis of this scenario here. This was only the beginning of a transversal learning process that will continue to evolve on a solid foundation, but which has already given everyone confidence in their ability to learn.

It is important to note how involved these students are, how they try to find the solution, how attentive they are despite a rather complex learning process. One can observe the attention with which they listen to each other, the way in which the reflection advances *with* and *through* others, the fluidity with which the thought progresses in the group and the pride of the students when they realize that they have understood well. What is the role of the teacher here? What are the challenges that he faces and that we also encounter when it comes to teachers' education and to *university teaching and learning?* I would like to highlight three of them.

First challenge

The first challenge is to *build the confidence and commitment of students* to join the project. I refer here to what Bruner (1996) calls *establishing intersubjectivity,* to stress the importance of making mutual expectations explicit: these expectations do not only concern the object of learning, but also the 'rules of the game' and how personal stakes will be taken into account. Students' intention to learn, 'motivation' depends largely on how they will perceive the meaning of the situation and their own role in it.

It is our singular history, our frame of reference that guide the meaning we give to 'reality', be it existential, mathematical, literary, or otherwise. The past (our experiences, knowledge, beliefs, attitudes, and values), the present (what the situation means to us, the confidence it inspires in us),

and the future (how we fit the present into a personal project) all come together to influence the intention to engage in a learning situation.

This perception of 'well-being' or 'unhappiness' when engaging in learning activities at school or university is of an emotional nature, and perhaps we have not sufficiently taken the measure of the interdependence between emotional and cognitive involvement: these are two sides of our intelligence, and one does not function separately from the other. As neurobiologist Antonio Damasio (1995) teaches us, to be rational is not to cut oneself off from one's emotions; on the contrary, it is our emotions that guide our reasoning: 'To increase the faculty of reasoning, it is necessary to pay more attention to the vulnerability of the inner world' (p. 309). We can no longer ignore the fact that the emotional and the cognitive are not separable.

The pedagogical challenge is to help the learner build a worthwhile self-image. In an interaction that is structured, with mutual expectations made explicit and roles agreed upon, the teacher and students – and the students among themselves – can express themselves and cooperate to complete a task together. The 'guideline' used in our experiment is designed for this purpose[5]. The safe environment and the teacher's listening posture encourage students to express and refine their thoughts, while also enabling the teacher to build upon that and adjust accordingly. The relationship of trust – self-confidence and trust in others – can then evolve within the relational dynamic of this shared activity. This is the most important challenge because cognitive activity emerges within these relational spaces.

Second challenge

The second challenge is to provide intellectual training for students: to introduce them to the use of tools and methods of thinking. *How* you learn becomes as important as *what* you learn.

The search for meaning is at the heart of the process we have just observed. Meaning is not a *déjà-là*. It will emerge in this back and forth between the contextualized situations (examples and counterexamples) that everyone can live as a personal experience and the common abstract

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5   For more on this, see Barth (2013, p. 76 and subseq.)

words that we will look for together to refer to. One enters through a *process of conceptualization*[6] induced by the teacher's mediation, which makes it possible to 'make visible' the way in which students *observe* examples; *compare* them, looking for similarities; and *make inferences, verifying them*… It is in the very space of this cognitive activity and dialogue that meaning is elaborated, students' perception being guided by the *choice and order of the examples*, by the *contrast of the counterexamples*, by the *eliciting questions*, and the regular *feedback* of the teacher. Systematically encouraging students to *justify their responses* requires them to anticipate the coherence of their remarks and opens the door to *argumentation*. These are tools of cognitive mediation. We are no longer only in a 'world on paper'[7], an abstract world, but in a cultural and collective activity that leads to linking abstract knowledge (here the essential attributes) to its concrete referent (here the examples and counterexamples). In a continuous back and forth, contextualized experiences are inserted into a larger unit that gives them meaning. This is what Morin (2011) calls 'relevant knowledge'. By these means, the teacher-mediator thus creates the conditions that allow students to engage in a process of conceptualization that becomes a learning process.

In fact, what young students are learning – while becoming familiar with disciplinary content – is how knowledge is constructed and how one can enter into the knowledge constructed by others. They learn to tell the difference between *how* you think and *what* you think about. They learn how to structure knowledge and thereby structure their thinking.

When we work with students in this way, their enthusiasm can be seen in their mutual commitment, their perseverance in the search for attributes, their audacity in making a new inference, the manifestation of pleasure when they find the right words. This process involves them, because it starts from themselves, from what each one can see and understand, while gradually attracting their attention through the new connections made possible. The sense of pleasure comes from the pleasure of meaning – the shared meaning. The proposed activities lead

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6   Defined as a sequence of mental activities involving *observation, comparison, inference and its verification, and hypothesis and its verification*. For more on this, see Barth (2013, p. 59 and subseq.)

7   Expression borrowed from Olson (2010).

everyone to participate in a dialogue where diversity is used as a tool to help everyone increase understanding.

The challenge for the teacher, whether at school or university, is to provide good support for thinking: with what and with whom will students interact? What supports can be offered to help them acquire new forms of questioning and language to develop their understanding? What are the challenges to stimulate their cognitive involvement? What are the structures of interaction permitting everyone to take part in the ongoing 'negotiation' of meaning?

These are questions to be addressed among the teachers themselves in their collaborative search for materials and activities to implement in order to support the intellectual development of their students.

Third challenge

The third challenge concerns awareness: to go back to one's own thoughts to become aware of them. It is *metacognition* that aims to broaden the field of consciousness of learners and thus their ability to reuse what they know in different contexts. To be conscious is to be able to access one's own thoughts and act on them. In elementary school, this can be achieved at the end of the day by asking: 'What did we learn today?' The question can also be about how one has learned and how one can show understanding: 'How do I know that I know?' Whether they are young students at elementary school or university students, all learners need to become aware of the tools of thinking. As Bruner (1996) reminds us, knowledge is not just a sum of concepts, it also integrates its acquisition process. Recognizing cognitive processes, methods and learning strategies allows one to reuse them, to regulate and modify one's action, and, in the end, to gain self-control and the ability to act.

The challenge for the teacher is to encourage students to think, by introducing them to the use of tools and methods of thinking that need to be identified, made explicit and observable, and deployed on a regular basis. Without conscious 'cognition' there is no metacognition. You cannot go back to something you can't define or observe. The approach used here encourages students to make successive connections based on examples and counterexamples, experienced as personal. Such a ritual scenario, or a 'format', in the sense of Bruner (1983, 1987), enables back-and-forth between analogical thinking (which considers the whole)

and analytical thinking (which focuses on details) to maintain a shared attention towards a specific goal: elaborating the meaning of disciplinary knowledge. Gradually, the learners thus trained become aware of the cognitive approach; they adopt it and develop a greater capacity to act independently and take more responsibility for their learning. The positive experience subsequently gives them greater confidence to take initiatives, to propose their own interpretations, examples, and questions.

In conclusion: Prospects for initial and continuing teacher education

Current school reforms in most developed countries are in line with this theoretical orientation, which seeks to make *all* students more reflective, more responsible, and more committed to the co-construction of their knowledge. From this perspective, the role of the teacher is changing. Instead of exposing his own knowledge, he must put it at the service of students' learning, taking the position of mediator between the learners and the knowledge/skills to be acquired. For the students, having a place to participate, being equipped with the intellectual tools to succeed, and feeling confident in themselves to engage in the learning process are therefore conditions for such an educational project to be viable. It's a paradigm shift.

Achieving such a profound change in teaching implies coherence between teacher education and classroom teaching practices. There will be no paradigm shift in the classrooms if this same shift has not already taken place in universities. The challenge is undoubtedly the creation of a new culture of learning, offering the same experience in teacher education that one would like to see in the classroom.

It is when the teachers in training grasp the meaning of the activities, in direct connection with professional practice, that the training allows them to change their view, and to make their practice evolve. Theory and practice are inseparable: it is the same principle as in the scenario described, designed for students. Contextualized experiences inserted into a larger unit give them meaning. The support of teachers 'in training' is as important as that of the students. The *mediating trainer* must act in coherence with *the mediating teacher.* The possibility of *metacognitive feedback* on what actually happened, through videos of

the teaching/learning sequence, allows a deeper understanding and recognition of the cognitive operations implemented by the learners. This new perspective leads everyone to be more attentive to the learning processes of students, and to analyze and adjust their teaching practice accordingly.

In such a context, the 'mediation' plays an essential role for the quality of learning of students at all levels. It creates an environment that solicits and supports emotional, cognitive, and social interaction. It adjusts to diversity and provides the opportunity necessary for everyone to engage with others and deploy the cognitive tools they need. This is how you go from 'transmission' to 'transaction', to generate transformation.

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Part III

Prospects for Initial and Continuing Teacher Education

Chapter 8
The Role of Peer Interaction on Early Literacy in Schools

Franca Rossi, Clotilde Pontecorvo and Francesco Arcidiacono

This chapter aims to reconsider some of our previous work on learning written language and acquiring the writing system from the perspective of the role of peer interactions in a school environment. Our objective is to contribute to the international discussion on teaching and learning processes by highlighting the importance of social interactions (mediated by the teacher, especially in the context of young children dictating stories to adults) in two key areas of learning: text production (and engagement with specific genres, such as announcements) and the development of the alphabetic code. It is in this spirit that this chapter is a re-elaboration of a scientific path that led us to discover, from our first systematic research on peer interaction in a situation of learning written language (Orsolini, Pontecorvo & Amoni, 1989), the link among writing, collective reading, and comprehension of written and oral texts in the classroom. This journey began with an international scientific meeting on literacy held in Rome in 1988, which produced a collective publication in Italian (Orsolini & Pontecorvo, 1991), as well as others in English (Pontecorvo, 1997; Pontecorvo, Orsolini, Burge & Resnick, 1996).

At the intersection of various lines of research, we have discovered that preschool children, beyond mere attempts at writing and reading, when invited to explore the features of the writing system (first pre-phonemic and then syllabic, as per Zucchermaglio, 2001), are simultaneously engaged in different forms of textual elaboration

(Zucchermaglio & Scheuer, 1991). This process is carried out through forms of children dictating stories to adults: children are thus able to build a written story together by collectively imagining different scenarios to carry out their activity, for example using Playmobil (Orsolini, Devescovi & Fabbretti, 1991), or the dictation of stories already known orally, e.g., in Catalan (Teberosky, 1988) or Italian (Ferreiro, Pontecorvo, Moreira & Garcia Hidalgo, 1996). This latter approach, in particular the dictation of culturally diffused and known stories and tales, inspired comparative research in elementary school on the writing of the story of *Little Red Riding Hood* in three languages (Italian, Portuguese and Castilian). In the dictation of known stories, we have observed different formal modalities used by dyads of children in order to guide the adult transcribing the text, sometimes indicating very specific aspects such as punctuation or layout (Pontecorvo & Zucchermaglio, 1989). Dictation of known texts has the advantage of excluding the dimension of ideation (in the sense of fantasy and imaginary creation) in the production of a written text and allows a strong focus on the choice of linguistic forms for writing known content. In other contexts of interaction, we have compared dyads of elementary school children reconstructing already known stories or inventing new stories from images (drawing or photo). The results of these observations showed very different performances in terms of literary styles among children at the beginning of elementary school (Morani & Pontecorvo, 1991; Pontecorvo & Zucchermaglio, 1984).

This chapter is organized in three parts. In the first part, we discuss the social dimension of producing a written text in a small group work situation and by dictation to the adult (teacher). The second part aims to deepen reflection on the process of alphabetic code-building: examples of small group activities are presented to show situations where children who cannot write in a conventional way are discussing the identification of a shared solution for writing a word. The participation of a child in several groups with different levels of competence is also questioned. The third part of the chapter provides methodological guidance for teachers who wish to include the devices described and discussed in this contribution in their classroom practices. The examples presented are part of a sample of situations observed in public schools located in urban contexts in Italy.

The production of texts in small groups through adult dictation

Dictation to an adult (or to a peer who is proficient in writing) is a particularly productive way to become familiar with the written language. Children, not being concerned with transcribing, can concentrate more on the production of the text, on the choice of appropriate linguistic forms in relation to the communicative function that the text must achieve, as well as the characteristics of the addressee. However, the potential of dictation has been little explored, especially from the point of view of the processes of construction of the written text and the quality of the texts produced in children who have mastered a writing system.

Designing and dictating an announcement

Our first example concerns a small group of 4–5-year-olds in a kindergarten engaged in dictating an announcement to parents. In particular, the purpose of this announcement was to invite parents not to throw objects into the school's external premises when classes are over.

The following sequence includes four children and the teacher. Marco (turn 46) opposes Olga's initial proposal in turn 45: the objective of the conversation is the need to combine two constraints, namely the need to include in the announcement the list of objects not to be thrown in the school garden, and the need for the text to be concise. Children want to add a long list of items, but they know that an effective message must be short.

Excerpt 1. Writing the announcement

45. Olga: then let's write 'You, parents, don't throw away papers and cigarettes either because the garden has been cleaned up a bit and then it shouldn't be dirty anymore'

allora scriviamo 'Voi genitori non buttate le cartacce e neanche le sigarette perché il giardino é stato un po' pulito e poi non deve essere più sporco'

46. Marco: it's too long

é troppo lungo

47. Noemi: I have to say one thing

         io devo dire una cosa

48. Teacher: wait, first, Marco

         aspetta, c'era prima Marco

49. Marco: indeed, I thought of another way. 'Don't throw things on the floor' is all

         infatti io ho pensato in un'altro modo 'Di non buttare le cose per terra' basta

50. Olga: not things! They throw away everything if we say things, no, they only throw away cardboard, pieces of cigarettes, that's what they throw away

         no le cose! loro buttano tutto se diciamo le cose, no, loro buttano solo cartone, cicche di sigarette, questo buttano

51. Marta: and the glass

         e il vetro

52. Noemi: and then we also write 'Kids, don't throw papers on the floor and French fries'

         e poi scriviamo pure « Bambini, non buttate le cartacce per terra e le patatine»

AQ: Note that no opening double quote for the closing double quote has been provided in the phrase 'per terra e le patatine". Please check and amend necessary.

