

## CHAPTER 1

### MATHEMATICS LEARNERS IN TRANSITION

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#### 1. RECENT SOCIOCULTURAL CONCEPTUALISATIONS AND DEVELOPMENTS

Formal, non-formal and informal mathematics<sup>1</sup> education practices continue to evolve through globalisation and through the use of technology and the WWW. They do so in response to the need for more mathematics to be learnt by increasing numbers of students, both school students and adults. As these practices develop, and as adult education and life-long education grow in importance, along with their mathematical versions, there is an increasing need for mathematics education to move away from ideas and practices based on traditional child development theories and normative ideas. This is particularly important if research in mathematics education is to continue to have relevance and influence in these new and diverse fields of activity.

In the last two decades educational and psychological research studies on social, cultural and political aspects of mathematics learning, have raised awareness of the complexities of the process of learning and using mathematics in specific sociocultural practices (see for instance, Bishop, 1988a, 1988b, 1994; Secada, 1992; Van Oers & Forman, 1998, Cobb & Bauersfeld, 1995; Lerman, 1994). On the other hand such studies have also indicated the potential of this field for informing and developing teaching practices at all levels of mathematics education.

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<sup>1</sup> This triad of terms is best defined in Coombs (1985), where formal is what happens in required schooling, non-formal education is what happens in non-required courses and structured educational provision outside and after formal schooling takes place. It could include after-school programs, trade courses, university courses etc. He describes informal education as being non-structured and non-required, such as may be obtained from peers, from TV, libraries, WWW etc. Bishop (1993) applies these definitions to different forms of mathematics education. Nunes et al (1993) distinguish between formal and informal education while Coombs' distinctions separate their 'formal' into his two categories of formal and non-formal. However Nunes et al. (1993) also point out that it is important to bear in mind that informal is defined by exclusion, that is informal mathematics, in their terms, is what is not learned at school. Coombs also makes the additional point that as demands on formal education have increased during the last decade so non-formal and informal education have both expanded to meet the increased need.

For example, recent studies have:

- documented the wealth of mathematical knowledge accumulated over history by specific cultural groups,
- identified relationships between logical and social organisation of specific cultural tools and individual's thinking processes,
- given some indication of the relationships between the ways knowledge is valued and the mechanisms which can lead to social inclusion or exclusion, and
- informed the development of theories of situated learning.

To achieve such a state of knowledge researchers had to be selective and sometimes have undertaken studies on individual and isolated practices. Some relevant examples here are the studies on 'everyday cognition' focused on out-of-school practices, such as tailoring, farming, cooking, street vending, etc., (see for example the research summarised by Nunes, Schliemann & Carraher, 1993; Barton, 1996).

Focusing on individuals engaged in a particular sociocultural practice has been very important in producing evidence of the existence of legitimate forms of mathematical knowledge other than school mathematical knowledge. However, our concern with these studies is related to the fact that individual learners and societies are not static entities, but are dynamic. Moreover it is our belief that neither ontogenetic (individual development) nor sociogenetic (social group development) aspects of change are properly accounted for by current ethnomathematical or sociocultural theories.

Developmental psychologists working within an individual tradition are also questioning the discrepancy between the explanations produced by researchers and the observed 'facts' in the real world. Siegler (1996) made his point by asking: 'whose children are we talking about'. He doubted it was his children! For him the crucial research challenges lie in explaining these three aspects of learning: **variability**, **choice** and **change**. This is certainly not a problem which is restricted to Siegler's information processing approach. Situated cognition and other sociocultural accounts of cognition also have not provided adequate accounts of any of those three aspects (Abreu, 1995).

Firstly, sociocultural accounts have not yet provided satisfactory accounts of **variability**. Although a focus on diversity has been a central issue in the agenda of approaches to learning and development from a cultural psychology perspective, like other branches of empirical psychology it has tended to explore differences between groups, and left un-analysed any within-group and within-individual differences. It is unclear why the same person can use mathematics competently in one practice, e.g. street mathematics, and then experience tremendous difficulties in learning the mathematics associated with another practice, e.g. school mathematics. It is also unclear why some people from similar backgrounds show one pattern of performance across practices, e.g. some are competent in both, while some show another pattern, e.g. they succeed only in one. This lack of explanation leaves the situated cognition accounts too vulnerable and opens a space for this diversity to continue being 'explained' in terms of a biological basis.

Secondly, *choice* and agency, were not central issues in the theoretical and empirical developments in situated cognition. In general the studies channelled their efforts into demonstrating that individuals and social groups have the ability to learn. The methodological choice for the researchers was a focus on a microanalysis of the mathematical competencies of individuals engaged in specific, very often non-mainstream, and low-status, practices (e.g. street children in Brazil). However, social psychology has for a long time demonstrated that even minority groups are not passive, and it is time for learning theories to try to understand the processes of agency at group and individual level (Moscovici & Paicheler, 1978). As several authors have been stressing, the problems of power, access and transparency of how one becomes a member of a community of practice need to be addressed (see for example Goodnow, 1990; Lave & Wenger, 1991).

Thirdly, sociocultural accounts have been criticised for their limited or biased accounts of *change*. When focusing on the practices, very often these were described in rather static ways, that is they captured the traditional side of the practice but paid no attention to innovation and change (Abreu, 1998). When focusing on the individual, the tendency is that the accounts of change portray patterns, but less attention is paid to the uniqueness of changes in actual individuals. Also very little attention is paid to any conflicts that may occur between the cultures experienced by the learners inside and outside the school (Bishop, 1994).

Authors following approaches that centre around understanding the emergence of new meanings at the individual level (Cobb, 1995), or at the social group level (Duveen, 1998), suggest that the focus on reproduction of the traditional, i.e. the homogeneous side of cultures and societies, can be linked to particular uses of Vygotsky's ideas. Bruner (1996) also argues that a focus on the cultural symbolic systems is not sufficient to explain learning in modern plural and rapidly changing societies. For him 'nothing is "culture free", but neither are individuals simply mirrors of their culture. (...) Life in culture is, then, an interplay between the versions of the world that people form under its institutional sway and the versions of it that are product of their individual histories' (Bruner, 1996, p.14).

Finally, researchers interested in the emergence of new meanings in mathematics tend to emphasise the importance of communication, negotiation and interpretation (Bishop & Goffree, 1986). Meaning-making processes are however very enigmatic (Wertsch, 1991). Although most authors tend to agree that the meanings that the person brings to a situation influence the course of learning, we still know very little about meanings that are not just cognitive.

