

Social Interactions in Multicultural Settings

Margarida César and
Kristiina Kumpulainen (Eds.)



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ALL BOOKS HAVE A STORY...

The theme of this book was discussed for the first time during the *SIG 10 – Social Interactions on Learning and Instruction* and *SIG 15 – Special Educational Needs* joint meeting in Lisbon, in April 2004. The initial idea was to choose a theme for an Invited Symposium of SIG 10, that was by then coordinated by the two editors of this book. It would be part of EARLI 2005. Then we aimed at inviting other members of SIG 10 that were not in Lisbon and that could be interested in participating in the book. And also to include an alternative focus on multicultural issues, that was not present in EARLI Conferences until 2003.

Like many collaborative works this book took some time to be ready. But we all learned a lot with the discussions of the previous versions of these chapters during the EARLI Conferences, SIG 10 Meetings and in *WG 10 – Mathematics Education in Multicultural Settings*, from CERME 3 to 5. We now have a group, including researchers from different countries and cultures, that meets once or twice a year and discusses issues related to diversity, social interactions, and teaching and learning in multicultural settings.

While we were preparing this book, *SIG 21 – Learning and Teaching in Culturally Diverse Settings* was created by Guida de Abreu and Ed Elbers, in EARLI 2007. This was an important step towards the exchange and discussion of information related to this topic.

We like to see this book as part of a journey we made together. Reading previous versions of each other's chapters, discussing theoretical issues, method and English language details, having a double review process that is not usual in many books, but that was essential to have these final versions, were the features that made this book a collaborative enterprise. Thus, our gratitude to the reviewers who accepted to collaborate in a non-blind review process, allowing us to discuss improvements in a way that blind reviews do not allow.

Like many other journeys, we hope that this book is not an end in itself. That it will open gates to the issues related to cultures, identities, intercultural education, equity, social justice and inclusive education and societies. And we also hope that you will have as much pleasure reading it as we had doing it.

In 2008 we are celebrating the year of the intercultural dialogue. We hope that this book can be a contribution to this celebration. Reading these chapters illuminates what was already accomplished but also how many other things still need to be done.

Moreover, this book is in itself a multicultural enterprise. It includes 13 chapters and an introduction, and the authors are from Switzerland, Denmark, England, Portugal, Greece, Spain, the Netherlands, United States of America, Brazil, Australia and Finland. Some of these authors and chapters refer to several cultures, and discuss this topic in relation to different settings. This diversity helped us, as

authors, to be aware of the need to give detailed information about the contexts, situations, educational systems, and cultures we were referring to.

A special gratitude is due to Óscar Fernandes, a Master student from Portugal who was a great help to assist us formatting the manuscript according to the Sense norms and also solving technological issues related. And also to Jorge Donga, who participated in the research group from the project *Interaction and Knowledge*. He is a friend and a remarkable photographer, kind enough to give us for free the photo used in the cover of this book. His contribution to this book made us very happy, for the symbolism of his photo: the difference of the elements of that chain, and the joint and beautiful effect they make.

A final word to all the authors whose collaboration and effort were remarkable. They did a great job. And also to thank all those who contributed with ideas during the SIG Meetings, or with comments at an early stage of this book, like Douglas Smith, from the University of Saskatchewan, Canada, or Alan Bishop, from the Monash University, Australia.

Margarida César and Kristiina Kumpulainen

INTRODUCTION

It is quite an honour to be invited to write the introduction of such a timely and interesting book that invites the reader deep into the daily life of multicultural classrooms in different places in the world. Surprisingly the readers will feel at home in all these places, even when they could not have expected to, because the authors have succeeded in joining their efforts to describe processes that are likely to take place everywhere, even if in different ways.

The consideration of learning within the more general landscape of societies growing evermore multicultural gives this book its present relevance. The study of social interactions in learning via the minute observations *in situ* of the teaching and learning processes opens fruitful new ways of understanding the dialogical nature of learning and the qualities of classroom management. Social interactions in the classroom do not happen in a social vacuum: schools are institutions with traditions and political mandates that structure the field of interactions; students come into the schools with their life experiences framed by another major institution, i.e., the family and its own social nesting in the wider (ever more global) society. Only a better knowledge of the interdependence between these micro and more macro processes can help design pedagogical situations fruitful both for the integration of minority students in the local schools and for the enrichment of the members of the other social groups.