Within the same group, a second interesting sequence appears later, in turn 68: the teacher requests the beginning of the dictation by assuming the role of writer (turn 71). It is at this point that Olga makes explicit her knowledge of the fact that an announcement must begin with a title (turn 72). She knows that the title, to be effective, must be short. For this reason, Olga opposes Marta's proposal to add elements (turn 75), using an effective argument in turn 76. Following the exchange, Marco intervenes in turn 77 by taking the title proposed by Olga and proposing it to the group after a revision, in order to look for a written formulation adapted to the nature of the announcement.

Excerpt 2. Writing the announcement (continued)

68. Teacher: then we have to decide, how can we start writing?

         allora, dobbiamo decidere, come si può cominciare a scrivere?

69. Olga: it can be displayed with glue

         si può attaccare con la colla

70. Noemi:	it's a nice idea
	é una bella idea
71. Teacher:	then how can we write? You dictate and I write
	allora, come si può scrivere? voi mi dettate e io scrivo
72. Olga:	then, first write the title
	allora, prima scrivi il titolo
73. Teacher:	first I write the title? And what is the title?
	prima scrivo il titolo? e qual é il titolo?
74. Olga:	don't throw away papers
	non buttate the cartacce
75. Marta:	…and toys and candy
	…e i giochetti e le caramelle
76. Olga:	no! We're not writing now, we're writing the TITLE.
	no! noi non stiamo a scrivere ora, stiamo scrivendo il TITOLO.
77. Marco:	don't throw things in the garden. NO. the things that, we must not, you must not throw in the garden.
	non buttate le cose nel giardino. NO. le cose che, non dobbiamo, dovete buttare nel giardino.

Building and dictating a letter

The following example concerns a small group of children in a children's school engaged in building and dictating to the teacher – who takes the role of writer – a letter addressed to a classmate who has been absent for several days. The group discussion leads to the final text of the letter after a long discussion, following the teacher's rereading of the text by the children. The sequence including turns 1–27 (see Table 8.1) concerns the first version of the letter drafted by the group.

Table 8.1. The first version of the text read by the teacher in round 27

Giacomo, Giulia, Nicola, Valeria. **Hi, Giorgia**. Are you sick? I'm sorry if you're sick. Ciao Giorgia, next week we begin the library books. **Come back soon. We hope you come back soon** because otherwise you can't take the books as well as for the theatre because otherwise we are very sorry.

Giacomo, Giulia, Nicola, Valeria. Vi saluto, Giorgia. Sei ammalata? Mi dispiace se sei ammalata. Ciao Giorgia, dalla prossima settimana cominciamo i libri della biblioteca. Torni presto. Speriamo che torni presto perché se no non puoi prendere i libri e anche per il teatro perché se no ci dispiace molto a noi.

The version of the letter presented in Table 8.1 contains various unconventional elements that sometimes make the text ambiguous. Specifically, the beginning is unconventional because there is the indication of the names of the authors; there is confusion between the plurality of authors and the single addressee of the letter ('Hi, Giorgia/*Vi saluto, Giorgia*'); errors in the use of verbal tenses ('Come back/*Torni*'); and repetitions ('We hope you come back/*Speriamo che torni*').

From this first version of the text, the teacher explains to the group the possibility of action on the text, trying to help the children to consider the perspective of the recipient of the letter (turn 31). As a result, the children propose revisions (turns 32, 34, 50, 53, 69).

Excerpt 3. Writing the letter

	[…]
31. Teacher:	**no, but do you think it's written correctly? We can remove, add. Listen carefully, imagine Giorgia reading**…
	no, ma vi pare che sia scritta in modo corretto? possiamo togliere, aggiungere. ascoltate bene, immaginate Giorgia che legge…
32. Giulia:	**then we have to delete some things that have already been written. We have to delete 'Come back soon' because otherwise**…
	allora, dobbiamo cancellare certe robe che sono già scritte. dobbiamo cancellare 'Torni presto' perché se no…
33. Teacher:	**I'll read it back to you so you can tell me if it's okay**
	ve la rileggo così voi mi dite se va bene

34. Giulia:	**'I'm sorry you're sick' is the one I think should be deleted.**
	'Mi dispiace che sei ammalata' dovremo togliere secondo me.
	[…]
49. Teacher:	**so, 'Are you sick? I'm sorry. Ciao Giorgia, next week we start the library books'.**
	allora 'Sei ammalata? Mi dispiace. Ciao Giorgia, dalla prossima settimana cominciamo i libri della biblioteca'.
50. Nicola:	**delete**
	cancella
51. Teacher:	**I'm deleting it, why?**
	lo cancello, perché?
52. Giulia:	no
	no
53. Giacomo:	**no, otherwise she doesn't understand that we have to choose them.**
	no, se no non capisce che dobbiamo sceglierli.
54. Teacher:	**but we wrote that we 'choose them…' or 'we start the books…' what does that mean, 'we start…?'**
	ma noi abbiamo scritto che 'li scegliamo…' o che .. 'cominciamo i libri…' cosa vuol dire 'cominciamo…?'
55. Giacomo:	**we start taking books.**
	cominciamo a prendere i libri.
56. Teacher:	**then I add 'we start…'**
	allora aggiungo 'cominciamo a…'
57. Giacomo:	**taking books from the library.**
	prendere i libri della biblioteca.
	[…]
69. Carlotta:	**you have to delete 'Giorgia' because otherwise she'll read 'Giorgia' and yet her name is Giorgia and so**…
	bisogna cancellare 'Giorgia' perché se no poi lei legge 'Giorgia' che però lei si chiama Giorgia e così…

Giulia:	**in my opinion this (indicates the names written at the beginning) should be deleted, because it should be said at the end, on behalf of**… **because it is Giacomo's text**…
	secondo me questi (indica i nomi scritti all'inizio) dovremo cancellare, perché si direbbero alla fine, da… perché è il testo di Giacomo…

Giulia takes the floor in turns 32 and 34, proposing the deletion of repetitions that she has identified. She also identifies the non-conventionality of the beginning and proposes to add the names of the authors at the end of the text rather than at the beginning. In turn, Giacomo identifies the ambiguity of the expression 'we begin the books/*cominciamo i libri*' and proposes a possible correction in turn 55. Another intervention, from Carlotta, aims to clarify the non-conventionality of the greetings in the middle of the text (turn 69) and requests a final intervention from Giulia (turn 70) who agrees to delete the names at the beginning.

The group thus arrives at the second version of the letter (see Table 8.2) that the teacher will read.

Table 8.2. Second version of the text read by the teacher in turn 72

Are you sick? I'm sorry. Ciao Giorgia. Next week, we start taking books from the library. Come back soon.
Sei ammalata? Mi dispiace. Ciao Giorgia. Dalla prossima settimana cominciamo a prendere i libri della biblioteca. Torni presto.

The ensuing discussion shows that the group is not yet satisfied. Giulia proposes to correct a verb (turn 75) and to complete the text with other information (turns 79–86). At the same time, the children check that the teacher introduces the suggested corrections (turn 88).

Excerpt 4. Writing the letter (continued)

75. Giulia:	**Come back soon**.
	Torna presto.
	[…]

79. Giulia:	because otherwise…
	perché se no…
80. Giacomo:	…you also miss the bus.
	…perdi anche il pullman.
81. Giulia:	because otherwise you also miss the bus and you would have to arrive early.
	perché se no perdi anche il pullman e dovresti arrivare presto.
82. Carlotta:	at 9:00 a.m.
	alle 9.
83. Giulia:	Monday after next.
	il lunedì dopo quello prossimo
84. Nicola:	tell dad and mum to bring the money.
	dì al papà e alla mamma che si devono portare i soldi.
85. Teacher:	where to?
	per andare dove?
86. Nicola:	at the theater.
	a teatro.
87. Teacher:	wait, I'm writing.
	aspettate, che scrivo.
88. Giulia:	**did you add what Nicola said?**
	hai aggiunto quello che ha detto Nicola?

THE CONSTRUCTION OF THE ALPHABETIC CODE BY COMPARING ENTRIES IN SMALL GROUPS

Peer interaction aimed at comparing and identifying the 'correct way' to write a word has been the central mode to support conceptual change concerning writing in children. This change is achieved through a transition from the pre-syllabic level to the syllabic level (Ferreiro, 2003; Ferreiro & Teberosky 1979; Pontecorvo, 1989; Vernon & Ferreiro, 1999). This involves peer interaction facilitated by the formation of small groups of up to five children.

The small groups were formed according to a principle of heterogeneity calibrated to the levels of conceptualization. The goal was not to achieve conventional writing but rather to identify a shared solution through a discussion aimed at solving the problem posed by writing a word. Research on literacy shows that the demand to write a bi-syllabic word at a given point in the conceptualization process determines a conflict for children between the hypothesis of syllabic writing and the idea that written words – in order to be considered forms of writing – must include at least three signs (Pascucci, 2005). Another study (Ferreiro & Zamudio, 2008) also highlighted the role of different syllabic forms in the construction of alphabetic conceptualization.

The following excerpts relate to work situations in early childhood education in which children systematically participate in the confrontation of spontaneous writings in small groups and in the dictation of texts to adults. We observed several experiments of about 15 minutes each, once a week for a period of about two months. To process the data, we opted for a double level of analysis of discursive interactions: one focused on the group; the other focused on the individual child. More specifically, we closely observed the participation of a child (Damiano) – with a pre-syllabic level of conceptualization – in two groups (A and B) characterized by a different frequency of argumentative oppositions[1] (group A: high frequency; group B: low frequency). The two groups conducted experiments involving the comparison of the written forms of the words '*folletto*' (elf) and '*pasta*' (pasta). These words were chosen because they were related to a general activity carried out in the school classes during the period of our observations.

In the following Figure 8.1, the distributions of the turns for each participant in the two groups (A and B) in which there is the same child (Damiano) are presented. The first element that emerges from our observations concerning the distribution of the turns of talk is the fact that in both groups there is always one child (Filippo for group A and Luca for group B) who speaks more than the others. The rest of the group is fairly evenly distributed. Similarly, the teacher's interventions do not vary between the two groups.

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1 Opposition is a discursive act that marks a disagreement with a previous statement by another speaker. It may be followed by explanations in order to argue the reasons for such disagreement.
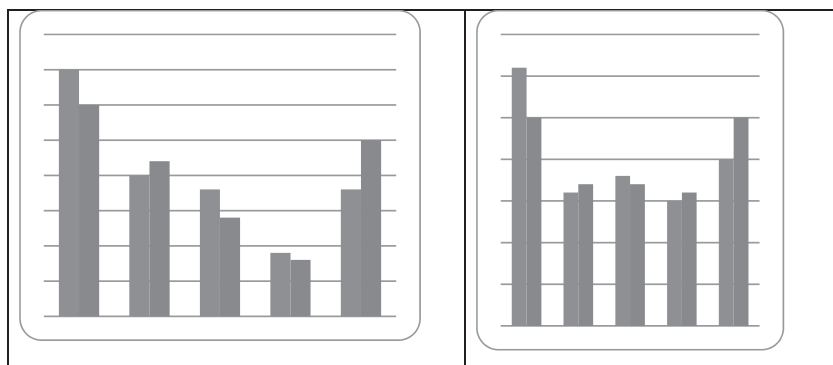
Figure 8.1. Frequencies (in percentage) of participants' speech activity in the two groups (A and B) by experiment ('elf' writing/'pasta' writing). Left side: Red = 'pasta' writing, group A; Blu = 'elf' writing, group A. Right side: Red = 'pasta' writing, group B; Blu = 'elf' writing, group B

With regard to the target child of our observation (Damiano, who participated in the experiences of both groups) there is no variation in the two situations with regard to the frequency of speech activity. Speech activity frequencies are clues to the management of verbal interactions within groups and the way children work. In order to solve the assigned task, the children manage the activity in small groups in a way that is comparable and effective in terms of argumentative exchanges.

In order to understand more specifically what happened in the small group of children who cannot yet write in a conventional way, we analyzed the verbal exchanges in the different situations (see Table 8.3). How do children cope with writing a word? What happens when the entries produced within the group are different?

Table 8.3. Thematic focus characterizing the various discussions analyzed

Experiment 1 – Group A writing 'elf'	Experiment 1 – Group B writing 'elf'	Experiment 2 – Group A writing 'pasta'	Experiment 2 – Group B writing 'pasta'
Children write the words and discuss the length of the words (turns 2–8)	Children disagree on how to write and how older children or peers (who can already write) are writing (turns 2–9)	There are two-letter words: this is the group's problem during the whole activity	Children disagree about the length of the word and eventually decide to reduce the length of the word
Children discuss how to read the words: should all the letters be read? (turns 9–14)	Stefania and Luca rewrite, Sara and Damiano do not rewrite (turns 18–28)		
Children discuss the length of the word *folletto* (elf). Three letters – as Filippo says – or more letters as the others say? (turns 19–35)	Children discuss (turns 29–33) the color to be used for writing. This exchange ends when Damiano says 'but the color is not important, what is important are the words!'		
Children agree to delete the extra letters (turns 36–45)	Children disagree on the reading strategy to avoid getting extra letters (turns 38–45)		
	Luca adds (turn 40): 'I leave it like this, because if I read my word quickly, there are no letters too many'		

During the first two experiments, the children focus their attention on at least two different aspects of writing. Group A looks at word length and reading modalities; group B engages in rewriting the word to remove letters, as well as less relevant issues (e.g., confronting older children, classmates who have mastered writing, or the choice of color for writing).

More specifically, group A – having a higher level of conceptualization and a strong capacity to use argumentative forms of opposition – targets from the beginning the most relevant questions: How many letters must be included to write the word 'folletto' (elf)? On the other hand, group B seems to be looking for arguments to legitimize the sample writing produced before entering into a real confrontation.

In the second activity, each group focuses its attention on a single dimension: for group A it is the legitimacy of words written with two letters, while group B focuses on the length of the word 'pasta'. The problem within group A emerges as a conflict between the syllabic writing hypothesis adopted by Filippo and the anchoring to the principle of minimum quantity to which Federica attaches herself in order not to legitimize words composed of two letters. This point does not find a shared resolution within the group at the end of the activity.