Bruner's view that the meanings that a child brings to a situation 'are not to his own advantage unless he can get them shared by others' (1990, p. 13) seems to us extremely important. Contextually-bound and socially shared meanings concerning such phenomena as language use, appropriate behaviour, values, and customs are crucially important factors in learning. They may indeed be more important when intercultural communication and interpretation are involved. For example, Pinxten (1994) characterises what he calls Navajo learning in these terms:

- More emphasis on qualitative ordering and aesthetic aspects and less on quantification and universal statements,
- More stress on orthopraxy (to behave properly, appropriately, and so on) and less on orthodoxy (to share the same contents as the other members of the group),
- More dependence on the persons involved in knowledge transfer, and much less room for a curriculum format and hence for a universal status of knowledge,
- More awareness of the negotiation aspects of each learning situation and less respect for the institutional authority of a teacher. (p. 88)

Walkerdine (1988) in her seminal work 'The Mastery of Reason' also concurs with Bruner in illustrating how Western school practices regulate what comes to be seen as the 'right meaning'. She suggests that schools do not enter into a process of negotiation which helps the learner to construct chains of signification, where concepts and mathematical objects can acquire multiple meanings, legitimated by the contexts in which they are used. Instead, she argues that schooling 'empties' and 'represses' the multiple mathematical meanings acquired outside school in order to replace them with a unique and presumably disembedded meaning.

Evidence from empirical studies, however, suggests that this is not the whole story (see Abreu, 1995; Planas, Vilella, Gorgorió & Fontdevila, 1999; Presmeg, 1998). Learners continue to bring meanings into their mathematics lessons, although most of the time this can occur in 'silence'. Learners clearly negotiate much of the learning process as well as the content being learnt. For example it is also not unusual to hear accounts from well-intentioned teachers about the refusal of their students to use outside school knowledge in the classroom. However what we need to know in order to provide any learner with learning environments conducive to expression, sharing and negotiation of meanings still seems to be an open question.

We believe that:

- (1) it is necessary to get insights into the dynamics of mathematics learning of individuals who might behave and apprehend meanings in situated ways, but who certainly move across the different practices and institutions of societies, that are themselves continually in the process of change, and
- (2) it is therefore necessary to focus on analyses of how individuals and/or social groups experience their participation in, and transition between, more than one sociocultural mathematical practice.

This then is the focus of this book: the idea of transition in mathematics learning, particularly of mathematics learners in transition, and of their transition between different contexts for mathematics learning and practice.

## 2. TRANSITION – PRELIMINARY DEFINITION AND WORKING NOTIONS

In a certain way this book also tells a story of a group that has been connected by their shared research interests. Our adoption of the notion of transition as a central construct in our work, and the way it has been evolving, also reflects the developing

process of the group. In retrospect most of us feel the way we see transitions now is quite far away from where we started. In this section we tell a bit of this story: how it emerged; where we looked for inspiration; and how we proposed to approach it. We believe that this background is important in enabling readers to evaluate the general validity of the ideas the group has generated.

### 2.1. THE EMERGENCE OF THE NOTION OF 'TRANSITION' AS AN INTEREST OF THE GROUP

The focus on understanding how participation in home mathematical practices that are distinct from school mathematical practices impacts on the learner has been central to the research of most of the contributors of this book for quite a long time (see for instance Abreu, 1995, 1998; Abreu, Bishop, & Pompeu, 1997; Bishop, 1994; Presmeg, 1988). However, our use of the notion of transition to help to theorise this relationship is recent. Although it is difficult to be precise about when we started using this concept, the re-construction of the history of this book leads us to believe we first used it based on common sense. It seems we took for granted, as many social scientists do, that the meaning(s) of the word was shared during our discussions.

We vaguely defined it in our initial group meeting and outlines. It is certainly not difficult for us to identify the phenomena that for us are disturbing. All the contributors to this book have dedicated a part of their lives to understanding why particular groups of learners have difficulties with their school mathematics learning. Though we manage to provide evidence that these learners are capable of mathematical thinking in their home and other environments, we are still a long way from clarifying for teachers why they continue to have difficulties in more formal learning situations such as at school. This gap in our knowledge is disturbing not only for us as researchers and educators, but also for classroom teachers for example, who reject theories of deficits in the child, only to find themselves in a position of not knowing what to do to help the child progress at school.

The idea that we had in mind was that our problem required investigations that go beyond a focus on single practices. Participation in multiple social practices requires the person to move between them and this movement needs to be understood. From movement between contexts of practices we progressed to the notion of transition. Or indeed 'transitions' in the plural, in the sense that from the beginning we also assumed a person can move between various contexts (e.g. home, school, peer groups, etc.) and also that there exist various types of transitions (e.g. linguistic, social, cultural, etc.).

Other key assumptions in the development of our thinking were firstly, that the movement between practices required the theorisation of both the social environment and the individual learner as dynamic entities. Secondly, in accordance with our view that multiple mathematical practices co-exist in society, we were interested in transitions as bi- or multi-directional trajectories. In taking this view we were departing from a common use of the concept of transition in the traditional develop-

## CHAPTER 2

# IMMIGRANT CHILDREN LEARNING MATHEMATICS IN MAINSTREAM SCHOOLS

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### 1. IMMIGRANT CHILDREN LEARNING MATHEMATICS IN MAINSTREAM SCHOOLS: A TRANSITION PROCESS

We understand the schooling of the immigrant<sup>1</sup> children as a transition process, because when they arrive into a new country they have to cope with the many changes involved in moving from one culture to another. In particular, they have moved from one school culture into another, if they have attended school, or perhaps they have moved from a 'no-schooling' culture into a school culture. We regard immigrant students as having the need to build a bridge from the meanings of their initial situation to those of the present one. All of them have the right to be offered the opportunity to develop their potentialities to the full, regardless of their country of origin or the reasons for their migration. We believe that school should contribute to help them create a continuity between their home and the host culture's meanings. From that point of view, and not avoiding the researchers' commitments to society and particularly to teachers and students, the goal of our study is to find teaching approaches that contribute to co-construct the students' transition in order to make it as smooth as possible.

We say 'co-constructing the transitions' because a one-sided construction would not be complete, since the meanings a child brings to a situation, as Bruner states, 'are not to his own advantage unless he can get them shared with others' (1990, p. 13). Everyone involved in the dynamics of the mathematics classroom has to participate in the negotiation of the meanings associated with the diverse situations, in order to ensure a real sharing of them (Kao & Tienda, 1998).

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<sup>1</sup> In our study, the word 'immigrant' is considered as taken in Ogbu's classification of minorities (Ogbu & Simons, 1998). Therefore, we take into account voluntary immigrant minorities, who are supposed to have moved willingly to Catalonia, and involuntary immigrant minorities, such as refugees, migrant/guest workers, undocumented workers, and binationals, including descendants or later generations. Even though there can be different types of minority status among these groups, all of them have in common, to some extent, the need for a social adjustment and equal educational opportunities in their school performance.

Smoothing the student's transition would require, in particular, making the cultural conflicts something positive, both for immigrant and local students. When analysing the meanings that a child brings to a school situation, it has to be taken into account that those are constructed in relationship not only with the sociocultural context of the learning, but also with his or her emotions, values and beliefs. Immigrant students cannot establish reference points with which to direct themselves, without the guidance and the acceptance of people belonging to the host culture, the teacher and their classmates, among their 'significant others'.

In this chapter we present the analysis of the immigrant students' process of transitions, from their home and school culture to the school culture that hosts them, and we shall focus on the mathematics classroom, and understand the construct 'culture' in its broadest sense. By focusing on the cultural conflicts that arise in a mathematics classroom, we study the transition processes both as they are understood by the teachers and as an external manifestation of how the students themselves adapt to the changes, by constructing new meanings and values and adapting the old ones. In particular, we will refer to the social and sociomathematical norms, and the norms of the classroom mathematical practices.