The general bet of the book is that this can be a “win-win” situation. But the authors are not naive. They also know (and show empirically) that in some places in society, schools are not invested as instruments for personal development of the multitude, social inclusion, cultural and economical sustainable development, peace, mutual understanding and equity. Where knowledge and cognitive growth is appropriated (... like petrol!) for the sake of a few privileged groups who perceive themselves in competition with one another in a “win-lose” situation, then the general process of knowledge creation and transmission in an “open society” (to use Popper’s term) becomes distorted by procedures of social selection and exclusion. Knowledge creation and transmission can be unlimited resources – but only if societies care.

The contributions of the studies gathered in this book are in search of the levers for more inclusive approaches for all members of a classroom, especially when they come from diverse socio-cultural backgrounds and hold different life motives and time perspectives. In doing so, the authors shed some light on the educational challenges that societies have to meet when transformed by migrations and globalization. But they also force into reconsideration general questions about teacher-student relationships and learning activities that classrooms have always

had to face, but that might be forgotten in a period where a lot of attention is placed on the supposedly purely “cognitive” aspects of learning irrespective of their social and emotional components. Knowledge expansion in individual development and in society can only be achieved through caring attention to delicate processes of mutual attention, joint efforts in communication, respect of the others, openness to share one’s understanding, capacity to argue and convince, and trust in the mutuality of efforts between teachers and learners, or experts and novices (Perret-Clermont, Pontecorvo, Resnick, Zittoun, & Burge, 2004; Rijsman, 2008). It requires generativity in the elders towards nurturing the next generation. Reciprocally, the young have to identify to some extent with their elders in order to appropriate their previous experiences. If not, why would the adult make efforts to reach in what Vygostky (1934/1962) called the “zone of proximal development” of the child? And why would the learners wish to coordinate their actions with those of the experts to join in complex activities that are not theirs?

As Piaget, another of the forefathers of cognitive psychology, made clear: thinking requires also reciprocity between partners, their actions and co-actions; this is a condition for the co-construction of logical operations. Taking part in peer interactions that foster autonomy, initiative and reciprocal confrontations is important for cognitive growth and in turn contributes to the development of personality by offering ways to coordinate and equilibrate feelings and understandings with *values* and not only with the fear of authority and power (Piaget, 1947/1972). In order to develop an understanding of the world, the person has to engage in meaning making activity and, contrary to what Piaget might have suggested, this is not only a matter of “logics”, as Bruner well shows (Bruner, 1986, 2001). Pañ (1989) suggests that in fact the confusion between logical and symbolic processes can severely hinder both cognitive and affective development. Youngsters experience transitions (from childhood to adulthood), adults also (e.g. into parenthood, in employment shifts, etc.), and migrants face major changes. All these transitions require from the person not only the development of new competencies but also of symbolic resources that can help her to preserve a sense of integrity and that allow her to develop an understanding of the present, within a time perspective that includes past and future (Zittoun, 2005, 2006b; Zittoun & Perret-Clermont, 2002). How are these processes at stake in multicultural classrooms and how can the pedagogical design of the pedagogical settings sustain both learning and identity?

LINGUISTIC AND CULTURAL DIVERSITY IN THE CLASSROOM

In Switzerland, as in many European countries, most of the classrooms have always been multilingual because rare are the totally monolingual areas. For instance, in large regions the dialects are very present and, as a consequence, when children come to school they are invited to speak another language than the one they share at home or even on the playground of the school. In urban schools, migrations have brought together Swiss and foreign students of diverse linguistic origins. An interesting case, among many, is the observation in a vocational school

of Samedan that offers its training to an area of Graubunden, in the Alps of South-Eastern Switzerland, with disseminated populations speaking different languages (Willemin & Perret-Clermont, 2004; Willemin, Perret-Clermont, & Schürch, 2006). The teaching is officially said to be in German but in fact, the teacher cannot rely on German solely and, even unconsciously, continually paraphrases his teaching in the Swiss German dialect, in Italian or Rumanstch or asks the students to help each other with a translating.