Excerpt 5. Experiment 2 – Group A

7. Federica:	pasta is small but it has four letters.
	pasta è corto ma sono quattro lettere.
8. Filippo:	no, pasta has two letters.
	no, pasta è due lettere.
9. Federica:	but you've written two letters, and you can't write them, you need at least three
	ma hai scritto due lettere, e non si possono scrivere, devono essere almeno tre
[…]	
22. Federica:	but two words don't exist.
	ma due parole non esistono.
23. Sara:	and how much should it be?
	e di quanto deve essere?

24. Federica:	at least three, or four otherwise it's not a word.
	almeno di tre, o quattro oppure non è una scritta.
25. Filippo:	then only one word, what does it do, there are words with few letters, one or two.
	allora solo una parola che fa, esistono parole con poche lettere, una o due.

In our observations, the importance of establishing word length is a point of discussion at the outset. This element stems from the attention induced by the reading of children's written productions that the adult invites them to make. It is reading that brings out the problem of the 'correct length' of words. In this respect, the two groups have different perspectives: group A sees reading as a process of identifying words that need to be changed – sometimes too long, sometimes too short; group B sees reading as an opportunity to adopt a flexible and 'scalable' strategy to overcome the problem, for example letters that are too many.

The participation of a child in a two-group experiment of spontaneous writing confrontation

Our second level of analysis involves observing the same child in both groups. Before we focus on the participation of each child, it is important to underline the fact that at the end of the discussion all the participants decide to modify their own starting point and reduce the number of characters in accordance with Filippo's suggestion, who is obviously the only one not to modify his first production.

What happens when a child participates in two groups with differentiated skills? It is interesting to check whether the characteristics of the group, in relation to the discursive exchanges that emerge, produce a different participation of the child in the two situations. It is on this subject that we turn to Damiano's interventions in groups A and B.

In the first experiment of group A (writing the word 'folletto'/elf), an opposition arises from the fact that different writing criteria are used: Federica, Sara, and Damiano use a pre-syllabic criterion; Filippo, on the other hand, uses a syllabic criterion (cf. Figure 8.2) according to which as many letters must be written as the syllables of the word. Following the discussion, Damiano accepts Filippo's suggestion and modifies the word he wrote by deleting letters (see Figure 8.3).

Federica

Filippo

Damiano

Sara
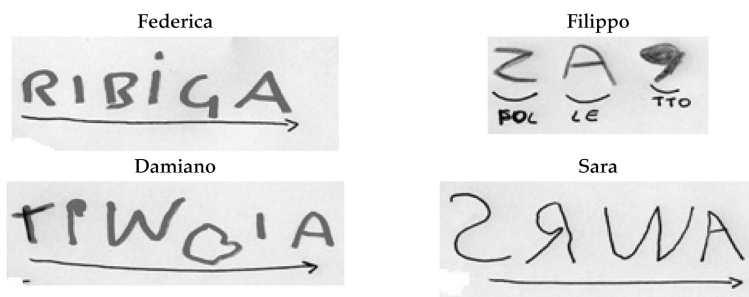
Figure 8.2. The first writings of the word 'folletto' (elf) by children of group A

Federica

Filippo

Damiano

Sara
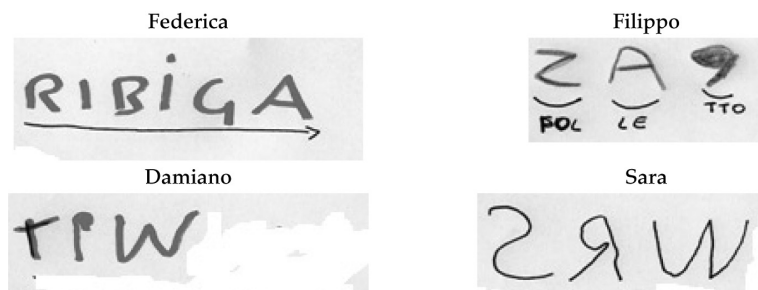
Figure 8.3. The final writings of the word 'folletto' (elf) by children of group A (Federica and Filippo chose not to modify their first production)

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AQ: Note that no opening double quote for the closing double quote has been provided in the phrase 'same question he asked himself". Please check and amend necessary.

Regarding the same request (writing the word 'folletto'/elf) within group B, it is interesting to observe Damiano's conduct. After having problematized Luca's reading in relation to the excess number of letters, he asks his classmate the same question he asked himself 'پشمپشمپشمپشمپشم'e the word eque ce, a e not to modify their first prdoctionpos. e propos de dpart and reduce the number of caracétait during the previous situation.

Excerpt 6. Experiment 1 – Group B

16. Luca: now can I read?

                    adesso posso leggere?

17. Teacher: yes, read.

	si, leggi.
18. Luca:	fo-lle-tto (elf).
	fo-lle-tto.
19. Damiano:	but if you stop here there are too many of them, you have to remove some of them.
	ma se ti fermi qua queste ti avanzano, sono troppe ne devi cancellare qualcuna.
20. Sara:	it's true there are too many of them
	è vero sono troppe
21. Luca:	teacher, so can I rewrite?
	maestra allora la posso riscrivere?
	[...]
35. Damiano:	but there are still a lot of letters, there are still too many of them.
	ma le lettere sono sempre tante avanzano uguale.
36. Luca:	it's not important now, okay, I won't change it.
	non mi importa adesso va bene io non la cambio.
37. Damiano:	but you see that if you read these they are extra and you have to delete them.
	ma vedi che se leggi queste ti avanzano e le devi cancellare.
38. Sara:	if it's okay with him, you leave it like this, everyone writes as they want.
	Se è ok per lui, lascia così, ognuno scrive come vuole.
39. Stefania:	yes, everyone writes as they wish.
	si ognuno scrive come vuole.
40. Luca:	I leave it that way because if I read my word quickly there are no letters too many.
	io lascio così perché se leggo veloce la mia scritta non avanzano le lettere.

In Experiment 2 in group A, Damiano again proposes his syllabic writing hypothesis, which was the end point of Experiment 1 in group B.

Excerpt 7. Experiment 2 – Group B

1. Teacher:	let's try to write the word pasta.	
	proviamo a scrivere la parola pasta.	
2. Filippo:	teacher it starts with P.	
	maestra inizia con la lettera P.	
3. Damiano:	those are two words, pa-sta.	
	sono due parole, pa-sta.	
	[…]	
14. Teacher:	Filippo he's right, you have to choose the most suitable one, you've all written different words.	
	Filippo ha ragione, bisogna decidere qual è la più convincente, avete scritto tutti parole diverse.	
15. Filippo:	but they don't listen to me that pasta is two letters.	
	ma non mi danno ascolto che pasta è di due lettere.	
16. Damiano:	me and Filippo wrote two and that's right.	
	io e Filippo abbiamo scritto due ed è giusto.	
	[…]	
33. Filippo:	there's a problem, someone wrote four words and three others, but in my opinion there are two.	
	c'è un problema, chi ha scritto quattro parole chi tre, ma per me sono due.	
34. Damiano:	for me there are two too.	
	per me pure sono due.	
35. Filippo:	and yes two words, teacher how many two words are there also when looking at Jesus, for example, there are two words.	
	e certo due parole, maestra quante due parole guarda per esempio pure Gesù sono due parole.	
36. Damiano:	it's true there are two words.	
	è vero sono due parole.	

In the second experiment, Damiano not only autonomously reuses a syllabic hypothesis to write the word 'pasta', but he also supports Filippo's position, verbalizing his agreement (turns 16, 34 and 36).

Directions and hints for teachers

From the point of view of the didactics of reading-writing, the most important general indication that we can take from our theoretical approach is the possibility of modifying the methodological framework in a global way through a double action: (a) the organization of the space; and (b) the activities proposed to children.

Regarding the organization of the space, it is essential to be able to benefit from the structuring of the classroom in such a way as to create places in which children can explore different *tools*. In this case, it is necessary to insert sheets of white paper, notebooks for taking notes, stickers, stamps, movable letters, a container with pens, a typewriter, a computer with writing software with a predefined size (at least 24) to facilitate the identification of differences and similarities between letters and words. Likewise, the children's spontaneous writings should be placed in an accessible space so that they can be used at any time and to allow for confrontation between peers. The presence of a lit blackboard can allow the sharing of spontaneous writing within the class, which is particularly stimulating.

In relation to *reading*, it is important to ensure that the teacher can guarantee not only the encounter of tales and fables, but also other textual genres, for example catalogues, advertising flyers, comic strips, magazines, encyclopedias, and cookbooks. It is desirable to have access to books in different languages to allow exploration of various writing codes. From the point of view of the activities to be proposed, starting from the experiences presented in this chapter, it is possible to set up activities for the production of texts of different genres, dictated and written by the teacher, as well as activities for the confrontation of spontaneous writings in small groups. In relation to classroom situations, our research experiments suggest indications and ways to set up pedagogical tools aimed at the confrontation of spontaneous writings in small groups.

The key elements that we feel must be considered can be summarized as follows.

Number of participants: the activity is to be carried out in small groups of a maximum of 5 children, because it is in a small group situation that peers can engage in a fluid and dynamic discussion, facilitating their active participation.

Group composition criteria: it is essential to have heterogeneity in levels of conceptualization, calibrated heterogeneity in a way that allows for joint elaboration. The level of conceptualization is identified by asking the children to write words of varying lengths 'as they know how to do' and to read their production 'while pointing out with a finger how they know how to read what they have written'. Pre-syllabic children (whose written productions do not relate to the length of the word) and syllabic children (whose productions have a letter of the alphabet or a pseudo-letter for each syllable of the word), as well as syllabic and syllabic-alphabetic children (whose productions have a letter of the alphabet to designate a syllable or phoneme of the word) can work together effectively. It is important not to include alphabetic children in such groups because they already know the rules of the writing system.

Aim of the activity: The aim of the exercise is not to write the word correctly, but rather to find a shared graphical solution to the writing request. We would like to remind that, at least in the Italian system until 2017, teaching the alphabetic code in preschool is not provided. Instead, there is an initial familiarization with written language. Therefore, the graphical solution becomes the outcome of negotiation within the group. It is precisely the recognition of this work of negotiation that allows the teacher to value the process and accept a non-conventional written production (which is a sign of a gradual approach to alphabetic writing).

What students learn from such an activity: children learn to construct a point of view on the rules of the alphabetical system, learn to argue this point of view in front of peers, and learn how to solve a problem.

Teacher's role: the adult's role is to support the group in finding shared solutions and to focus attention on the children's reading and writing.

Data to be documented: In addition to documenting the written word, which is valuable in informing us about students' conceptual transformation, it is important to document the discussions that are conducted during these activities. These discussions allow us to identify changes in the forms of participation of each student, as well as changes in the way the teacher manages the class and the activity.

In conclusion, we believe it would be interesting to conduct longitudinal research aimed at confirming the effectiveness of such a methodological approach. This kind of extension could provide insights into students' skills in successive textual productions, such as at the end of primary school.

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Chapter 9
Learning Together: Ways to Structure Classroom Interactions

Céline Buchs

This essay asks the questions: 'How can students learn to interact with others in order to learn' and 'How does the teacher organize the different forms of interaction, discussion, or collaboration in the classroom?' Among the pedagogical approaches that focus on social interactions among learners, sociocognitive processes, and the social conditions of teaching, cooperative learning (Gillies, Millis & Davidson, 2023; see Davidson, 2021, for an overview of main methods) offers avenues for learning to cooperate and cooperating to learn (Slavin, Sharan, Kagan, Hertz-Lazarowitz, Webb & Schmuk, 1985), as well as for structuring group work (Topping, Buchs, Duran & Van Keer, 2017).

The 'Learning Together' method (Johnson, Johnson & Holubec, 2008) represents a well-documented teaching-learning system with clearly identified theoretical bases (Johnson & Johnson, 2015; Slavin, 2014) and practical resources (for example Johnson & Johnson, 1996). This method has the advantage of offering general principles for structuring group work, allowing the teacher to make them their own and adapt them to their specific context. These principles thus offer flexible avenues for reflection, adaptable to different ages and school tasks, without the need for specific teaching materials. Their aim is to stimulate constructive interactions between students in order to improve the quality of learning. We propose to map them out in two stages (Figure 9.1): principles to prepare learners for cooperation, and principles to organize group work in order to promote the quality of social relations

and learning. In the rest of the chapter, we will present each of these principles and synthesize some of our research findings.

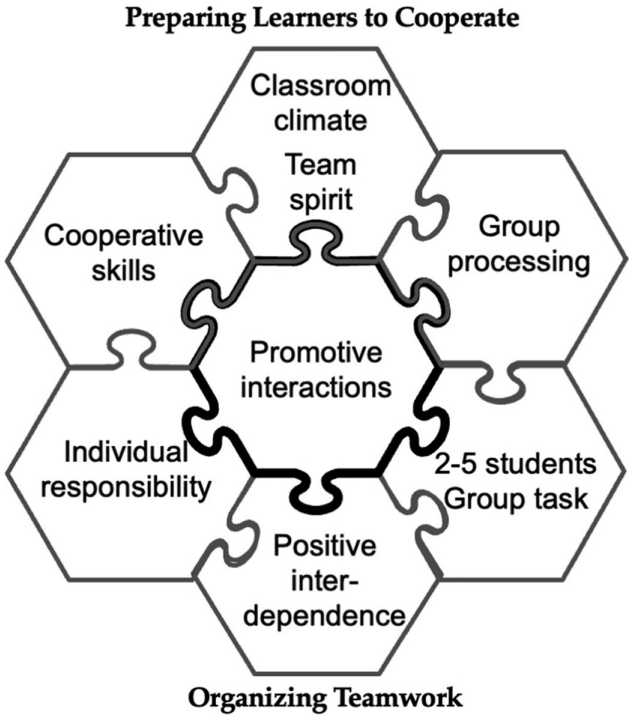**Preparing Learners to Cooperate**

Organizing Teamwork

Figure 9.1. Diagram of the two steps inspired by the 'Learning Together' method

Constructive interactions to be stimulated

The strength of peer learning approaches is to enable students to engage actively through social interactions that enhance the quality of learning. Research has highlighted the constructive role of peer interactions, such as providing social support, encouraging learners, and facilitating each other's efforts to accomplish tasks. This includes exchanging information, discussions, providing explanations, co-constructing knowledge, and engaging in sociocognitive conflicts (Gillies, 2015, 2023; Johnson &

Johnson, 1989; Perret-Clermont & Nicolet, 2001; Slavin, 2014; Webb & Palincsar, 1996; Webb, Ing, Burnheimer, Johnson, Franke & Zimmerman, 2021). Information exchange and co-construction are correlated with learning (arguing, Muller Mirza & Perret-Clermont, 2009; Muller Mirza & Buty, 2015; summarizing information, Annis, 1983; providing explanations, Webb, 1985; repeating studied information and adding new information, Johnson, Johnson, Roy & Zaidman, 1985). This work emphasizes the importance of active learner participation and verbalization of reasoning in cognitive progress.