We take as our starting point the definition of culture by Geertz (1973) and we analyse the context of the transition process, being predominantly the mathematics classroom, but we consider it within the school, and within the educational and social structures that frame it, and condition what is possible and what is desirable. We consider the main interest of our project to be knowing more about how the significant persons that influence the learning process as a transition process, essentially the teachers, understand these processes. As our research is not only interpretative, but also has the intention of promoting change, we have been designing, experimenting with, and analysing, different classroom situations that are potentially useful for making explicit and positive the cultural conflict which is often invisible in the mathematics classroom.

We understand the construct 'transition' not as a moment of change but as the experience of changing, of living the discontinuities between the different contexts, and in particular between different school cultures and different mathematics classroom cultures. The construct 'transition' is, in our understanding, a plural one. Transitions arise from the individual's need to live, cope and participate in different contexts, to face different challenges, to take profit from the advantages of the new situation arising from the change. Transitions include the process of adapting to new social and cultural experiences, and students need to be helped to understand the meanings of the new experiences and to reinterpret them and construct new ones based on their own individual meanings and values.

Researchers and teachers can only see the external part of the transition process and they only have the means to interpret it. As it is a private and personal process, and most of the time hard to exteriorise, one can just interpret what is going on in the student's transition process through its external manifestation. The mathematics classroom is a social and cultural scenario and, as in every educational situation, it has its social dynamics and its social interactions. The various moments of those dynamics have different meanings for the different participants in them and these

differences can create cultural conflicts (Bishop, 1994). On the other hand, as Bishop remarks, there is an unavoidable part of cultural conflict in every educational situation.

Cultural conflicts and disruptions between the various meanings that different persons attach to the same situation are, probably, the most visible manifestations of the transition processes lived by the participants in a multicultural classroom. However, misbehaviour, lack of interest, absenteeism, could be reinterpreted as an external manifestation of a difficult transition process, if the observers were aware of the tensions lived by the students in the new situation. Often, the apparent lack of conflict only means its invisibility to the observers, and when cultural conflict remains invisible it may turn into different types of blockage that can slow or hinder immigrant students' learning process and their participation in classroom community life.

Researchers and teachers also have their own meanings and expectations related to classroom situations. Thus, for instance, teachers find immigrant students to be 'different' from what they expect their pupils to be. When talking about differences in a social situation we mean differences from the 'normality', where this is defined according to the assumptions and expectations of the persons concerned. As Bauersfeld et al. (1988) state: 'social interaction takes place among individuals or subjects, which mutually constitute expectations, interpretations from each other, and test these interpretations by negotiation processes, producing, this way, meanings, structures and acceptance norms and norms to validate' (Bauersfeld et al., *op. cit.* p. 174). When acknowledged, cultural conflict can be assumed as a positive starting point in order to accept the fact of cultural diversity, and making it explicit is the first step to facilitating the students' transition processes. Therefore, for a real sharing of meanings, it is important that the adults involved in the teaching of immigrant students are explicitly conscious of their own. More than that, they should be ready to review them and to change them if they want their students' transitions to be co-constructed: the move has to take place on both sides.

The immigrant students that we have worked with experience different kinds of transition processes. Some transitions are go-and-come-back continuously, following the classification given in chapter 1 we can call them 'collateral transitions', where students participate in the experience of more than one context, for instance, the mathematical practice inside and outside school. These transition processes should contribute to give plural meanings to the signifiers and to mathematical knowledge. The students also experience 'lateral transitions', the transitions resulting from an irreversible change, if not psychological, at least physical, having moved from one country to another where they now have to live. We understand this transition process as being most significant when establishing their path of progress, since it is linked to opportunities and barriers.

However, what is important about transitions, all of them, is that the immigrant students move from a world with particular meanings and values to another world with other meanings and other values. To be able to react to them, by appropriating them, or not, they need to understand and reinterpret them both on the basis of the meanings and values they had in the previous context and on those they perceive in



the new situation. It is also important to take into account that the more difficulties the individuals have to structure the new meanings, the more obligation there is for us as educators to help them to create a continuity bridge. The 'good' students, from a high social and cultural class, even if they are immigrant students, have fewer difficulties in engaging in the process of transition and thus suffer less. The unschooled students, with social, familial and economic difficulties, need to be helped much more to 'organise and structure' their new meanings. The more distant the meanings are from the different worlds, the more need there is for making explicit those in the new situation.

The issue then, in the context of our project, is what are the continuities and discontinuities, their coherence and non-coherence, between the meanings attached to the mathematics learning process by the different participants in it? What are the meanings that teachers and students attribute to learning mathematics, to the different mathematical practices within and outside school, to successful learning, to assessment, to mathematical usefulness? And what are the values associated with these by the different participants?

The more we help to further the coherence, the smoother will the transition be, and the greater will be the opportunities for students to learn mathematics. We are not facing students defined only as 'being from another culture' or another country, but as students who are at a certain moment in time in a continuity between the two cultures. It is one of our goals to try to find ways to help the teachers to contribute to creating this continuity and coherence in the entire educational activity. Continuity cannot be established without the clear intention of acknowledging the student's culture and the culture of the group. History is full of abrupt breakdowns of this continuum, and of curricula imposed artificially that are far from the real needs of the individual.

In our understanding, coherence and continuity are not only necessary from the point of view of educating or helping in the development of every immigrant student as a person, but are 'powerful' social tools. Transitions between different educational cultures have certainly to do with issues of equity and justice. Transitions are related to social progress, and have to do with 'social selection'. Transition is not a matter of 'changing the scenery or the decor' of the educational process but it is about living changes that are linked with chances of success. There are transition processes that are more likely to result in the child succeeding at school and, from the point of view of the system, a 'successful transition process' would be the one that enables the student to get 'good results' within the system. However, the transition process must also be a positive one for the person, one that is lived as enrichment. What for some people will be a benefit, for others could be a loss. Furthermore, we would argue that it should be a process through which people adapt to the new situation without having to give up their cultural background, but can reinterpret it in the light of their present needs.

Mathematics educators, teachers and researchers, through their attitudes perpetuate the myth that the subject is just for elites, consciously confirming the failure of some students through poor learning conditions, or unwittingly through prejudice, values and expectations (Apple, 1998; Dowling, 1998). Researchers and teachers

should be aware that teaching may induce, consciously or not, intentionally or not, failure among the immigrant students through their transitions. In their individual action as agents for change they have a big responsibility that cannot be avoided or excused by the constraints of the structure that limits it.

## 2. THE RESEARCH CONTEXT: ITS COMPLEXITIES

In recent years, there has been an increasing immigration into Catalonia, an autonomous region in northern Spain (whose capital is Barcelona), which has led to significant changes in the school population. The immigrant population in Catalonia is about 1.4% of the whole population and, in 1997, it reached 2.3% in Barcelona. This percentage is not homogeneously distributed in the city; in particular, in the area where we have focussed our research the percentage of immigrant students rises to 90%. This new situation has focused attention on the inadequacy of the educational provision in multicultural schools and classes and raises many questions related to issues of equity and justice.