Yet, the consciousness of the linguistic diversity does not seem to be an automatic process as will be made evident in other chapters of this book that show how training that sustains an increased awareness of the linguistic diversity in the classroom has a deep impact on the efficiency of teachers. I myself was quite impressed when, one day, of the late sixties, as I was visiting a school behind the railway station in one of the major Swiss cities, a teacher spontaneously shared with me her despair: year after year, she said, in spite of her efforts, she was experiencing a growing difficulty in teaching spelling to her students and losing faith in her capacities as a teacher. She took me into her classroom and pulled out of her cupboard the students answers to the last spelling test to show me the ever more numerous mistakes that they were making. We looked at them together, perceived some similarities in the errors made, but then discovered, to her surprise (and mine, as a consequence of hers) that many of her students were Portuguese children of very recent immigration and that this could explain their difficulty with not only spelling French but also mastering the oral language and understanding the daily activities in the class. In conformity with her professional *ethos*, she had been “fair” with each child, but with no awareness (this was not part of teacher training in the sixties) that the linguistic and social background of the students might require special attention.

For researchers also, the first step has then been to acknowledge the linguistic difficulties of allophone students in a mono-linguistic environment (Gretler, Gurny, Perret-Clermont, & Poglià, 1981; Perregaux, 2008). These were then discussed in light of the recent advances in sociological research on social class differences, language and control (e.g., Bourdieu & Passeron, 1970; Bourdieu, Passeron, & de Saint Martin, 1975; Bernstein, 1973; Lautrey, 1980). Interesting pedagogical interventions were then designed, such as those of Cecchini, Tonucci, Pinto, and Dubs (1972) or Cecchini and Tonucci (1973) who explored the positive impact of teaching in dialect in infant schools in order to gradually introduce the rural children to the use of the official Italian language. Titone (1973) impressed researchers, parents and teachers with his demonstration that bilingualism was not necessarily a handicap for the child’s development. Studies such as that of Rey-Von Allmen (1989) called attention to the importance of a good mastery of the mother language as a linguistic pre-requisite to the successful learning of the official school language. In certain schools special classes were devised to teach the official language to immigrants before integrating them in mainstream classrooms. And, in countries like Switzerland (Cesari-Lusso, Cattacin, & Allemann-Ghionda, 1996), Italian, Spanish and Portuguese embassies organized

special courses for their emigrants to assure some basic schooling in their native language (or national language as many of them were speaking dialect at home).

In parallel, discussions were open as to the interdependency between linguistic and socialization processes in immigrants. Py (1982, 1986) described the development of “interlanguages” in the communities of immigrants as they adapt to the local life. The interlanguage is characterised by interferences between the first and second languages that are not only (or not always) linguistic “errors”. They are also a form of linguistic and social competence in relation to the contexts in which the languages are practiced. They are the result of (conscious or unconscious) interpretative processes within the conversation that create (or do not create) a sense of familiarity with the events, of proximity between the interlocutors, thereby contributing to their identity.

Siblings of immigrant families were observed using the local language as “a secret code” to manage their projects among themselves out of parental control, or invested by their parents with (adult) roles, as interpreters and mediators of their relations to the local society and in particular to the school. This is a heavy load on a child’s shoulders and complicates his or her relations with teachers and parents.

The development of social psychological studies of language and communication contributed to clarifying that language is not only a means of communication but also a marker of identity (Bell & Gurny, 1989; Forgas, 1983; Giles & Hewstone, 1982; Giles & Johnson, 1987; Robinson, 1983). In a nice experiment, Doise (1976) observed adolescents from two different cantons with different regional accents of the French speaking part of Switzerland. In one experimental condition pairs of adolescents (one from each canton) played a cooperative game, and in the other a competitive game. Their talk was recorded and their accents are evaluated by external judges unaware of the design of the experiment. The results show that during the cooperative game, their accents tended to converge to a common one, whereas, in the competitive condition, their accents diverged to become even more typical of their own regions. This research shows again that differences are not reified characteristics of the individuals and groups but signs of dynamic processes at work in intergroup relations and social positioning. Of course, these processes are also at work, besides homes and playgrounds, in the classrooms, both for students and for teachers.