As regards socio-cognitive conflicts (Doise & Mugny, 1997; Butera, Sommet & Darnon, 2019), their links with learning depend on the way they are regulated (Figure 9.2, Quiamzade, Mugny, Falomir-Pichastor & Chatard, 2006; Buchs, Butera, Mugny, & Darnon, 2004). Conflicts between learners are positive when they focus on understanding content and points of view. This epistemic regulation stimulates the integration of different points of view and promotes learning. On the other hand, when learners are centered on a social comparison that questions their respective competence and becomes a threat to their own competence, the relational regulation that takes place reduces the benefits of confrontations of points of view. This regulation may lead one learner to take over what the other says in order to end the conflict (a compliance in the form of an imitation without critical examination), or on the contrary to compete with each other in an attempt to protect or demonstrate competence. Thus, while interactions between learners can encourage confrontation of points of view, their effects on learning depend on the type of regulation.
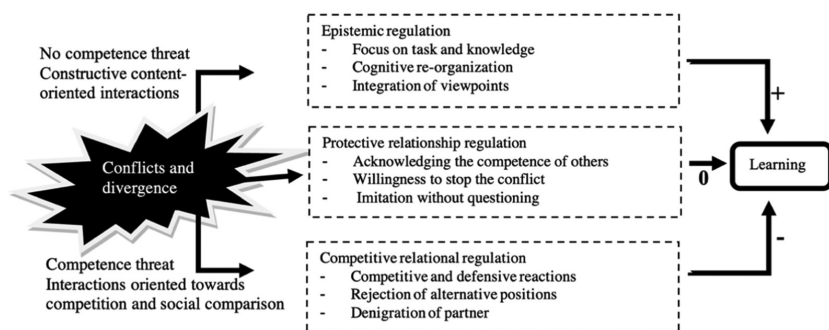

Figure 9.2. Schematization of confrontation regulations as mediators of the effects of social interactions on learning

The teacher's role in a cooperative learning approach is to structure teaching-learning situations in such a way as to stimulate these constructive interactions, to prepare learners to cooperate, and to organize group work.

Ways to prepare learners to cooperate

Fostering a positive classroom climate and team spirit

The first step is to establish a learning and mastery-oriented climate (Meece, Anderman & Anderman, 2006) by orienting learners towards mastery goals (increase skills, progress in learning) rather than performance goals (showcase skills, perform well, outperform others; Darnon, Dompnier & Poortvliet, 2012). Six particularly important elements are summarized in the acronym TARGET (Maehr & Midgley, 1991): Task, Authority, Recognition, Grouping, Evaluation, and Time. Clearly structuring tasks, involving students in certain decisions, valuing their efforts, allocating time for learning, grouping students to promote mutual assistance, observing and providing formative feedback, and using mistakes to enable progress, all contribute to creating a classroom climate focused on learning (Sarrazin, Tessier & Trouilloud, 2006). Thus, it is important to emphasize the quality of learning and social relationships in the classroom, paying attention not only to the classroom climate but also to the quality of relationships within teams. This can be achieved through specific activities (Abrami, Chambers, Poulsen, De Simone, d'Apollonia, & Howden, 1995). Margarida César's suggestions (in this volume) are particularly interesting for creating a conducive climate.

Developing cooperative skills for learning

Several authors note that students are not accustomed to cooperation and that preparation for cooperation is beneficial (Blatchford, Kutnick, Baines & Galton, 2003; Howden & Kopiec, 1999; Johnson & Johnson, 2006; Webb, 2009). Some research (Gillies, 2007) has shown that training in interpersonal skills that facilitate communication (e.g., active listening, constructive criticism of ideas) and collaborative skills for working in small groups (e.g., waiting one's turn to present ideas, ensuring that decisions about the group are made democratically) is beneficial for the

quality of interactions and learning. Other research has shown the positive effects on school learning of a more targeted training on questioning (King, 2007), requests for and provision of aid (Webb & Farivar, 1994), and explanations (Fuchs, Fuchs, Kazdan & Allen, 1999).

Building on the 'Learning Together' method, we propose considering the activity and the specific task that learners must accomplish in a group, as well as the teacher's observations during previous sessions, to identify whether a skill could help the learners work together more effectively. If this is the case, it's valuable to introduce this skill by explaining how it can manifest through actions and words during a collective discussion in which the learners are encouraged to actively participate. This explanation can lead to the creation of a cooperative chart outlining how the skill can be concretely demonstrated. Depending on the phrasing chosen, this chart can depict what students can do and say (as shown in Example Table 9.2) or what the teacher can observe and hear when learners demonstrate this skill. Once this reference tool has been constructed, students work in teams on the school task, making sure to practice the skill they have worked on. It is then possible for the teacher or one of the group members to observe how the skill is practiced qualitatively (how the learners did it) or quantitatively (frequency of behaviors and/or words). This observation can be used to reflect on the implementation of the skill.

We studied the importance of working on cooperative skills in two classroom interventions led by an external practitioner, whose objective was to test the effects of short work (over a single session). In these studies, we have been careful to introduce a climate conducive to learning by valuing cooperation for learning: we have explained that cooperation and mutual support are conducive to one's own learning. Once the activity and group task were defined, we determined, in consultation with the regular teachers, the skills that would meet the needs of each class to help learners work well together in this task.

The first intervention took place over three forty-five-minute periods in grade 6 (11–12-year-old) students working on the argumentative text in the context of a French activity (Golub & Buchs, 2014). We have structured the work into cooperative dyads based on two texts presenting arguments either 'for' or 'against' dogs as pets using a cooperative controversy (Johnson & Johnson, 2007) that takes place in five phases (see Table 9.1). The students had to prepare one of the positions on the

basis of reading the assigned text, then each student in the dyad presented their position and listened to the other's position, asking for clarification if needed to ensure understanding. The students then critically discussed the two positions, justifying their point of view while trying to find flaws in the opposing position. Students had to change their positions and defend the opposite position on the basis of what the student's partner said. Before the last phase, the speaker presented the function of connectors in the argumentative text by giving examples. The students decided in their pairs how to use arguments and connectors to propose a common position. Finally, students answered questions about the texts, measuring their understanding of the text.

Table 9.1. Summary of sentences of the controversy in relation to the disciplinary objectives and the specific work on cooperative skills and rules introduced to half of the students

Stages of the controversy	Cooperative skills and rules introduced to half of the students	Disciplinary objectives
	How to express support (10 min)	
Explanation of the five steps (15 min)		
Importance of expressing support and introduction of the 3 cooperative rules[1] (5 min)		
	Explanation and discussion of the three relevant rules for the different phases (10 min)	

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1 'I listen to my classmate's ideas, and I make sure I understand them well even if I don't agree with them'; 'I criticize ideas and not people'; 'The objective is to build the best proposal together and not that everyone tries to be right'.

Stages of the controversy	Cooperative skills and rules introduced to half of the students		Disciplinary objectives
1. Individual reading of the assigned text (7 min)			Summarizing arguments given in a text
2. Each partner presents arguments concerning the assigned text (2 X 4 min)	I listen to my classmate's ideas and make sure I understand them even if I disagree (reminder)	Expressing support	Presenting a summary of the arguments given in a text
3. Critical discussion of the two positions, each one defends his or her position and looks for the weaknesses of the other position (8 min)	I criticize ideas, not people (reminder)		Expressing Disagreement Researching and writing arguments against given arguments Considering the position of the other
4. Partners change positions and defend the opposite position (2 X 4 min)	I listen to my classmate's ideas and make sure I understand them even if I disagree (reminder)		Presenting a summary of the arguments given in a text

For all students, the three rules for constructive controversy were introduced. For half of the students, this introduction was reinforced by a twenty-minute preparation for cooperation. Ten minutes were spent working on the cooperative skill targeted by the teachers: students reflected individually, discussed in pairs and then collectively on how they could express their support. Ten more minutes were needed to explain the three rules. The students were encouraged to play an active role in determining what they could say and do to 'listen to their class-mate's ideas and make sure they understood them well even in case of disagreement', provide examples and counterexamples to 'critique ideas

and not individuals', and rephrase the rule 'construct the best proposition together without trying to be right'. We recorded the interactions among students, and two judges coded these videos to test the effects of this preparation for cooperation during the debate.

The results show that students who benefited from this short preparation for cooperation showed more support, asked more questions, and paid more attention to their partner; overall, they cooperated better than students who did not benefit from this preparation. Students who received this preparation also tended to respond better to questions about the text (Golub & Buchs, 2014). In summary, a brief preparation for cooperation led to more constructive interactions.

We also wanted to test the effect of specific work on cooperative skills in the context of university education in a working session (one and a half hour) in a statistics course (Buchs, Gilles, Antonietti & Butera, 2016). Students completed two training exercises in one of three modalities: individual work, co-operative dyads, or co-operative dyads with awareness of co-operative skills. The instructions asked the students to explain how they solved the exercises. In the condition of co-operative dyads with awareness of co-operative skills, we also highlighted the benefits of co-operation for learning and added a presentation of about ten minutes on how one can go about explaining how to solve problems. Concrete examples were provided for students to explain their way of doing things, make sure that they understand the partner's way of doing things and suggest alternative ways of doing things (see Table 9.2).

Table 9.2. Example of a proposed co-operative chart to work on co-operative skills in a statistics seminar

I explain my process	
• I engage in the discussion • I'm trying to be as clear as I can…	• I explain the different stages ('I start with…, then I…'). • I explain the reasons ('I'm doing this because…') • I explain my strategy • I explain the concrete way to go about it

I make sure I understand my partner's process.	
• I encourage my partner to develop his ideas • I let my partner explain his idea without cutting him off… • I listen to my partner's proposals, even if I don't agree…	• I express my understanding ('okay, I understand') • I express my difficulties ('I don't understand, can you please explain again?') • I rephrase what the partner says to make sure I understand • I ask questions to invite her to clarify • I wonder about the potential problems
I suggest other ways	
• I engage in the discussion	• I suggest alternatives ('and if we start with', 'I'd rather…'). • I propose different strategies

Following these exercises, the students gave their impressions and worked individually on an exercise to measure learning. The results indicate that the students performed the least well on individual work and the best on work in co-operative dyads with co-operative skills awareness, with co-operative pairs without co-operative skills awareness falling in between. In the dyads, students who were sensitized to cooperative skills reported better relationships, greater cooperation, increased investment in the work, and lower concern about social comparison of skills. This study demonstrates that a short-term focus on relevant cooperative skills is feasible and beneficial in a university teaching context.

GROUP PROCESSING TO MAKE LEARNERS REFLECT ON THEIR LEARNING AND THE FUNCTIONING OF TEAMS

One way to continually improve the effectiveness of teamwork is to get students to reflect on how they have worked. This group processing provides an opportunity to discuss what learners have done positively to meet the objectives and what they would like to improve (Gillies, 2007). It can be a spontaneous comment on how teamwork works, an open discussion based on a series of questions (related to a cooperative skill or role), or a (self-)evaluation form to be completed. The teacher can contribute to this reflection by making comments based on observations made during the work. However, this critical reflection carried

out following team activities is all the more beneficial for learning when learners play an active role (Bertucci, Johnson, Johnson & Conte, 2012; Johnson, Johnson, Stanne & Garibaldi, 1990).

Ways to organize group work

A group task in small teams

Cooperative learning involves having learners work in groups on a common task without direct teacher supervision. It seems important to us to propose a task that is really a group task, i.e., a task that cannot be carried out individually. A group task involves utilizing information, knowledge, problem-solving strategies, materials, or skills that none of the team members possesses fully (Cohen, 1994a). The contribution of each member then becomes necessary to achieve the team's objective and stimulates interaction.

In our view, teams should have between two and five learners to encourage individualized face-to-face interactions among members. While many books suggest making heterogeneous groups (e.g., low, medium, and high achievers), research findings suggest that this composition does not always generate benefits for all learners (Webb & Palincsar, 1996). It would be more efficient to compose teams according to several criteria without being limited to a single competency (Lou, Abrami, Spence, Poulsen, Chambers & d'Apollonia, 1996). Varying the compositions (based on student choice, teacher choice, chance) and observing the interactions that take place could be an interesting avenue for reflection.

Two complementary principles are central to organizing group work: positive interdependence and individual responsibility (Johnson & Johnson, 2005; Sharan, 2010). Research suggests that the way in which these two principles are structured promotes constructive interactions between learners.

Strengthening individual accountability

To prevent the work from being carried out solely by a few learners (with some relying on others or some taking over the work without allowing others to contribute), it's important that each learner feels responsible for their share of the work. Individual responsibility within the team

entails making efforts to achieve the common goal and feeling accountable for facilitating the efforts of team members. The teacher ensures that the contribution of all members is both possible and necessary for achieving the objectives (for instance, ensuring that everyone can perform their assigned tasks, forming small groups, randomly selecting a member to explain the group's stance, observing everyone's contributions, assigning unique tasks or specific roles to each individual). Making each learner's progress visible allows for more effective mutual support among learners.