In 1997, the first of the authors received a grant from a Catalan private foundation devoted to education, *Fundació Propedagògica*, to carry out a project concerned with mathematics teaching in schools that have large numbers of immigrant students<sup>2</sup>. The project was also supported by the Catalan Ministry of Education. In this section we introduce the research context and we discuss its complexities, both from the global point of view, as to how the political and social structures are in tension with the researchers' assumptions, and from a more local point of view, the complexities of the classroom reality in everyday life.

Even if the project was initially linked to a request from the administration, the team's understanding of the multicultural situation in schools goes far beyond that of the educational administration. The team negotiated strongly to change what initially was expected to be a policy-driven 'research' project into a research project with no inverted commas. Probably, the most difficult argumentation with bureaucrats and politicians, has been about mathematics being a cultural product and that learning and teaching mathematics is linked to values, beliefs and expectations and that this emotional aspects can explain many of the difficulties immigrant students have when learning mathematics.

To acknowledge mathematics as a cultural product is a first step to taking advantage of the cultural diversity among the students as a source of richness for mathematics learning (Wilson & Mosquera, 1991). On the other hand, since any mathematics classroom can be considered to be a multicultural class, understanding culture in a broad sense (Borba 1990), an approach that considers mathematics as a cultural product will benefit all students, whether they are immigrant or not. The search for curricular models and methodological approaches that take culture into

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<sup>2</sup> The context of the research has already been presented as a contribution to MEAS1, 1st International Conference on Mathematics Education and Society, held at Nottingham on September 98: Gorgorió (1998)

## CHAPTER 3

# THE TRANSITION EXPERIENCE OF IMMIGRANT SECONDARY SCHOOL STUDENTS: DILEMMAS AND DECISIONS

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### 1. INTRODUCTION

Being an immigrant school student in a new country is a difficult matter. Language problems predominate, compounded by not knowing which other students to trust in the school, not knowing the school rules (except that you know there are likely to be many school rules), and not knowing the teachers:

Interviewer: How good do you think your teacher thinks you are?

Tra: I don't know, no idea. It is hard to know what the teacher thinks.

The social pressures on the students are immense. As well as their own self-imposed pressures to survive in the new environment, there are pressures from their parents who may be ultimately dependent on their ability to earn money for the family. There are the usual learning and assessment pressures from their teachers which although well-meant, are not always well-received, and there might also be the less well-meaning pressures from some of their peers who may not be willing to accept them into the social milieu of the classroom or the school.

These social pressures are exacerbated by the cultural conflicts experienced by every immigrant person, but particularly by immigrant students. It is a particular problem for students because of the predominantly cultural nature of schooling. Education is a process of cultural induction, and schooling is the formal instrument of the induction process. As an immigrant bus driver or nurse, one might well be able to 'slip into' the same job in the new country, as many occupational practices are similar from country to country, although there too will be cultural differences causing conflicts and anxieties. Schooling, although superficially similar in different societies, differs markedly in its cultural framing.

Moreover, whilst for a bus driver or nurse the expectations of society for the newcomer will almost certainly be spelt out (if only for health and safety reasons) there is no such provision for the immigrant school learner. There will probably be some

descriptions of aspects such as the appropriate clothes to wear, the books and materials needed, the times of the school day, the sports provisions etc. No-one though describes how one is supposed to operate in the new learning environment, which other students to pay particular attention to in class, the new social niceties of how to make friends, or which rules are to be obeyed and which are negotiable. It is never written down which teachers are particularly sympathetic to the plight of the immigrant student, or which ones are to be avoided. There are no manuals explaining what counts as an acceptable reason to be late for class or not to have done the homework, or how much work needs to be done in class. These are all part of the hidden curriculum of the school and classroom and are necessarily never written down. But students who have ever been to school before know just how important the knowledge of such hidden 'rules' is.

This chapter is especially concerned with analysing aspects of the transition experience of immigrant secondary school students in their new mathematics classes. Learning mathematics in school classrooms is a particular kind of mathematical practice with its own criteria and rules. It is not simply a matter of learning mathematics with a teacher. There is a variety of special tasks, done to certain standards, according to certain procedural rules, and in a social context that is not well-defined partly because it is continually being reconstructed by the participants. For the newcomer there is a lot to learn, and perhaps the least of the problems is the mathematics itself.

A learner's mathematical practice is shaped and negotiated by the classroom participants, but not all participants have equal power in that shaping. The teachers have of course the power invested in their position, but that is only power of the formal, institutional kind. It is the kind of power that allows the teacher to decide on the implemented curriculum in the class, the kinds of activities to be done, the materials to be used etc. Effective power, the kind that enables the teacher to shape interactively a learner's mathematical practice in the classroom, must be earned and won through negotiation and respect.

The classmates or peers also play a fundamental role in shaping learners' practices, again not all equally. There are 'significant others' among the peers who will be particularly influential for the new student, and they may have particular attributes, such as age, ability or a particular personality. However studies of influence (e.g. Moscovici, 1976) suggest that it is as much the learner who choose whom to be influenced by as it is the significant others choosing whom to influence. The suggestion is that it is the learner who chooses which 'others' will be 'significant'.

The learner has in some sense the most power over their learning, choosing for example how much effort to expend, whom to listen to, and whose views to respect. But also they are in another sense a party to the power of others, being a product of their cultural and social history, a history shaped in large part by their family life and by their life outside school. Their parents in particular are likely to be influential, and in the case of mathematics learning it seems from the interviews quoted later that it is often the father who is the more influential of the parents.

Much of this is likely to be the case for all mathematics students. In the social situation of a mathematics classroom they must learn to 'read' the social dynamics, the social interactions, and the social and body 'language'. For the immigrant mathematics student the situation is much more challenging since all of this must be learnt afresh.

Language is a useful metaphor here. When one learns one's first language there is little awareness that one is learning a language. This usually occurs when one begins to learn a second language. That is when one becomes acutely aware of the phenomenon of language. The same is true for learning to 'read' a mathematics classroom. In one's home country and culture, learning to read one's classroom comes naturally, and one is rarely aware of doing it. Of course that does not mean that it is an easy matter, far from it. But in another country, and in another classroom, one quickly realises that one does not automatically understand the 'language' of that classroom. The signs and symbols must be learnt afresh. One is in a transition situation.

Language usage, literally, is of course the most obvious and pressing aspect for all students, as it is the source of all communication of meanings. For the teachers also the students' language use is a strong indicator of the effectiveness or otherwise of the acculturation process. Here is an example of the kind of challenge that the immigrant student faces in mathematics classrooms:

Interviewer: Do you ever do any maths in English?

Ty: Yes, in the Philippines, I lived there for 2 years before I came here.

Int: But you are originally from Vietnam?

Ty: Yes, Vietnam to Hong Kong and then the Philippines.

Int: It is a long way round?

Ty: Yes, for 7 years.

Int: It must have been very hard?

Ty: Yes.

Int: When you are doing maths in the classroom do you think in Vietnamese?

Ty: I think in English.

Int: Do you ever think in Vietnamese when you are doing that maths?

Ty: No never, the solution is different. We have 4–5 ways of solving it.