As a growing interest for social class and/or cultural differences as explanations for students’ successes and failures in schools was spreading among researchers and teachers, some authors called attention to the risk of distracting attention from the pedagogical processes at stake by offering simplistic external explanations to difficulties in the classroom. Prejudices and normative expectations of students’ performances are known to influence the teacher-students interactions (Gilly, 1980; Marc, 1984; Rosenthal & Jacobson, 1968). Benavente (1988, 1990) observed that teachers who had followed a course in sociology of education had transformed the sociological correlations observed between social class and school performances into predictors of school failure, which “excused” them in advance in the case of poor performances by their working class students. Likewise, Allemann-Ghionda, de Goumoëns and Perregaux (1999) remark that at some point the poor diffusion of

these sociological studies has become a source of difficulty: “What is considered the culture of the *other* (most often stereotyped), offers an inexpensive explanation to the difficulties encountered by immigrant students (...). It makes their situation worse rather than improve it. In doing so, the culture is defined as a group of closed, deterministic meanings, which are resistant to changes like other (sociological and psychological) variables as long as they are dealt with separately” (p. 419). Hence, it is important not to consider isolated variables, but to try to understand the communicational and identity related dynamics and the processes allowing people, engaged in an exchange, to negotiate its sense: “The cultural difference is not any more an absolute value. It becomes an aspect of a broader diversity that modifies the previous categorisations, themselves becoming fluctuant and open” (Allemann-Ghionda et al., p. 422). The classroom might then appear as a much more complex environment than previously imagined, but the counterpart is that a better understanding of this complexity opens possibilities for pedagogical action. This is what the present book does, taking the readers into very precise pedagogical scenes and offering them the possibility to see a display of the interactional and semiotic processes that allow for inclusive or exclusive practices.

If classrooms are more complex, then certainly daily life is also a very complex reality worthy of investigating to better understand the nature of the adjustments that immigrant or minority allophone children have to manage. Difficulties have been pointed out in the literature. But what are the resources that these children can draw upon and what are their successful strategies? In this perspective, Cesari-Lusso (1997, 2002) made in-depth interviews of second generation young adults revisiting their life trajectory. These interviews reveal the importance of the quality of interpersonal relationships outside the family, and of the meaning making processes around language as well as food, sport and other social practices that sustain identity formation, support in adverse situations, openness to novelty and, as a consequence, success at school. Zittoun (2006a) takes the reverse perspective and investigates how a successful team of teachers developed a school program to facilitate the transfer of school fostered knowledge and skills into daily life and first employment. It is a matter of language and communication skills, but also of self presentation, self assurance, respect for social codes (that have to be made quite explicit) and of mastering competencies that suddenly – in the face of a real job and thanks to the accompanying person who helps them to understand the situations met – become relevant. There is still a lot to learn about the (successful or unsuccessful) meetings of students’ lives with pedagogical offers. This book also presents explorations of the conflicts or synergies between school expectations and the social itinerary of the learners in search of self-assertion, meaning and time perspectives.

STUDIES OF SOCIAL INTERACTIONS IN MULTICULTURAL SETTINGS: A JOURNEY THROUGH IMPORTANT ISSUES RAISED IN THE BOOK

In light of the previous discussion, let us now turn to specific issues that are investigated in the coming chapters and point to interesting processes that they

shed light on. We will start with the consideration of the present debate on language in the classroom.

Language as a major mediation tool for learning

Obviously, when immigrant children enter the classroom not knowing the local language, the communication between them and the teacher and peers will be difficult. Not only for reasons of not sharing a common linguistic code, but also because the child might feel threatened in his/her identity. In their chapter, Abreu and Hale give a nice example of this when they tell about the effects of the mispronunciation of the child's name and the way this discrepancy is being negotiated to save the gender marking, the feeling of continuity of the self or the social integration in the local community.