Structuring positive interdependence

Social interdependence represents a situation where individuals share a common goal, and each person's outcome is influenced by the actions of others. Interdependence is considered positive when learners perceive themselves as being positively linked to their teammates, and each partner's efforts contribute to the success of all members. Positive interdependence related to goals or objectives leads students to recognize their common goal or objective and how their efforts complement each other. They understand that achieving their goal/objective relies on the success of their team members as well. This positive interdependence tied to goals/objectives is crucial and, in our opinion, should be formulated in terms of learning for all students connected to educational objectives (rather than just in terms of a collective product). Adding positive interdependence linked to rewards can be useful when students need motivation to cooperate (Cohen, 1994b; Slavin, 1990). This interdependence is based on the fact that the rewards obtained by team members depend on the team's achievements. All members receive the same evaluation or reward ('either all members are rewarded, or no one is rewarded', Stevahn, Bennett & Rolheiser, 1995, p. 58). For example, a single score or bonus points are awarded to all members if predefined criteria set for the team are met. It's important to us that this interdependence is grounded in the individual learning and/or progress of each member. Structuring positive interdependence through teamwork strategies (like distributing complementary resources, Lambiotte *et al.*, 1987, or specifying distinct roles, Schellens, Van Keer, De Wever & Valcke, 2007) enhances individual responsibility and is beneficial for cooperation and learning.

In our work, we have further explored the issue of resource interdependence through the distribution of information when working on

texts. In all situations, we structured the positive interdependence by emphasizing that the aim was to work cooperatively and to ensure the partner's learning. Students worked on content that was important to master for the final exam. To reinforce individual responsibility, we suggested that students work in dyads with roles (O'Donnell, 1999). Under the condition of positive resource interdependence, the students worked on complementary information: each learner read only one text for which they were responsible and read the other text through his or her partner. We compared this to a system without resource interdependence in which the learners worked on identical information: both partners read one of the texts silently and one of the learners played the role of leader, summarizing the information to his or her partner in an active listening role. The roles were reversed for the second text.

We studied the dynamics generated by the distribution of information on social interactions and learning at the university when working on social psychology texts (see Buchs, 2020 and Table 9.3). A first study (Buchs, Butera & Mugny, 2004, study 1) has shown that working on complementary information enhances student cooperation and investment (time spent discussing texts, number of questions and answers provided), but does not necessarily facilitate learning. Indeed, with complex texts, the listeners in this condition achieved the lowest performance. Several factors highlight that the quality of the informational input is an important element in this condition. It's possible that the difficulty of the provided texts didn't allow the participants to accurately reproduce the information. That's why, in a second study, more accessible texts were used (Buchs *et al.*, 2004, Study 2). The results emphasize that with these texts, listeners working with complementary information were not disadvantaged; quite the opposite, and as the findings of Lambiotte *et al.* (1987) demonstrated, students learned better following engagement with complementary information than with identical information. At the same time, working on identical information strengthens the confrontation of points of view and the social comparison of skills, leading to competitive relational confrontations (Buchs *et al.*, 2004). The results indicate that these competitive confrontations helped to explain the poorer delayed learning when students worked with identical information (Buchs *et al.*, 2004). In other words, competitive confrontations were responsible for the negative effects on delayed work performance on identical information (Figure 9.3).
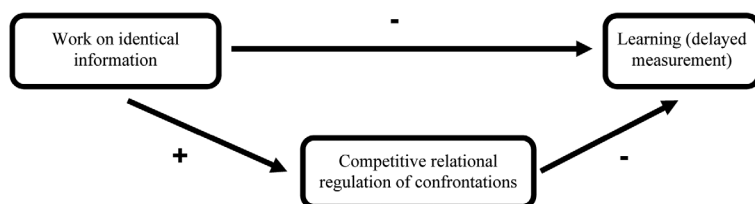
Figure 9.3. Competitive relational regulations of confrontations as mediators of the negative effects of work on identical information

Furthermore, the results indicate that the correlation between the perceived competence of the partner and student learning was only positive when working with complementary information. Conversely, this link turned negative when working with identical information. We also found this interaction between partner competence and student learning at the elementary school level (Buchs, Dumesnil, Chanal & Butera, 2021). These studies reveal that the more competent the partner is perceived to be or demonstrates competence (Buchs & Butera, 2009), the less learners benefit from their discussion. This underscores that partner competence is detrimental to student learning when working with identical information that encourages social comparison.

Table 9.3. Summary of the dynamics of resource interdependence

	Identical information	**Complementary information**
Responsibility	Average	High
Effort	Average	High
Interaction type	Exchanges, confrontations	Summary, questions, explanations
Social comparison	High (competitive relational conflict regulation)	Low
Competence of the partner	Threatening and harmful	Welcome and positive

	Threatening social comparison regarding skills disrupts learning	Constructive interactions are positive for learning only when the information input is of good quality

These results highlight a first pitfall in the implementation of cooperative learning, namely the ease with which students switch to a competitive mode despite instructions that encourage cooperation. Indeed, the simple fact of reading the same texts gives students the opportunity to compare themselves and they use this opportunity to question their respective skills, which distracts them from in-depth work on texts. When working with identical information, the relationship between students is oriented towards the social comparison of competences, which stimulates competitively regulated confrontations and actively threatens their own competences. This threatening social comparison is responsible for the negative effects of working on identical information on learning and helps to understand why the partner's competence becomes problematic when students work on identical information. In our opinion, these results reflect the difficulty of proposing a cooperative work approach in a competitive educational context without offering preparation for cooperation. In the continuation of our work, we have introduced elements aimed at mitigating the threat of competences in order to improve learning when working on identical information. The inability to take notes and have access to support during exchanges (Buchs, Pulfrey, Gabarrot & Butera, 2010) and a positive interdependence of rewards (Buchs, Gilles, Dutrévis & Butera, 2011) enhance learning when working with identical information.

Furthermore, our results highlight that cooperation and students' investment do not automatically lead to good learning outcomes. When students rely on complementary information, the quality of the partner's informational input moderates the positive effects of resource interdependence. While working with complementary information fosters positive social interactions, enhances cooperation, and promotes students' investment, it doesn't necessarily facilitate learning on its own. High-quality informational input from the partner is essential. Factors contributing to improving the quality of information transmission

between partners enhance learning in this situation. In our studies, accessible texts (Buchs *et al.*, 2004), a competent partner (Buchs & Butera, 2009), as well as the possibility to enhance the quality of the presentation (Buchs *et al.*, 2010), have proven to be positive elements to consider.

It emerged from this research that when working on complementary information, particular attention should be paid to the quality of the partners' informational input so that positive interactions between students promote good learning. However, when working with identical information, special attention should be given to minimizing social comparison of skills among learners. Preparing learners for cooperation by addressing the classroom climate, cooperative skills, and reflecting on team dynamics provides an interesting intervention approach, as we highlighted in the first part of this chapter.

In summary, this brief overview of structuring cooperative learning strategies provides some insights into how the teacher can enhance students' active role in knowledge construction while also illustrating the complexity of teaching-learning situations in the classroom.

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Chapter 10
Creating a New Object in Classroom: A Pedagogical Design for Innovation and Observation[1]

Anne-Nelly Perret-Clermont and Marcelo Giglio

In order to learn: It is better for students to imitate and reproduce models? Or to be creative and face the difficulties of producing their own new objects?

The widespread dissemination of a certain interpretation of the work of Vygotsky, Bruner, and the researchers who have drawn inspiration from these authors, has turned into a commonplace vision, a social representation of teacher-student interaction that is neither faithful to its inspiration nor to reality[2]. We will begin by sketching this commonplace vision in order to take a critical stance towards it, and draw new horizons for the study of teaching and learning processes, and for the development of professional skills. We will then present our efforts to offer teacher-trainers (and even teachers themselves) a methodology that allows them to do two things at a time: (1) to position themselves as the

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1   This research was carried out within the Knowledge Practices Laboratory (KP-Lab) project of the 6th European Framework Program (www.kp-lab.org). We are grateful for this support.
2   We want to clearly warn the reader that we are talking here about the social representation (a caricature) that we encounter much too often and not about the theoretical model itself, which is infinitely richer and more fertile.

main actors on a stage where they are creative in designing opportunities for their students to engage in creative activities, and (2) to conduct critical observations of what is happening then in order to adjust their actions progressively and, reflecting on them, to broaden their understanding of the processes at play.

In this methodology, teacher-trainers, teachers, students, and researchers accompany each other in their self-critical and reflexive attempts to carry out their activities. The successful creation of an *object* is at the center of these activities. In the example studied, this *object* is different for each category of actors even if they are involved in joint actions. For the students, it is a matter of composing a small piece of music to be performed in front of the classroom. For the teacher, it is a matter of making these creations possible for the students and improving their quality by offering them adequate contextualized knowledge just-on-time. For teacher-trainers, it is a matter of being able to adjust the information and support to be given to trainees on the basis of the precise observations of their needs, difficulties, and strategies, but also of their students' behaviors. For researchers, it is an opportunity to provide conceptual resources and methodological support to enrich these observations, and to have as the object of study not 'third-person' subjects ('they do', 'they say', 'they think', etc.) but partners who express themselves in 'first person' ('I wish', 'I predict', 'I react', 'I hypothesize', etc.). All partners are able to observe, *in situ* and over time, complex socio-cognitive dynamics and their outcomes.

The center of attention is then the 'pedagogical triangle' (Chapman, 1991; Engeström, 1987; Houssaye, 2000; Schubauer-Leoni, Perret-Clermont & Grossen, 1992; Zittoun, Gillespie, Cornish & Psaltis, 2007) as it develops in time with its ups and downs, its moments of common understandings but also misunderstandings.

Overcoming a pseudo-Vygotskian reductive theory

In the social representation of the teaching/learning activity that circulates and concerns us, learning is often seen as an end in itself, detached from the overall context of activities that enable it, and without any connection to the *creation* of knowledge. Learning appears to serve the sole purpose of acquiring knowledge and skills defined in a more or less

abstract manner. Additionally, the relationship between the teacher or the student and the object of learning is scarcely considered, with the focus instead being fixed on knowledge, to the extent that sometimes the object and knowledge are conflated. Teaching is reduced to the sharing of knowledge possessed by the expert. It is assumed as self-evident that any 'normal' student will readily engage in the activity proposed by the teacher, respond to his or her desire for transmission, and commit not only to completing the assigned task but also to assimilating the knowledge that the execution of the task is supposed to generate. This representation envisions the expert as a sort of image of the state the student should reach, and it imagines the student identifying sufficiently with the teacher to want to appropriate the teacher's knowledge through joint activity. There is no discussion of any intrinsic interest in the object from either the teacher's or the student's perspective.

As far as the teacher is concerned, this pseudo-Vygotskian representation presumes that, as bearers of knowledge, they would almost naturally know how to adjust their discourse and actions to those of the student in order to support both their participation in the activity and their learning efforts. The teacher would enter (instinctively?) the novice's zone of proximal development, naturally reinforcing the learner's actions and discourse to ensure success, which in turn would give meaning to the activity. In doing so, the expert would also provide semiotic resources to the novice who, gradually, would become capable of accomplishing independently what they could only participate in until now. The novice would start developing their own discourse and reflection – yet it is not clear how the teacher's discourse and knowledge could become the student's own reality when the latter is confined to the role of an imitator.

Rediscovering the pleasure of creating objects

In order to contribute to overcoming this very reductive social representation of the teaching/learning situation, we will present here an approach (both pedagogical and scientific research) which seeks to restore, within a Vygotskian approach, a place for the object and the student's interest in the object. This approach also aims to provide trainee teachers with a methodology enabling them to observe, for professional

purposes, the complexity of the teaching/learning situation. We will borrow from Claparède (1931) and Piaget (1947) the hypothesis that the child's own activity and, in particular, their interest, plays a fundamental role in learning. We are thus following a long tradition, taken up in particular by the philosopher Henri Bergson, the biologist Jean Piaget, and the pedagogues of the *École active*, in considering that creativity characterizes the living: a living thought is a creative thought that appropriates knowledge to respond to problems that it poses in its relationship to the world, including the world of objects and people (and not only the abstract world of ideas and knowledge). This appropriation necessarily involves a form of 'translation', extracting knowledge from its initial context (the context of its genesis) to 'translate' it, i.e. to move it into the context that presently intrigues the thinker. This displacement requires some adjustments. It is a process of reappropriation, of transforming a tool into an instrument (Rabardel, 1995), which is marked by the motives and interests of the person concerned and by the demands of the context *hic et nunc*. It necessarily requires creativity. It is important to highlight the role of creativity in learning. As well-described by Piaget, creativity involves both accommodation and assimilation: (1) accommodating the object (whether material or conceptual) while experiencing the pleasure of doing, acting, mastering, and anticipating; and (2) transforming mental schemes and structures to adapt them to the actual reality of the objects (material or conceptual) in order to assimilate them, i.e. to understand them. These schemes and structures encompass pertain to perception and memory, as well as the capacity to represent them, or even to imagine that they could be different that what they are. The working of the mind, which is inherently creative and can offer playful pleasure but also the basic pleasure of feeling alive, of experiencing one's strengths and potentialities, of imagining oneself in an elsewhere, of projecting oneself in an imagined world, of discovering the object so to say 'face to face' because the object is always simultaneously an externalization of a part of oneself and an entity with an autonomy of its own: every human being, from a very early age on, can discover it, he or she is given the opportunity to be active and to create objects. This pleasure can resonate with the pleasure of companions engaged in a joint actions, provided that adults and peers, thanks to an adequate framework, respect each one's space and the possibility of initiative.

An issue for schools

In the prevalent social representation of teaching and learning, once the expert has shared the knowledge, the expert has the power to validate this learning and acknowledge the student as a new expert on the learned topic, provided that the student demonstrates its mastery as expected by the expert. The knowledge initially possessed by the teacher is then considered to be internalized by the student. However, this social representation does not explicitly account for the creativity of the student, which could enrich that of the expert, nor for the co-construction of new objects (material or conceptual) that could emerge from the teacher-student interaction. Such a social representation is quite conservative from a socio-cognitive standpoint: it tries to explain how experts' knowledge is transmitted (reproduced) but it does not shed light on how new knowledge emerges in a society. It does not invite exploration of how new solutions can arise from interactions not only among experts but also between experts and novices or among novices. Yet, the present challenges of our time increasingly demand that schools foster innovation. Schools are expected to support the development of the capacity in children to solve new problems, to jointly create solutions in complex situations, to manage distributed actions and knowledge within a team, to anticipate joint actions and adjust to them, to recall co-constructed solutions, to imagine finding solutions to unforeseen problems. It is crucial for schools to draw upon a psychology of learning that addresses these skills and inspires properly designed pedagogical activities that facilitate and nurture their development.