It is hard to avoid the conclusion that life in the mathematics classroom would be fairly complicated and challenging for that student, even though he admits to being able to think in English, which is already a tremendous advantage for an immigrant into an English-speaking country. However learning mathematics through one's second or even third language still presents a unique set of problems (Dawe, 1983) that can hinder one's mathematical development and progress. More positively however, it might be possible that out of these contrasting language and cultural experiences immigrant students could be constructing a richer understanding of mathematical ideas than we might otherwise expect.

This chapter explores some of the significant aspects of this transitional mathematical practice in order to see what light can be shed more generally on the socio-cultural milieu of mathematics classrooms, and on how to improve the quality of mathematical teaching and learning for all students.

## 2. CONTEXTUAL BACKGROUND TO THE RESEARCH

Immigration into Australia has created an extraordinarily varied cultural history in the country. From the early days when the English, Scottish and Irish immigrants brought their mix of Anglo-Celtic culture with them, to today when there are estimated to be more than 150 languages spoken, not counting the Aboriginal languages, Australia has seen wave upon wave of new immigration from different parts of the world. Coming as refugees, or as members of families of existing Australian citizens, or as new migrants anxious to create a new life for themselves, the new immigrants have all brought with them their languages and their cultures. This mix of languages has therefore been changing constantly from the 1950s when the immigration policy for Australia meant a heavy influx into schools of Italian and Greek speaking children, through waves of other European groups to the mixture of Asian, African, and sub-Asian continent groups migrating at present.

The extent of the migration is shown by a report by the Public Affairs Section of the Department of Immigration and Multicultural Affairs, Canberra in 1996 which states: 'Today nearly one in four of Australia's 18.5 million people was born overseas. In 1995–96 the number of settlers totalled 99 139. They came from more than 150 countries. Most came from New Zealand (12.4%), the United Kingdom (11.4 %), China (11.3%), Hong Kong (4.4%), India (3.7%) and Vietnam (3.6%).' (Sources: Australian and Immigration 1788–1988 and other material produced by the Department of Immigration and Multicultural Affairs.)

Most Australian schools have a significant minority of non-English background students attending, and in their classrooms there can be a number of languages represented there. Although normally all teaching is in English, many classrooms can have up to 10 different languages spoken by the students, and some have more than that. Clearly the multicultural and multilingual situation in Australia creates special challenges for learners, teachers, families and policy-makers. It also presents ample opportunities for those concerned to research sociocultural aspects of mathematics learning and teaching, as a way of developing ideas for mathematics education in any multicultural society, not just Australia. Most countries in the world are experiencing rapid increases in migration, and school populations in many countries are becoming much more multicultural.

Earlier Australian research on cultural issues, summarised and reviewed by Atweh, Cooper and Kanen (1992), and by Ellerton and Clarkson (1995) in the context of language, generated a variety of literature. For example, Howard (1996) discusses his important research with Aboriginal teacher educators, making us aware of the importance of sensitivity in dealing with cultural issues. Leder, Rowley and Brew (1995c) present some challenging data about students' performances in the Victorian Certificate of Education, the end-of-school examination in the state of Victoria, which suggests that immigrant students often outperform their 'local' counterparts. Thomas (1995) argues for improving language policies in schools to

improve the chances of Non-English Speaking Background students succeeding at University mathematics.

This chapter is based on a research project, funded by the Australian Research Council, carried out in Melbourne, Australia, over a three year period, and undertaken in collaboration with Gilah Leder, Chris Brew and Cath Pearn. The basis for the theoretical framework was the construct of 'cultural conflicts', first elaborated in Bishop (1994) and discussed briefly in chapter 8 of this book.

In this research project the focus was on secondary school students, though not on immigrant students specifically. However one of the main reasons for proposing the project was that the previous research on such students had produced conflicting findings. Some studies showed that immigrant students were achieving better than local students, while other studies showed the reverse to be true (for example, see Leder et al., 1995c). The present study was formulated in the hope that, by considering the students' situation from the cultural conflict perspective, we would develop some richer and more illuminating understandings of the immigrant students' transition experience in mathematics classrooms in Australia.

Research on the cultural conflicts experienced during transition in the learning of mathematics has played a minor role in the mathematics education scene in Australia. However one hope is that the work of the project will demonstrate the potential and the promise of this kind of research, not just to benefit immigrant and Aboriginal students, but the school population more widely. So the scarcity of such research could not be due to any lack of potential benefit nor of interest. Australia, with its significant Aboriginal population, also contains the world's second highest variety of migrant country 'backgrounds', and would seem therefore to be a research site of huge significance for this theme.

As well as having intrinsic and pragmatic interest in terms of the contribution such research could make to the development of the unique multicultural nature of Australian society, there also seemed to be a large potential pay-off for the development of richer theoretical constructs. It is only relatively recently that mathematics educators have taken seriously the cultural nature of mathematical knowledge, with all that that idea implies, and most research and development in mathematics education still privileges a mono-cultural, or even a non-cultural, image of the subject.

However one crucial reason for the scarcity of this research could well be the inherent challenges of doing it. It is indeed a complex research field. As will be shown in this chapter, and as is shown elsewhere in this book, not only is it complex in terms of its theoretical constructs, and in terms of the educational issues involved, but there are specific and huge complexities in terms of the practicalities of doing empirical research in the area. Thus as well as having great practical and theoretical importance in Australia and in many other countries, research on cultural conflicts in mathematics education faces researchers with many other challenges that, if they can be met, may well enable the generation of ideas of potential benefit for the whole field of mathematics education.

## CHAPTER 4

### THINKING ABOUT MATHEMATICAL LEARNING WITH CABO VERDE *ARDINAS*

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The research reported in this chapter takes part of the results of the project *Cultura, Matemática e Cognição – Pensar a Aprendizagem em Portugal e Cabo Verde*<sup>1</sup>, especially in what concerns understanding the idea of ‘learning as an integral part of generative social practice in the lived-in world’ (Lave & Wenger, 1991, p.35) together with the perspective that addresses ‘learning as increasing participation in communities of practice’ (p. 49). The analysis of these ideas led us to try to understand the meaning of participation in a social practice (and therefore in a community of practice). Our goal was to look into the ways (mathematics) learning relates to forms of participation in social practice in an environment where mathematics is present but that escapes the characteristics of the school environment. Because we believe that culture is an unavoidable fact that shapes our way of seeing and analysing things, we decided to look at a culturally distinct practice and that constituted a really strange domain for us: the practice of the *ardinas*<sup>2</sup> at Cabo Verde islands in Africa.

In order to address the research problem we looked for analytical tools that we believe are coherent with the theoretical perspective drawing from Lave and Wenger (1991) and our need to understand the idea of social practice: (i) the explicit presence of rules in the *ardinas* discourse led us to Wittgenstein (1992/1953) and Goffman (1991/1974); (ii) the need to clarify the relationship between the ways that *ardinas* use mathematical objects within the practice of selling newspapers and the school mathematics they are supposed to know led us to address the connections between competence and ‘taxonomic features of knowledge’ (Julien, 1997) and to the idea of ‘thinking as internal conversation’ (Restivo, 1998).

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<sup>1</sup> Culture, Mathematics and Cognition – Reflecting about Learning in Portugal and Cabo Verde. This project was supported by Fundação Ciência e Tecnologia under contract PRAXIS/PCSH/C/CED/146/96.

<sup>2</sup> *Ardina* is the Portuguese name given to those people who sell newspapers in the street. This was the way newspapers were sold for example in Lisbon until the eighties.



In this chapter we first set the scene presenting a full description of the practice observed in Cabo Verde; the subsequent analysis takes advantage of short episodes depicted from the observations made; finally we conclude with a summary of our main findings.

## 1. A GLANCE ON THE *ARDINAS* PRACTICE

The practice of the *ardinas* has naturally a history that relates to the evolution of the country and to the society where it develops. The data collection that supports this research was carried out in two time periods: the first phase was from March to June 1998 and the second phase during the month of March 1999. This way it was possible to enlighten the historical transformation of the practice, mainly through focusing our attention on the transitions experienced by the participants. Focusing our analysis on those experiences helped us to understand better the forms of participation of the *ardinas* in that practice, its role in the learning that came out of that participation as well as in their use of mathematics. This research process brought also to the front some other issues that pushed us to reflect upon the research process itself within the field of mathematics education research.

Therefore, it seems important to give a picture of the life that we could share with the *ardinas* during the time of data collection, trying to make explicit the relationships among people, between people and activity and the lived-in world. We begin this part with a brief and global presentation of the *ardinas* involved in the study. In a second step we will present a description of the practice observed taking into account the time sequence of its development.

### 1.1. *Who are the Ardinás?*

The *ardinas* are young boys aged between 12 and 17 years that sell newspapers in the streets of Praia (the capital of the Republic of Cabo Verde). In 1998 there was just one national newspaper (called *O Tempo*) but from January 1999 there appeared a new one (called *O Espaço*). Both of these newspapers come out once a week and are written in Portuguese<sup>3</sup>. The group of *ardinas* who used to sell these two newspapers was variable (19 in 1998 and 32 in 1999). Only 9 *ardinas* from the 1998 group were carrying on this practice in 1999, and there was no formal link to the institutions that owned the newspapers.

One of the newspapers (*O Tempo*) was trying to implement a selling system based on the shops such as coffee shops or stationary shops but with very low success. In fact the population did not adapt to this way of buying newspapers, so selling news-

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<sup>3</sup> Portuguese is the official language in Cabo Verde. Therefore, it is for example used in the school and it is the language of the newspapers. However, Creole is the spoken language used in everyday activities. Far less people are really fluent in Portuguese.

papers in the city of Praia was totally dependent upon the availability and interest of the young boys to volunteer for selling. Some of these boys also were in charge, both in the past and in the present, of selling Portuguese newspapers, and especially a particular one on sports very popular in Cabo Verde. This one was on sale on the street but on a different day. There were also two other *ardinas* who did not sell national newspapers because they were dedicated to selling two Portuguese weekly newspapers of general interest whose contents are more in the field of politics. These two young boys had already a small number (but a rather constant number) of clients and the places for selling were clearly different from the others. In most cases these *ardinas* were taking the newspapers to the offices and hotels in the city. The relationships between these two *ardinas* and the others were not very strong and frequently they did not even say hello when they met in the street.

There was no external sign (such as a special t-shirt, a bag or a cap) that could be one to identify the *ardina* except the fact that he was carrying a number of newspapers under his arm. However they were careful in the way they dressed on the days of selling. They managed to be clean and it seems that they tried to maintain a certain combination of clothes especially for that activity. Some of them had special care with clothing in order to have access to certain places of selling (for example, in official departments).

Some of the boys started selling newspapers just prior to the data collection for this project (March 1998) but others had already been selling newspapers in the street for about six years. Most of them were *ardinas* because they wanted to get some money to help the family ('to help my mother' as they usually said).

Because data collection was carried on in two phases we could identify differences in these two periods. In 1998, the group of *ardinas* was living in two places, 9 *ardinas* were living at the Eugenio Lima area in Praia, which was one of the most problematic places in the city mostly with inhabitants coming from the rural zones looking for a job in Praia. There was another group of 10 *ardinas* coming from S. Martinho, a small village close to Praia. In 1999 the group was enlarged with boys coming from Praia, and those from S. Martinho started leaving this activity<sup>4</sup>. The growing of the number of *ardinas* in the group was slow; for example, during the month of March 1999 we observed the integration of only one new *ardina*.

## 1.2. *Ardinas' Practice*

In the two periods of data collection (1998 and 1999) some common aspects were observed; but we could also identify different aspects. The work of the *ardinas* was divided into three different phases: (i) receiving the newspapers, (ii) selling, and (iii) paying back the money to the newspaper agency. The organisation of these three

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<sup>4</sup> Several factors contributed to the fact that these boys abandoned the practice of selling newspapers in the street: some of them had the opportunity of working in S. Martinho helping the construction of infra-structures in the village organized by the local authorities.

phases was necessarily connected to the instructions of the directors of the newspapers but the *ardinas* positioned themselves in that organisation in their own way according to several facts (that then become more visible). This means that in this practice we could identify a pre-existent structure or arena, in Lave's (1988) terms, which was redefined in the local context of action and that develops with the participation of the *ardinas* (and that certainly would be different for other *ardinas*).

### 1.2.1. In 1998

Every Friday morning, in the main building of *O Tempo* agency, the newspapers were delivered to Disidori, the man who was responsible for the whole process of selling<sup>5</sup>, returning the non sold newspapers and payment. In order to have the newspapers sold Disidori distributed them among the *ardinas*; this operation took place at the door of the agency. The number of newspapers distributed to each *ardina* was negotiated and in most cases the number of newspapers varied between 50 and 150 for each. During the **distribution** Disidori wrote down in a list the names of the *ardinas* and the number of newspapers distributed to each one. This list was the reference document for the final phase when the *ardinas* were paying back to Disidori after selling.

The participation of the *ardinas* in the activity of selling was based on their will to do that. The link of the *ardinas* to the newspaper agency was very informal assuming a very personal character in relation to Disidori (more than to the agency); there was no penalty and no need for justification if the *ardina* decided not to show up for selling. If he decided afterwards to come back for selling he knew that he could do it (notwithstanding that he could not have immediately available the number of newspapers he wanted to have). On his side, Disidori had a link to the administration of the newspaper, which was made visible to all when he signed a document against the delivery of the newspapers (which made him responsible for the payment to the administration). Besides that, Disidori received a fixed amount of money (that he recognised as the payment for assuming the responsibility) plus a part of the money of selling each newspaper. We can say that there was a mutual dependence among the *ardinas* (in order to get money they had to sell the newspapers), Disidori (to get more money he had to be sure that the *ardinas* really sold) and the administration of the newspaper (to sell the newspapers they needed the help of Disidori and the *ardinas*).