Others have revisited this pseudo-Vygotskian social representation (e.g., Fernandez, Wegerif, Mercer & Rojas-Drummond, 2001), notably by building upon Bruner's original work (Wood, Bruner & Ross, 1976; Bruner, 1983), but forgetting that it dealt with the relationship between mothers and their very young children or the relationship between educators (especially teachers) and young children (for example: Wertsch, 1988; Rogoff, 1990). Generalizing beyond these age groups makes the researchers blind regarding other types of relationships. It overemphasizes a 'material' attitude. The properties of the specific relationship between a mother and a young child are not identical to those of the different types of institutional relationships, for example, that between a teacher and a student (or rather between a teacher and a large group of

students in a classroom). Not all learning arises solely from a 'material' type of relationship (even though the power of these initial interactions is undeniably fascinating). Furthermore, the prevailing social representation tends to idealize this 'mothering' relationship and this creates other distortions.

The social representation overlooks the fact that Vygotsky (1925/1971, 1930/2004, 1931/1994) studied creativity in his work; and that Bruner and his successors (e.g., Barth, 2004) consider active learner discovery to be essential. Various lines of research (Bruner, 1996; Edwards & Mercer, 1987; Mehan, 1979) draw attention to the fundamental role of the teacher not only in the transmission of knowledge but also in the implementation of different formats of interaction in the classroom with communicative styles adapted to the different tasks and goals (César & Kumpulainen, 2009; Mercer, 1995; Mercer, Wegerif & Dawes, 1999; Schwarz, 2009). These goals should not be confused with (or reduced to) issues, important at a given point in development, of imitating a parental figure.

A TEACHER TRANSMITS KNOWLEDGE BUT ALSO A MODE OF INTERACTION WITH THE KNOWLEDGE AND A STANCE TOWARDS IT

In the laboratory, the experimental studies of dyadic interactions between experts and novices (Tartas, Baucal & Perret-Clermont, 2010; Tartas & Perret-Clermont, 2008) have shown that what is learned is not only knowledge, but also a format of interaction, a mode of interaction: and that transferring these learnings into new relationships is not straightforward, especially if the novice believes that they involve language norms or rules of action that they must primarily conform to, even if that is not what the experimenter expects from the children.

Piaget had already drawn attention to the essential role of the learner, who can only answer a question (and therefore, learn) when they genuinely ask it themselves. A 'conflict' needs to arise from a contradiction between their expectations and what they perceive from reality: this gives rise to a 'cognitive conflict' that they must resolve to avoid staying in a state of imbalance (Inhelder, Sinclair & Bovet, 1974; Piaget, 1947). It was later demonstrated that this cognitive conflict is frequently,

in reality, a 'socio-cognitive' conflict, as it arises not solely from an internal reflection on reality but rather from a clash of perspectives between individuals (Perret-Clermont, 2022). Research on socio-cognitive conflict has highlighted that for learning to occur, it is not always imperative to have an expert involved. Novices engaging with each other can also, under certain fairly specific conditions, learn through the process of generating new knowledge (Ames & Murray, 1982; Doise & Mugny, 1981; Howe, 2010; Littleton & Howe, 2010; Littleton & Light 1999; Perret-Clermont, 1980; Schwarz, Perret-Clermont, Trognon & Marro Clément, 2008). These results can be read as shedding new light on the interpersonal relationships that enable learning: it is not necessarily asymmetrical and transmissive. These results show that novices interacting with each other are sometimes likely to produce new knowledge that none of them possessed before. They also draw attention to the conditions that allow not only the transmission of knowledge already mastered by one of the partners in the interaction but also the creation of new knowledge for each other. And this is important for those who want to understand the fruits of thinking and not limit themselves to the mere description of the reproduction of knowledge already held. Creating a new object (material or conceptual) requires doing something new with old. How is this done? How can a teacher support this process? This is not well known. Conversations have rules and the cognitive processes involved in these conversations are dialogical. It can be interesting to observe them closely and this is one of the goals of the methodology that will be presented below.

WHAT IS THE OBJECT OF THE JOINT ACTIVITY?

There is often ambiguity regarding the goal behind a precise educational activity: is it goal to execute the task to the best of one's ability, to find a solution, to create something, or to produce a highly anticipated outcome (often assessed in schools through grades)? Or is the priority to learn (i.e., to develop a conscious and sometimes abstract piece of knowledge), with the task merely serving as a pretext for learning and not an end in itself? Frequently, the school curriculum or even the teacher focuses on learning, while the student believes that successful completion of the task is the goal (especially if it is graded). However,

from a scientific perspective, we often know little about the relationship between successful completion of the task of the curriculum and learning: one does not necessarily lead to the other.

Studies grounded in activity theory (e.g., Burnard & Younker, 2008; Engeström, 1987; Engeström, Riettiner & Punamäki, 1999; Hakkarainen *et al.*, 2006; Ludvigsen, Lund, Rasmussen & Säljö, 2011; Muller Mirza, 2005; Muller Mirza & Perret-Clermont, 2008a) prompt us to reevaluate our understanding of teaching/learning by consistently questioning the purpose of the activity in which educators and students are involved. While the official objective typically revolves around knowledge transmission, it is essential to consider whether this objective is genuinely realized in practice. Observation (Perret, 1985; Perret & Perret-Clermont, 2004) shows that this is an ambition that often remains formulated in an approximate and abstract way, usually followed by a careful operationalization but without scientific verification that the desired objective is achieved. From the students' point of view, it is often mainly a question of completing the tasks prescribed by the teacher as quickly as possible, in accordance with a set of institutional requirements. And how does the teacher deal, consciously or unconsciously, with the dual challenge of completing the task successfully and learning? How does the institutional division of roles between the teacher and students unfold, along with the role of tools and objects, and the reciprocal adaptation of often implicit goals of each participant?

In the wake of these questions, one might also ask under what conditions the professional knowledge of the teacher can be transmitted. For example, if a teacher manages to teach students satisfactorily, will the teacher be able to pass on know-how to fellow teachers or young trainees? What problems will this transfer encounter? What makes it easier? Very often 'teaching methods' have been presented as if they had a life of their own. But in fact, they exist only through their contextualizations and are dependent on the interpretation of those who use them according to the institutional insertion of their activity, the evolution of the classroom, their goals, and the many other, often-implicit, realities that underlie the situation. As a result, each use of a 'pedagogical method' is each time a 'new edition', different, and sometimes not very comparable, to the previous ones (Bonvin, 2008; Cardinet & Weiss, 1976; Muller Mirza & Perret-Clermont, 2008b; Sandoval, 2002). The use of a method necessarily confronts the teacher with a kind of paradox: it provides a framework and resources to guide action, but at the same time, the

teacher must remain creative to adapt the instrument to the conditions on the ground. What are the conditions for the teacher's independence and agentivity in the face of what a method seems to prescribe? How can a trainer inform, 'train' and support innovation at the same time? The learner-teacher, much like the student, requires a framework that is both secure and open, enabling the creation as well as the assimilation of knowledge held by others. This knowledge should not remain abstract but should seamlessly integrate into *just in time* into their actions in the classroom.

If the role of the teacher is not only to transmit and if peers are likely to have a role in the cognitive progress of the learner, then how can the understanding of the different modalities of teacher action be advanced and how can they be trained to do so? We will be addressing these questions because of our scientific interest in capturing the aforementioned processes in real-time, and because, additionally, we are driven by our professional interests as higher education teachers. Besides, one of us (Marcelo Giglio), after being a musician, is teacher trainer and also responsible for developing research programs on learning and training processes. At all levels, the aim is to facilitate the expression of creativity in the learner (whether the learner is a student or an adult in professional development).

A methodology of observation

Observing these processes: Example of musical creation in a classroom situation

We will not attempt here to justify the choice of music as the object for this research, as it is born of our personal predilections and circumstances. However, it is important to note from the outset that music education is not a minor discipline. It holds significance in both school traditions (music has been taught as a subject since antiquity in almost every country) and in terms of the complexity of the knowledge involved. Giglio has pointed out that even though contemporary school curricula emphasize the importance of fostering musical creativity, in practice, schools often prioritize listening to a repertoire, reading, singing, and even instrumental performance, while seeming to neglect (or feel challenged by) the activity of musical creation (Giglio, 2006; Giglio

& Oberholzer, 2006). However, observations of young people's musical activities outside of school reveal that not only are they capable of creating music, but they also thoroughly enjoy it. The significant role that music creation plays in their leisure time with peers is well known.

The aim of this project is to examine how to make room for the activity of musical creation within classroom activities, based on an approach of observation *in situ*, including the necessary know-how on the part of the teacher. We are, therefore, seeking to develop an observation methodology that will enable us to address the questions raised above: observing students creating (in this case musical objects); observing students acquiring and making use of knowledge held by the teacher; observing the relationship between the activity of creation and learning, with particular attention paid to awareness, the formulation of technical solutions, the appropriation of external inputs, etc.

To achieve this goal, Giglio gradually developed pedagogical sequences (Giglio, 2010a, 2010b, 2013; Giglio & Perret-Clermont, 2010) that placed collective musical composition at their core. These compositions were progressively enriched through input from the teacher based on the students' needs or desires for creative openings suggested by the teacher. Giglio first refined these pedagogical sequences through various trials with his own students. He then handed them over to teacher trainees he was responsible for and observed their functioning. Finally, he shared them with other teachers from different countries, accompanied by an observation process. In parallel with the pedagogical activity, an observation process, partially inspired by that of other researchers (Schubauer-Leoni, 1986; Schubauer-Leoni & Leutenegger, 2002), involving self-observations, audio and video recordings, reflective work with students, and *post-hoc* interviews with teachers, allows both teachers and researcher-trainers to capture information about what is happening in the classroom.

The action and observation framework

This pedagogical and research innovation framework 'Predicting, Describing, and Observing' (Giglio & Perret-Clermont, 2012) comprises several components:

1. iterative pedagogical sequences designed by Giglio with the intention to: (a) provide a space in which students can create a musical object

in small groups and, in doing so, feel the need to develop solutions or acquire knowledge; (b) establish teaching moments linked to this production activity on the part of the students;

2. an effort from the teacher to pre-visualize the pedagogical scene and prepare to observe it in a way that is sensitive to what is happening, especially with regard to unforeseen events. For this purpose, before each iteration of the sequence, the teacher writes down, as precisely as possible but relatively spontaneously, their preparation for this pedagogical action and how they envision its unfolding (antici-pated difficulties from the class as a whole or from specific students, planned adjustments, tasks expected to be easy, hypotheses about student behavior, duration of the activity, etc.);

3. an audio and video recording of the lesson's progression, along with collection of written traces left by the students;

4. a 'mini recital' (also recorded) during which student groups perform their compositions in front of the whole class;

5. a reflection after the mini recital, in which the teacher engages in a discussion with the class, and one of the students, equipped with a recorder like a radio or television host, goes around to each student (sitting in a circle) asking them to comment on their experience (com-position activity, use of existing resources and knowledge, group work, production, etc.);

6. a confrontation work by the teacher between their initial expectations and predictions (as documented) and what actually happened;

7. additionally, some teachers agreed to be interviewed, individually or in groups, while watching the recordings using an approach inspired by the Cross-Confrontation Interview method (Clot, Faïta, Fernandez & Scheller, 2001).

The iterative structure of pedagogical modules

Pedagogical modules were therefore gradually developed, consisting of an invitation to students, generally aged between 6 and 13, to create a melody or rhythm in small groups. These pedagogical modules attempt to reproduce, to a certain extent, the 'working' conditions of young peo-ple who have been observed outside the school composing in groups of budding musicians, appearing in mini recitals, developing their

comments in discussion circles, etc. The aim is to create an environment in which students are able to express themselves in their own way, in the form of a group of young people that resembles those observed outside the school. These modules comprise teaching phases aimed at broadening the students' knowledge and equipping them to deal with the difficulties they encounter when working in group to create a melody.

These pedagogical modules have taken a general iterative form (once phase 5 is completed, another activity follows, again beginning with phase 1, and aimed at building on the knowledge acquired in the first iteration), as follows:

Phase 1	The teacher introduces students to the activity to be performed: for example, the composition of a melody or a rhythm.
Phase 2	Students work in small groups to compose the melody or rhythm by using simple instruments available at school: synthesizer, antaras, panpipes, and percussion in Argentina; xylophones, pianos, and percussion in Canada (Figure 10.1, left side); recorder, guitars, and percussion in Brazil; and xylophones, metallophones, and percussion in Switzerland.
Phase 3	Mini-recital: the groups present their compositions (Figure 10.1, in the middle).
Phase 4	Discussion with the whole class: the teacher invites students to talk about their productions and to reflect on the ways they were working, e.g., how they mobilized the available resources and their previous knowledge (Figure 10.1, right side).
Phase 5	The teacher transmits (sometimes even in a very formal way) new knowledge in order to offer students new resources to enrich their future productions, their working methods, their awareness of what is at stake, and to solicit further reflections.
Phase 6	Phase 1 The teacher introduces students to a new activity (always aiming at creating a performance, a recital) by inviting them to mobilize the experience and knowledge acquired by the previous iteration. Phase 2, etc.

Figure 10.1. Images of the different phases (2, 3 and 4–5) of a teaching module

SOME EXAMPLES OF THE OBSERVATIONS COLLECTED

Here we present some of our observations in relation to our main research questions. These examples offer only a general overview of the richness and potentialities of the data corpus we have collected and analyzed by using our methodology[3].

PUTTING THE STUDENT'S CREATIVE ACTIVITY AT THE CENTER OF THE LESSON: YES, IT IS POSSIBLE

As a first result, we observed that it is indeed possible, under certain conditions, to place the creative activity of groups of students at the center of the lesson (even when school furniture is not provided for this purpose). Students may succeed in creating a rhythm or melody and performing it in a variety of school contexts. Once the task is understood, students are really enthusiastic to produce a piece of music, to write it, and to perform it in front of the classmates. They can put the *object* at the center of the activity, as a fruit of their efforts.

The students' sound productions take different forms (see the examples given in Figure 10.2 for an illustration) that we are describing in this chapter for space limitations. We focus on their written productions

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3   In order to improve the intelligibility of the excerpts, we indicate here the convention of symbols we have employed:
- each 2-second pause is indicated by a slash {// = 4 seconds}.
- the indication of an additional sentence or an explanation of the context is written in square brackets [].
- deleted passages that were considered not necessary for this chapter are marked between two parentheses (…)
- the last syllables held are indicated by suspension points …

(rough drafts of partitions) that denote various strategies adopted to face different kinds of technical problems (which the teacher may possibly take up again later in Phase 5). These difficulties do not prevent students from making progress in composing their musical.

Figure 10.2. Examples of partitions composed by students

However, while this module is not difficult to implement, it is not always obvious to all teachers and students to take this opportunity of using such a space to create. The setup of the module allows us to

investigate why this is the case, particularly through the notations that teachers have made regarding their expectations and predictions before the action. In the following sections we propose to observe what emerges from this investigation.

Teachers' predictions reveal fears they have that could have been paralyzing without support

Some teachers did not believe that such a pedagogical sequence could work in their classroom and approached it with hesitation and even significant apprehension. For instance, some teachers predicted that students (and consequently themselves) would encounter many difficulties during the music task having as a goal the composition of a melody or rhythm (Phase 2):

> At the beginning of the preparation, the students will be a little lost. I'll have to let them manage as much as possible on their own, but if I see that it's not working at all, I'll approach the group to help them. They might not get along very well in the group either, but they will have to agree quickly enough to be able to make a production at the end of the time limit. (Predictions of teacher Hélène, class with 11–12-year-old students in Switzerland)

> Once phase 2 has started, some groups may need to have the setpoint explained again. It will take a lot of time for the groups to get started and make decisions; maybe they don't want to spend time playing what they produce, or they will ask to present their creation from their table (phase 3), this problem will challenge me to find other ways to motivate them[4]. (Teacher Sergio's prediction, class with 12–13-year-old students in Argentina)

They also sometimes fear that phase 4 (i.e., the phase during which a teacher-led collective reflection aims to get students to reflect on the steps they have taken to compose the music) is not going well:

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4 'Una vez iniciada la fase 2 quizás haya que volver a explicar la consigna a algunos de los grupos; a todos les llevará un tiempo empezar y tomar decisiones; tal vez no quieran pasar a tocar lo que produjeron o pidan presentarlo desde el banco (fase 3), cuestión que me va a desafiar para encontrar otras maneras de motivación'.

> I will have to be very careful what I ask and how I repeat what the students say: how can I read the partition? This time I hope that I will make myself understood by the students. I have the impression that it is difficult for them to reflect on what they are doing. (Predictions of teacher Hélène in Switzerland)

Other teachers, on the other hand, do not expect difficulties. We note, however, that these are often teachers who have already familiarized themselves with the process in previous iterations: in this respect, they have gained confidence. Our feeling is that the greater the scope for creative initiative left to the students, the more the teacher fears the unexpected and, by consequence, perceives that the object will escape from his or her control. However, after a few tries, teachers begin to have a more accurate and informed idea of what might happen and, consequently, were reassured.

Students are committed to the task and strive for success

The object of the activity (the composition of a melody or rhythm) in Phase 2 seems to have been easily taken up by most students. The following excerpt presents a student's statement collected during Phase 4 to answer our question 'How did you compose the piece of music together?'

The student Mateo (11 years old, in Switzerland) states the following:

> […] and then we each tried to do something that we thought was good and then we put it all together and we did it and then we made improvements. For example, I said, this is an example, I told Sacha that maybe we shouldn't do this, or do other things, we helped each other.

A classmate (Laura, 12 years old) continues:

> Well, actually, we worked a bit alone, we found partitions, we were looking, we had to manage on our own for a while and then we tried to put everything together and then we, uh, we, uh, we took out what was too much, uh, where, uh… And put it down.

On the other hand, Phase 4, requiring a general discussion and a reflection on the process is new for the students and its purpose is indeed much less clear and more abstract. As a consequence, students do not

always understand what is expected of them. We asked students about their experiences in Phase 4 by requiring them to tell us how they thought about it and how they shared their experiences with the teacher and their peers.

Mateo said:

> We have no idea. No idea yet. Because, well, we don't hear the questions directly, so they're complicated for the most part and we don't understand what to do. […] because when someone understands, he starts to say, well it's more like repeating what he says, but with a little adjustment. […] Uh, well, yeah, it's like she says, yeah, yeah, we copy a bit, but with a bit of tweaking, but deep down inside maybe they didn't quite understand, well, for example, me the other time when we recorded, I didn't really understand, but I was saying what the others said, but adding a bit of what I thought. And when you hear yourself talking, you feel like saying yeah, you have to say that, and say that…

Mateo gives us a nice example of a student's effort to meet the teacher's expectations, trying to find a meaning for an imposed activity and looking to move forward without understanding the sense of the activity. This implies a need for a further reflection on this phase whose object (to verbalize and conceptualize what happened) is probably not a 'real object' for the students.

Teachers positively surprised by students' attitudes and achievements

It is interesting to consider the difference between what teachers predict before the action and what they notice after the lesson. We refer to the case of teacher Sergio (working with 12–13-year-old students): his predictions were not evoking his concerns, but instead there were his notes after the lesson. It seems that this feedback contributed to make him aware that finally he was feeling very tense:

> I felt pressured into thinking that everything was going to go wrong; I suffered, and I was uncomfortable, and I was looking for how I could save the situation. When the groups started to write their compositions, I thought that they hadn't understood anything, that I hadn't been able to explain the process to them and I expected the worst result. But it wasn't like that. When I started going through the groups, I noticed that they were working well

and that the partitions emerged with creativity, which I could verify when they returned what had been produced[5]. (Sergio's notes after the lesson)

This teacher, like others, is concerned by the possibility that students may not understand the goal of the activity. He wonders how he would be able to continue his pedagogical work in such an unpredictable situation. However, while confronted to the video recording of the session, he finds that, contrary to what was expected, the students managed to create a partition and to perform it.

Teacher Hélène follows the same path:

Contrary to what I thought, we started working very quickly without asking countless and unnecessary questions. Having a diagram on the board and the positions of the groups very far apart helped in this goal. (Helene's notes after the lesson)

New awareness and the pleasure of improving professional gestures

The analysis of the teachers' notes shows that their pre-lesson predictions are sometimes weak and give a relatively undifferentiated picture of the processes of interaction, collaboration, and learning that are at stake. However, the notes written after the activity reveal an awareness of both their expectations and their behaviors. Of course, a discrepancy is particularly present among student teachers, although it applies to everyone (as the reality is always more complex, subtle, and unexpected than we imagine).

Karine, a pre-service teacher doing her training in a Swiss class with 6–7-year-old students, is planning a lesson during which the students will be asked to create and perform a musical piece with a series of objects (papers, sticks, cans, etc.). Her intention is to facilitating the work

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5 'Me sentí presionado creyendo que todo saldría mal, sufrí incomodidad y buscaba la manera de salvar la situación. Una vez que los grupos empezaron a escribir la composición creía que no habían entendido absolutamente nada. Y que yo no había sabido llegar con el escenario y esperaba el peor resultado'.

of the groups and to empower the autonomy of the students engaged in the creative work.

In her predictions, she writes the following:

> In group work, I will help the children only if they need me. I will let them do their own tests and composition; I don't want to influence them too much. I will still drop by to see how they do it. (Prediction of pre-service teacher Karine, in Switzerland)

But, after the lesson, she indicates in her notes what follows:

> [During Phase 2 of the pedagogical module devoted to the group composition], I can't help but intervene and try to encourage students in their discoveries in order to obtain the most positive results. (Notes from pre-service teacher Karine, after the lesson)

Karine notes that she had decided not to intervene during the students' creative activity. However, after the lesson, she realizes that she was not able to prevent herself to take part in the students' activity and to put her own ideas into it.

Concerning the reflective discussion with the whole class (Phase 4), Patricia, another pre-service teacher doing her training in a Swiss class with 7–8-year-old students, predicts as a result of the activity a general learning for the children:

> The children will tell us what they've discovered. This may lead to a discussion on this or that element that was raised… Then we will try to put musical terms to the elements that the children have highlighted. (Predictions of pre-service teacher Patricia in Switzerland)

After completing the lesson, Patricia writes the following:

> [during the discussion] the children explained to me what they had noticed in the workshops, but could not find a clear rule or explanation. (Notes from pre-service teacher Patricia after the lesson)

She thus becomes aware of her inappropriate expectations, which will subsequently enable the teacher to redefine her role. This awareness is facilitated by various elements of the teaching module: the effort to predict and then confront the reality; the existence of audio- and

video-recordings that support the effort to reach an objectivity and make it possible to observe what actually happened; the opportunity offered by the third party (the researcher or the trainer-researcher) to talk about it. In addition, it is important that the teacher is placed in an active and creative professional role. She is not asked to simply 'apply' the module, but she can test and modify it with the freedom to evaluate, if necessary, whether it suits her professional action or not. This freedom offered to the teacher to exploring his or her role, to creating and recreating it, to modifying, if necessary, some of the elements of the module, to adapting them to the resources (furniture, instruments, and other objects present), to intervening according to preference and interpretation of the students' needs, seems to play an important role. It is by endorsing his or her professional role that the teacher can fully engage in a critical examination of the activity in order to better achieve the teaching objectives. Pleasantly surprised by the creativity emerging during the activities in classroom and motivated by their own assessment of the students' needs, teachers can take pleasure in designing and proposing the activity, even gaining an improvement of their own professional skills.

Then, the teachers can discover, in a much more differentiated way, the nature of the activity in which the students are engaged, the difficulties for them, and the possible solutions.

Social interactions are not necessarily fruitful: On the need to learn how to organize them and bring in new knowledge in a judicious manner

It is not enough to put students in small groups so that they know how to work together. It is not enough for a teacher to want to help students to be effective. In order to be fruitful, social interactions must be organized according to a certain architecture. But what is this architecture? This work of prediction-confrontation, observation, and reflection allows us to identify some key elements in this respect.

Thus, the teacher may find, for example, that the expected 'group work' of the students is related to their ability to organize themselves, to allocate roles, to manage conflicts, to integrate the use of instruments, etc. The students should also understand the whole activity and agree on how to carry it out (by organizing subtasks). This is done first by trial and error: each student should be open to be sustained by the other, or, on the contrary, by contradicting the peers' initiative. A students'

awareness of mistakes or *impasses* is gradually created by stumbling over specific problems. The solicitation of the teacher's help can support students in finding or adopting a solution. However, there is also the risk that, faced with difficulty, students may give up and leaving it to the teacher who, accordingly, will then have to take the responsibility for a solution.

A very frequent phenomenon in the observed corpus of data is the teachers' discovery of their tendency to intervene: there are too frequent actions and verbalizations which, even when perfectly devoted to help students, are not functional to deserve the goal of implementing the students' agentivity. Many of the teachers are very surprised by this and are eager to make efforts to be into a 'silent withdrawal', with a pedagogical posture that, rather to be passive, is more 'contemplative'.

It is relevant to highlight that the more the teacher, from this posture, perceives the active buzzing of his or her students and the related advantages and limitations, the more the teacher becomes aware of the multiple roles he or she is likely to assume, as well as the knowledge to be transmitted to the students. However, this means that teachers may be confronted with their own limitations. For example, generalist teachers (who often have little musical knowledge) may become aware of their difficulties in continuing the lesson in Phases 4 and 5 of the module, which require them to have a precise expertise, and may therefore discover a need for continuing education:

> I will have to be very careful what I ask and how I repeat what the students say: how can I read the partition? This time I hope that I will make myself understood by the students. I have the impression that it is difficult for them to reflect on what they are doing. It will be time for me to take up what the students have said, which is interesting, to do some theory. I am not at all sure what I am going to tell them. I hope I won't say too much nonsense. (Predictions of generalist teacher Hélène)

During an interview conducted after a series of implementations of pedagogical modules, the teacher Sergio (music specialist teacher) says the following:

> I was expecting other results // or to work from a more comfortable space, mine, right? I worked with some discomfort but, in the end, I saw very good results […] It was really a situation // (that concerned me) as a teacher, in

that discomfort. The students // you can see that they understood well and that they were able to produce things and that was really the objective[6].

He also explains that if he had to advise another colleague on how to conduct such an educational module, he would tell them:

[…] we should approach (groups) to see, well, to ask how it's going? Do you have any doubts? Look at every aspect of what you're working on. Look together. See how you can divide up the tasks in the group. And walk around the classroom, right? Don't stay in one place and expect the students to say, 'Okay, we're done'. Don't get too involved, say, without interfering too much. That is, we are together, we are present. We are working in groups, each group composes its own melody, but we are all involved in the same work [composing]. I don't know what else to say to him […] Let him be sensitive, observing what [the students] show when they respond, when they comment on what they have worked… on […] To see what suggestions to provide them for future work[7].

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6   'Yo esperaba otros resultados//o trabajar en un lugar más cómodo que por ahí es el mío, ¿no? Trabajé con cierta/incomodidad, pero después yo vi muy buenos logros al final […] Esta fue nada más que una situación verdaderamente//mía como docente/de esa incomodidad. Los alumnos//se ve que entendieron bien y pudieron producir cosas […] ese era el objetivo/de última'.

7   'se vaya acercando para ver, bueno, preguntar ¿cómo están?, ¿tienen alguna duda?//Fíjense cada aspecto de lo que estén trabajando. Que lo busquen juntos. Que vean cómo se pueden repartir las actividades, dentro del grupo. E ir en el salón, ¿no? No quedarse en un solo lugar esperando que los alumnos le digan//bueno ya está, terminamos. Ir metiéndose sin intervenir del todo, digamos. Es decir, estamos juntos, estamos presentes. Estamos trabajando en grupos [distintas composiciones] pero, todos en un mismo trabajo [componer]. No sé qué otra cosa más le diría. Que esté sensible, observando lo que [alumnos] manifiestan cuando contestan, cuando comentan lo que han trabajado…. […] Para ver qué sugerencias les hace para los próximos trabajos'.