The group of *ardinas* changed over time. After a varied period of time some of the *ardinas* abandoned the activity of selling newspapers. Usually these boys got involved in other activities (for example, serving the army, getting a job or emigrat-

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<sup>5</sup> This adult had been one of the *ardinas* when he was a boy and for some years he was involved in the work with the *ardinas* but in no way that had not much visibility in institutional terms. He had not a working place in the agency of the newspaper and he only worked for the newspaper on the day when it was being sold. Besides that he lived in S. Martinho and had friendship links and even family links to some of the *ardinas*.

ing to another country). New boys then came to substitute for those who dropped out and generally these newcomers were accompanying a friend or someone from his family who was already an *ardina*. In the case of these new *ardinas* Disidori had the last word for their acceptance in the group. Disidori tried to know the *ardina* and talk to his family. He also used to choose one of the old-timers to take responsibility for the newcomer – ‘to teach him and to protect him’ as they said. In the distribution of the newspapers among the *ardinas* what happened was that the old-timer received all the newspapers (for him and for the newcomer) and it was his job to give a small number of newspapers to the newcomer (first 5, then 10, 15, etc.) as he was selling.

Immediately after receiving the newspapers the *ardinas* ran very quickly to the usual places for **selling** in the city; their goal was to try to sell all the newspapers during the day. Some of the *ardinas* tried to maintain their own place of selling. However, those places varied during the day according to the rhythm of selling and the rhythm of the city (namely, at the street in the rush time, at the working places on the working schedule, close to the restaurants at lunchtime). The price of the newspaper for the customer was 100 escudos; by the end of selling, the *ardinas* should pay to Disidori 87.5 escudos per newspaper sold and give back the non-sold newspapers. These amounts were defined by the newspaper administration. During the day most of the *ardinas* spent some time at the Square of the city or in nearby streets given that these were the places where selling was more common. In fact this is the area where most of offices, banks and public services, coffee shops and markets are located. On the other side this is the zone of the city where some local people develop their activity selling sweets and pottering on the street. Because those people stayed on the Square during the day, the *ardinas* got a close relationship with them which is in fact useful to both parts: the *ardinas* ask those people to keep a number of newspapers for them avoiding to have to carry a big number of newspapers, they exchange small coins in order to facilitate the change to customers and together contribute to attract potential customers.

Besides the strategic role of that interaction in the integration of the newspaper selling into the socio-economic life of the city, the Square was the place where Disidori stayed for long periods during the day of selling. He also walked around to the different places where the *ardinas* were selling in order to check how the process was going. Some time after the distribution of the newspapers by the *ardinas* Disidori went to the Square carrying with him a set of newspapers for the possibility of those *ardinas* who were in the school (and because of that could not come to the distribution of the newspapers at the agency) or that he could distribute to those who sell very quickly and ask for more newspapers. The Square was the main point of convergence of the boys at several moments during the day: (i) at lunch time, those who did not approach the restaurants to sell, stay and rest for a while, (ii) when they finished selling and came to pay back to Disidori.

Those *ardinas* who were in a beginning phase of learning the practice of selling usually kept close to an old-timer who was responsible for them. On one hand, this was because the newcomers received a small number of newspapers (which they had’ to pay back to the old-timer before receiving more newspapers for selling). On the other hand, it was within the observation and interaction with the old-timer that

## CHAPTER 5

# EXPLORING WAYS PARENTS PARTICIPATE IN THEIR CHILDREN'S SCHOOL MATHEMATICAL LEARNING: CASES STUDIES IN MULTIETHNIC PRIMARY SCHOOLS

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### 1. INTRODUCTION

In industrial and post-industrial societies the process of starting school is, arguably, one of the most significant transitions children make in their development after birth. This is the moment when for the working day they leave the cocoon of the family and are placed in the care of the school, an agency set up by society to manage the next phase of their preparation for their role as adult citizens. Symbolically parents pass responsibility over to teachers, and these professionals become the custodians of key elements of the knowledge and understanding that society requires the children to develop. But parents still retain key responsibilities and continue their emotional ties to their offspring. So all too often the alliance between parents and teachers over children's learning is an uneasy one. Even in areas where teachers might expect to have unchallenged sway, such as the core subjects of the school curriculum, the influence of the home and its local community may remain powerful and may prove to be in competition with the influence of the school. Children's representations of aspects of the curriculum will be affected by what their parents and their teachers say and do and by the degree of consistency and harmony between these key players in their lives and between their actions and their words. In this chapter we aim to explore the specific role of parents in children's experience of one aspect of this transition – the transition between mathematical practices at home and mathematical practices at school.

The chapter focuses on a recent research project on mathematics learning in multiethnic primary schools in England<sup>1</sup>. We investigated the experiences of high

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<sup>1</sup> This research project entitled 'Mathematics learning in multiethnic primary schools' was supported by an ESRC – Economic & Social Research Council / UK, Grant (R000222381). This chapter was written while the first author was a visiting scholar at the Department of Social and Political Sciences at the University of Cambridge, UK (February–July 1999). We are grateful to the parents, the children, the teachers and other staff in the schools for their collaboration in the project, to Maria MacIntyre for her help in the transcribing of interviews, and to the Project Advisory Group (Helen Abji, Imtiaz Chaudhry, Gerard Duveen, Zafar Khan and Terry Redmayne) for their advice at various stages of the investigation.

achievers and low achievers from two ethnic groups, White-British and Pakistani-British, in an attempt to understand the dynamic factors that influence individual differences among children from the same ethnic group. On the assumption that children's parents and teachers are likely to play key roles in these social dynamics both were interviewed. In this chapter we analyse the dynamics related to parents. Our interest in investigating the influence of parents in collaboration together grew out of earlier research we had carried out separately with children from home backgrounds that were culturally different from that assumed in their schools. Our starting points included Cline's (1993, 1998) work on the school situation of children with learning difficulties who were learning English as an additional language and Abreu's (1995a, 1995b) research with children from homes where parents practised a type of mathematics that was different from the mathematics of the school. In each case our earlier work had highlighted situations in which the transition between home and school posed particular challenges for the young learner.

In this study interactional effects became salient when the perspectives of both the parent and the child were considered. It appeared that parents both influenced and were influenced by their children's participation in school mathematics. So, in reporting our research we will try to make visible the representations of both parents and children and illustrate how these interact to shape patterns of transition between home and school mathematics. The children who were most successful in mathematics at school tended to have parents who were confident in helping them to manage that transition.

## 2. BRIEF OUTLINE OF THE THEORETICAL APPROACH

From the outset this programme of research followed a sociocultural approach informed by Vygotsky's (1978) theory, situated cognition anthropological theory (Lave, 1988), social representations and social identity theory (Duveen & Lloyd, 1990). In this approach the mathematics that is practised in distinct social practices is based on forms of knowledge that have been historically produced, transmitted and transformed. Thus its representation has a double character. It is the representation of something (and therefore a cultural tool) and of someone (and therefore seen as belonging to specific social groups) (Duveen & Lloyd, 1990; Abreu 1993; Abreu, 1995a). In adopting this perspective we aimed to explore issues related to the mastering of specific cultural tools that are required in specific contexts of practice. But in addition we aimed to articulate the impact of valorisation and identification processes on the transmission and learning of knowledge.

The notion of valorisation we follow in our studies was introduced by Abreu (1993) to explain the relationship between home and school mathematics in a farming community in rural Brazil. She argued that understanding of how particular social groups learn, use and transmit knowledge requires consideration of the link between knowledge and values. In her view it is the association of mathematical practices with particular social groups that provides the framework for understand-

ing the value groups attach to their own mathematical practices. Social groups are located in particular social orders and do not function independently from the wider society. For example, the yardstick to evaluate and value farming mathematics against school mathematics in Brazil was provided by the access these forms of knowledge gave to individuals in the wider Brazilian society. This meant that social representations of mathematics give the individual understanding of the tools and of the codes to compare and categorise co-existing forms of mathematical knowledge.

The notion of identification aims to explain the emergence of differences between individuals exposed to similar practices. What processes lead individuals who share social representations to participate in quite different ways in the practices that are represented? This is a question about the interface between knowledge as represented in the social sphere and its re-construction in the process of individual development. Duveen and Lloyd (1990) have argued that the re-construction of social representations at a psychological level involves active elaboration of social identities. To explain this agency of the individual they distinguished as components of identity between the knowledge of social semiotic codes (tools and their social value) and the position he or she takes towards them. Positions are by definition evaluative. Individuals explain their positions in terms of how they feel towards something, how much they like it, the importance they judge that it may have in their lives, etc. However, how individuals adopt a particular personal positioning, which then becomes a part of their identity, is an area that needs further investigation.

Next we outline why we see this approach as important in the context of research on how parents support their children's transitions between home and school. The double character of social representations needs to be taken into account when investigating ways in which parents can influence how their child manages the transition between home and school mathematics. Firstly, this requires understanding of their use and/or their preference for specific mathematical tools and the way in which these can influence their children's transition. For instance, do parents tend to use mental or written tools for arithmetical calculations? When they use these tools do they emphasise rote use and memorisation or flexible use and understanding? It is often assumed in the literature that when home practices promote forms of thinking that are similar to the ones required at school, this will smooth children's transition to school and contribute to higher achievement there (Bernstein, 1973; Gallimore & Goldenberg, 1993; Heath, 1983; Tizard & Hughes, 1984). This type of explanation has been supported in various studies of home-school literacies. Recently Gallimore and Goldenberg (1993) reviewed a series of studies in which they had investigated literacy practices in Latino families in which American-born children were being brought up by foreign-born parents. Their observational and interview data convinced them that although members of the family usually valued and were prepared to help the child to engage in literacy activities what they actually did with the best of intentions was not optimal as a support for school progress. They found that a key factor in the way the activities were framed was the parents' representations, or what the authors referred to as 'scripts'. Even when the researchers tried to influence the home activities positively by creating external demands they found that 'as soon as

the parents construe an activity as the “teaching of literacy”, their prevailing conception of literary development is activated, driving the interaction and determining the script-in-use’ (pp. 328–329). For instance, they found that parents overemphasised correct answers (e.g. reading a word accurately) to the detriment of reading for meaning.

Secondly, it is necessary to take into account the valorisation of the social practices. Thus, parents can influence the transition through their selection of the information that they intentionally expose to or hide from their children. In this case the salient aspect of the representation on which they base their actions is a judgement about the value of particular forms of knowledge and the social identities that are associated with them. This explanation is of particular interest in the context of our work where we anticipated that home and school mathematics would be differentiated by both parents and teachers not only on the basis of the mathematical tools used in them, but also in terms of their social status. Goodnow (1988, 1990, 1993) has argued that a failure to attend to the impact of value judgements about the status of different forms of knowledge has stood in the way of the development of clear accounts of children’s learning.

Furthermore, Goodnow (1988) argued that how parents and children negotiate their differences either in knowledge or in positions regarding the social value of an activity depends on ‘two-way influences’. In her view:

‘Parents mark information as having varying degrees of importance. They provide it, withhold it, or frame it on the basis of judgements about value and about the other party’s need, age, or capacity to cope. They are selective in the social messages they pass on. Some they endorse, others they subvert or try to exclude from the child’s awareness. Such active management is not restricted to parents. We have a great deal yet to learn about the criteria that lead children to decide what information they will transmit, which members of an older generation will be the recipients, and under what circumstances’ (pp. 63–64).

Goodnow (1996) suggested that agreement can be reached when each generation takes into account the view of the other. In her opinion this can require that ‘each generation monitors where the other stands (a cognitive process) and is interested in resolving differences or reducing any disharmony they may create (a motivational process)’. On the other hand, when either the child or the parent holds on to particular positions or regards them as non-negotiable, divergence will be the consequence. In addition, divergence may also occur when neither the child nor the parent is aware that a difference exists. It is apparent that the way Goodnow described the interactions addressed the double character of the representations mentioned above and the corresponding psychological cognitive and identity processes.

In the next part of this chapter we describe empirical research into the management of the transition between home and school in relation to mathematics. In what ways is children’s performance in the subject at school influenced by the negotiation of what Beach (1999) termed collateral transitions – the simultaneous participation in mathematics practices at home and at school (see chapter one). We will in particular try to understand the influence of a key social actor in this process – the parent.



### 3. THE RESEARCH CONTEXT AND METHODOLOGY

#### 3.1. *Children in Multiethnic Schools*

Multiethnic primary schools in England seem to be an interesting situation in which to continue our investigations of home and school mathematics. Previous studies of ethnic minority students in this country have highlighted wide gaps between their lives at home and at school (McIntyre, Bhatti, & Fuller, 1997) and problems in the way they are assessed at school (Cline, 1998). Recent surveys also show substantial evidence of an interaction between ethnicity and achievement in mathematics (Gillborn & Gipps, 1996). Finally, patterns of ethnic group participation in the schools are more heterogeneous in this post-colonial situation than in the societies in which most of the research in this tradition has been conducted previously.

Multiethnic schools in this setting have some similar characteristics to the Brazilian schools in the original studies that generated the development of theory, ideas and new questions on relationships between home and school mathematics (Abreu, 1995a, 1995b and 1999). Some of them have on roll children from ethnic groups who, on average, underachieve at school. But it is likely that within any single year group there will be wide variation in performance among the children from the same ethnic group – including both high and low achievers. An important difference from earlier studies is that differences between home and school mathematics are likely to be linked to parents' experiences of a different culture and a different school system through going to school in their country of origin on another continent. In contrast, in the Brazilian study the focus was on parents' experiences with a distinctive non-school mathematics in the same area.

#### 3.2. *The Children, the Schools and the Parents*

The data presented in this chapter were obtained in a study that consisted of a series of linked case studies. Twenty-four schoolchildren, their teachers and their parents participated in the study. The selection of the children took into account school performance in mathematics (high versus low achievement), ethnicity (White-British versus Pakistani-British<sup>2</sup>) and level of schooling (years 2, 4 and 6). Pupils are 6–7 years old in year 2, 8–9 years old in year 4, and 10–11 years old in year 6.

The children were selected from four schools serving two multiethnic areas of a small industrial town in the South of England. In each of the four schools ethnic

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<sup>2</sup> All the children involved in the project were British. For the purpose of distinguishing between the two ethnic groups in the report we use 'White-British' for children whose parents were born in the United Kingdom, spoke English as their first language and came from the majority community and 'Pakistani-British' for the children whose parents came to this country from Pakistan and spoke Urdu as their first language.