Conclusion

Taking on the role of teacher creatively

These different lessons using these pedagogical modules were able to give room for the creativity of the student. When the teacher implements such modules that give students the opportunity to produce a musical object together and not only to listen to, read, or interpret it, we have found that some obstacles arise: it is not easy to compose and then write a melody and the teacher easily makes inappropriate interruptions in the students' work; it is not easy to get the students to talk to each other. Based on these findings, the teaching modules were gradually adapted and now manage to give the teacher and students different speaking times to encourage student agentivity in their relationship to music and classroom learning. The teacher's role has been disrupted and the teacher has had to learn to assume their role creatively in the face of a process that includes unknow elements, i.e., what the students will create. Indeed, asking students to simply imitate and reproduce what the teacher does or knows is not scary: at most the risk is that the students will not succeed. While inviting their students to produce something new puts them in a (relatively) unpredictable situation from the outset, since the teacher does not know what children are going to do. Some teachers initially experience this openness towards the unknown as very unsettling, as they feel they have to be the 'masters' of the situation. In the current state of our corpus, this is one of the major lessons: the fear of the unexpected productions and behaviors of the students. But the process also shows that it can be tamed, step by step, as experience makes the 'unexpected' more 'expected'.

A framework for creating and learning: From silence to the teacher's word

The other fruit of the current exploration of the data is this discovery (which takes on a special significance in music teaching!): it is the importance of the teacher's *silence*. Silence that allows us to hear the music produced by the students. Silence that allows the student or group of students to be heard at work. Silence that allows the teacher to speak at the right time and to have more chances to be understood. And the silence of the trainer or researcher that allows the teacher (especially in

front of the video, but also face to face with his or her own written predictions) to hear what has happened and to understand why it is often not what was foreseen.

We, authors of this chapter, are at the beginning of a research project that we are expanding to other educational fields. And, just like the students in front of their creations, and like the teachers when they can feel fully responsible for their (intriguing) professional action, we are overcome by a certain enthusiasm as trainers and researchers. Even though our pedagogical sequences and observation approaches still need to be thoroughly developed.

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Conclusion: Scientific, Pedagogical, and Education Paths to Enrich Teaching

Marcelo Giglio and Francesco Arcidiacono

The contributions of this book have presented different scientific perspectives for the study of social interactions in classroom and in educational contexts with regard to the teaching/learning processes experienced in schools and in initial and continuing teacher education. Based on the findings of the different studies, social interactions in the classroom relate to a variety of spaces inside and outside the school, and to the teachers' practices and actions in different situations that can lead to learning with tools. From our perspective, based on our interest in teacher professionalization and education, the present work, carried out in different sociocultural and institutional contexts, contributes to the enrichment of knowledge about teaching practices in multiple situations of teacher-student and student-student interactions.

In an attempt to conclude this volume, we would like to highlight certain definitions that take on different meanings in the studies with which they are primarily associated. By transcending their conceptual framework, we offer a reinterpretation (of course, not exhaustive) of the chapters, with the aim of illuminating their connections and commonalities, while also adding nuance to each in relation to the others.

Different spaces for social interactions

This book refers to different situations and spaces in school and outside school that are linked in different social interactions. In their contribution, Zittoun and Grossen analyzed two types of interactions in distinct spaces: on the one hand, they studied spaces of re-appropriation that are given to students as 'created frameworks'; on the other hand, in their analyzes they identified a 'linking' between certain school knowledge within a lesson and extra-curricular cultural situations. Indeed, a student can acquire appropriate knowledge, but in a dialogue other than that offered or valued by the teacher or by the school's institutional framework. The study proposed by Zittoun and Grossen invites us to make teachers and teacher-educators aware of the multiplicity and multivariate nature of the dialogues that take place in different spaces: either in the classroom or outside the classroom or school.

A second study, presented by Muller Mirza and Grossen, showed that any situation can echo other cultural situations and even diverse experiences. It is perhaps through this link between a present and situated situation and other earlier or later situations that students may interpret what is happening or, on the contrary, find themselves in a situation of misunderstanding.

But how to 'orchestrate' these spaces of social interaction? In this volume, several scenarios, situations and modules have been presented. For example, in the experience proposed to teachers by Rossi, Pontecorvo and Arcidiacono it is essential to organize the classroom space in order to structure it, so that students can explore different tools. But sometimes this effort alone is not enough, because, as César's study showed in another chapter, it is not only teachers who construct formal learning scenarios, especially when they grant their 'power' to students using inter-empowerment mechanisms. These two studies show us the importance of students' interpretations of what is asked of them and in relation to the teacher's expectations. For César and Barth, in their respective chapters, the pedagogical challenge is to support students in constructing an image capable of valuing themselves. These spaces require a relationship of trust (in oneself and in others) in order to evolve in a cognitive activity. But these spaces sometimes involve other elements, and teachers may have great difficulty in letting students producing them in the classroom. Indeed, according to the observations of Riat and Groothuis, teachers need a transformation of their practices in

order for provisional writing to emerge in the students, to let them take on the role of novice reader/writer without the teacher taking on this role in their place. Similarly, in their chapter Perret-Clermont and Giglio showed how, by providing a space in which students can create a new object in the classroom by working in small groups (in their example, to create a short piece of music), teachers need to develop solutions or acquire professional knowledge. Many teachers wonder about how to continue pedagogical actions in such creative and unexpected situations, for example when, contrary to what they imagine, students manage to create a music partition and perform it in front of the class.

Teacher-student relationships requiring distinct practices

As already pointed out in the introduction, the actions of the person who guides the formal act of a classroom, i.e., the teacher, the instructor, the facilitator, have a key role for each action of the learner. This book offers examples of several of these actions that are explicit in both an 'action' and a 'reaction' within social interactions in the classroom. We have observed various interesting scenarios in which teachers' practices must adapt to the spaces of action, dialogue, and discussion. The scenarios proposed by Barth, for example, allow students to move back and forth between analogical and analytical thinking. In her study, Barth showed the need for 'teacher action' that can maintain joint attention towards the goal of elaborating the meaning of the knowledge being addressed. For the author, the teacher's challenge is to enable students to gradually become aware of their cognitive approaches by adopting and developing an autonomy of action and responsibility in their learning. It is the positive experience that can gradually give them greater confidence to engage in their own initiatives or address their own questions. Tartas, in her chapter, proposes a scenario that also requires different actions by the teacher to enable students to transform the multiple ways of thinking about a scientific phenomenon through an argumentation linked to a scientific investigation approach. César, too, showed the importance of the practices put in place by teachers so that students can be able to use *inter-* and *intra-empowerment* mechanisms autonomously in school situations and in other contexts. In addition to these actions and practices put in place by teachers, there are other situations in which the role of

the teacher or their function are very important in the orchestration of the class and in the organization of a certain architecture that makes specific learning possible. For example, in a situation of sharing personal experiences and emotions in classroom, as proposed by Muller Mirza and Grossen, the teacher plays the role of 'conductor' to open this space and to allow students to speak up and express emotions that will be the subject of observation, discussion, and sharing with others. Their study leads us to postulate that it would be important for the teacher to move beyond the framework of over-generalization, references to stereotypes or national and cultural categories, and even the risks of over-particularization or over-personalization of experiences already lived by certain students. Muller Mirza and Grossen observed a practice in which the teacher promotes a transformation of emotions with the aim of secondarization: a discursive back-and-forth movement between the individuals' own experiences and a shared or collective classroom experience.

In the chapter written by Rossi, Pontecorvo and Arcidiacono, which proposes reading and writing production situations, we also noted the importance of the teacher's role in supporting a group of students in search of shared solutions. This support would enable students to focus their attention more on their own actions and written outputs. The scenario proposed by Perret-Clermont and Giglio emphasized the preconceptions that the teacher must overcome when leading a lesson that involves back-and-forth interactions between created objects (a musical piece), communicated objects (a mini-concert), and discussed objects (meta-reflection). According to the observations made by the authors and participant teachers, it is not enough to simply group students together for them to immediately learn how to work together. Nor is it sufficient for the teacher to only assist their students. Any social interaction in a classroom requires organization to guide the students effectively.

A relational dynamic that requires discussion and interpretation

From what we listen to, *in situ* or elsewhere (Bakhtin, 1929/1981), social interactions are shaped and can take on meaning through the interpretations attributed to each situation. This is the case of the scenarios presented by César in which, during the mathematical tasks proposed

by the teacher, an intersubjectivity emerges that the student may or may not be able to identify with the peers working with them. This would require a relationship of trust (in oneself and in others), which is necessary to develop a relational dynamic in a common group activity. As pointed out by Barth, this is a main issue because cognitive activity always emerges in relational spaces. Awareness could give access to the student's own thinking and allow them to act on it. In her chapter, Barth illustrates a scenario with a presentation of small classroom moments in which the teacher asks a question about what the students have learned, followed by other questions concerning the tools of thought: for example, the way in which the student learned and the way in which they can demonstrate their own understanding and successful approach. However, in creative situations, classroom discussions seem to be much more difficult. In Perret-Clermont and Giglio's study, teachers also need to draw on some knowledge that is not based on students' discursive abilities to reflect on ways of creating music: the object of discussion (creative collaboration between students) is not always clear to some students and quickly becomes abstract, as it is a new object of discussion for students who also have difficulty in understanding what is expected.

The strategies for guiding a classroom discussion do not appear to be universally applicable across the various situations presented in this book. The subject of discussion can shape or determine the necessary actions of the teacher and the discursive dynamics between the teacher and the students. For instance, the study proposed by Muller Mirza and Grossen places emotions as the subject of discussion in the classroom: in this case, it is not easy for the teacher to control the situation. However, even if teachers are aware of this difficulty, this discussion space becomes a teaching opportunity, as it contributes to developing new knowledge about different objects related to the students' personal experiences. In such a case, emotions can become objects of observation, discussion, and perspective in a classroom dialogue.

The materiality of objects was also explored in Iannaccone's chapter. This materiality occupies a large part of the available space in the classroom, either 'private' (for one student) or 'public' (for the whole class). According to Iannaccone, the different dimensions of the objects also come into play according to the logic of use perceived by the subjects. According to the author, the students seem to establish a relationship among themselves with several 'material entities' that surround them.

A final aspect, which deserves particular attention in our scientific, pedagogical, and teacher education reflections, is that a dialogue in the classroom can refer to different situations and experiences. This is the case of the philosophical discussions observed by Zittoun and Grossen in high school: if, for a teacher, a subject of discussion on a given content can refer, *a priori*, to a previous lesson, for a student this same subject can refer to other lived situations, sometimes creating tensions and different positions regarding the object to be discussed in the classroom.

Diversify the ways of interacting with each other to learn in the classroom

In her chapter, César takes up the distinction drawn by Christiansen and Walther (1986) between *task* and *activity:* in a classroom, a task would be a teacher-proposed assignment; an activity would include the actions taken by students as they engage in solving a teacher-proposed task. But often tasks are only a pretext for learning and probably not a goal in themselves. Perret-Clermont and Giglio, in their chapter, postulate that very often the curriculum, or even the teacher, is aimed at learning, whereas the student may believe that they should be committed above all to the successful completion of a task. From a scientific point of view, it is legitimate to question the links between successful completion of a task and learning. From a pedagogical point of view, it is obvious that one of the activities, 'the task at hand', does not automatically lead to the other activity, 'learning'. A more global vision and organization of space are therefore fundamental to promoting the learning process. In this regard, in her contribution, Buchs presents a framework of pedagogical approaches that focus on the social interactions between learners, socio-cognitive processes, and social conditions of teaching/learning. We believe that *cooperative learning* offers avenues for learning to cooperate and cooperating to learn, as well as for structuring group work. The method presented by the author proposes general principles that can guide the teacher in structuring group work, allowing the teacher to appropriate and adjust the activities to the context.

But how do we create a *learning culture* that can be made explicit through real-life activity that allows students to make sense of what it means to learn and to change their understanding of knowledge? For Barth, it is possible to move from *transmission* to *transaction* to generate a

transformation of knowledge. For Perret-Clermont and Giglio, a transformation of thought could be accompanied by a translation of knowledge from a first context into a new context, with more or less adjustments. Moreover, this passage could include a measure of creativity. As Iannaccone points out, when students are faced with problems to be solved without a predetermined solution through didactic planning (cf. the example of the building of a solar boat or the construction of a robot), they are faced with real problems and must find solutions. This type of activity engages students in exploring and creating new strategies for overcoming obstacles and unforeseen events that are specific to less formalized school activities.

Some issues of social interactions in the classroom

Several contributions in this book encourage us to question what makes learning possible in a situation of social interaction in the classroom. In the pages of this book, we observe that, in different ways and in different contexts, social interactions in the classroom always have internal and external cultural perspectives in the construction of a common activity negotiated between several people, within a certain knowledge context. In the classroom, the interactions with the other cannot be dissociated from the objects at stake, as well as the tools, instruments, and artefacts available or to be created. The observations and analyzes proposed in this book allow us to better understand the complexity of these situations and issues, and to identify some possible obstacles.

Although the title of the book might suggest that it deals only with situations in the classroom, the contributors make it clear that the multiple social interactions 'in the classroom' and 'outside the classroom' should not be considered separately and are part of different spaces of transformation for the student and, consequently, for the teacher, even in a researcher's analyzes or in teacher education perspectives. Indeed, from the various contributions, we note the importance of considering the different spaces (in the classroom, in school or outside school) and times observed or evoked during a teaching/learning situation. For both the researchers in their observations and the teachers in their practices, these multiple spaces are combined with objects and available tools. Certainly, for both research and teaching practice, it would be

essential to contextualize all 'actions', 'interactions', and 'reactions' in the classroom in relation to objects and tools available within a time and a space that likely involve other objects, tools, times, and/or spaces. Furthermore, this rich complexity should not be considered independently from the tasks planned by the teacher or the actual activities of the students, the concrete teaching practices, and the multiplicity of discourses involved in these teaching/learning processes that take place within the classroom.

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Final notes by Francesco Arcidiacono

This book has been edited in collaboration with my colleague and friend *Marcelo Giglio* who passed away before the finalization of the work. The collective effort produced by all the contributors to complete this volume is dedicated to his memory.

During the completion of one of the contributions (Chapter 8), one of the authors (*Clotilde Pontecorvo*) passed away. The publication of the text realized together with her and Franca Rossi is a way to thank Clotilde for the useful and stimulating insights that she provided throughout the preparation of the text.