When considering schooling, it is especially important to remember that language is not only a social marker of identity, it is also, as Vygotsky (1934/1962) made so clear, the most important mediation tool for learning. If this is now obvious to psychologists, it was not always so in teachers' representations, as van Eerde and Hajer's chapter makes clear. The degree to which an inappropriate mastery of the classroom language can hinder learning is likely to be underestimated, especially in school subjects like mathematics. It is striking to see, in these authors' studies, that the mere fact of sustaining in teachers (through the active participation of the teachers in the research process) a growing awareness of the role of language lends to learning gains in students. Yeager, Green and Castanheira have compared monolingual vs. bilingual classrooms, the latter organized in a way that offers students the opportunity to use their own language not only in accessing knowledge but also in managing social relationships, building the community, and discussing multiple language use and its constraints. They can show that inclusion is a construction and not merely a given when one enters into a classroom. But, more important to the point we want to make here, they also show that the (properly managed) possibility of using one's own language to learn, can improve not only the access to the academic content but also the quality of the student's writing in the second language, i.e., the mastery of both languages.

The language also mediates the social relationships of the students, and this is important because conversation types and behavioural styles deeply affect the learning possibilities offered by peer interactions (Psaltis, 2005a, 2005b). De Haan and Elbers' research illustrates how language creates asymmetries between minority students and their peers, and how these asymmetries can differently affect joint work. In the classrooms they study in the Netherlands, they observe that the majority of peer interactions in work groups are initiated by the native Dutch students. They also observe that most interactions are asymmetric. But interestingly, when the minority students of Moroccan education interact among themselves, their relations are more often symmetric than those of their other classmates. This allows them to better benefit from this progressive education based on group work. De Haan and Elbers also observe that during conversations about difficult and unfamiliar words in mathematics, symmetrical collaboration is

also more frequent, even in mixed groups. There is more to understanding the meaning of a word in the context of a math assignment than just applying knowledge of the language, and as a consequence, the minority students do not automatically turn to Dutch.

In a quite different perspective, Chronaki joins in this discussion by showing how an appropriate intervention can give Roma children motivation to learn math via opportunities to count in their own language. In fact, Chronaki goes far beyond the mere use of the Romany lexical repertoire. In her intervention, the children were into active roles (that reverse the low status and minority position that usually tend to reinforce their feeling of being outsiders), such as teaching the class to count in Romany and role-playing real-life situations selling and buying in the market-place. The Romany children are observed stepping timidly into such a shift of status, but then becoming enthusiastic and eager to progress. The other children were also very keen on continuing with these activities which they perceived as an opportunity to improve their own resources to interact at the market. This minutely documented example shows how much identity, identification with the teacher's role and modalities of peer interaction are important for learning. Socialization and learning are interdependent processes.

Socialization, classroom participation and learning

Beyond language competencies and status, the students' participation in the classroom is also formatted by the classroom culture and their own family education. Regarding knowledge and learning, different ways of acting are more or less legitimate according to gender, self-image, personal goals and time perspectives. Abreu and Hale observe self-imposed withdrawal and Remédios and Clarke describe students' silences that have different meanings according to their socio-cultural traditions: some have a preference for listening to the fount of knowledge (teacher); others have learned that they should be active and that they are expected to participate by asking questions and taking initiatives. They have different expectations towards the teacher's role. The cultural representations of what is instrumental to learn and succeed in school vary along these dimensions. Monteil (1990) shows that high achieving students do not fear displaying their performances in the classroom and that, when asked to, this boosts their performances. On the contrary, poorer students fear any public display of their thinking and are inhibited by any request to demonstrate their understanding in front of their peers. It is then particularly interesting to see how César and her group manage to create tasks that invert this trend for the low-achievers in the difficult school in which they work by implementing explicit and implicit "didactic contracts" (Schubauer-Leoni, 1996) that are more inclusive. This requires a lot of attention and designing because – Gorgorió and Prat also make a clear point on this – norms installed by the teachers shape actions but never directly because they are interpreted by the students through their own personal and cultural lenses. One of César's students, once used to the new expectations of the implemented didactic contract, goes so far as to comment that it is almost like starting a new life in

school, and he gives many examples of the consequences that this change has for him in many aspects of his life, even out of school.

Socialization is also a matter of appropriating and sharing power, a more or less legitimate behaviour not independent of social positions, including gender, even on cognitive matters as Psaltis' studies show (Psaltis, 2005a, 2005b) Teachers themselves are more or less eager to share their knowledge with all children and have their own representations of who "deserves" more attention or tolerance. In the way they manage their classroom they construct the role of a legitimate participant. For instance, Gorgorió and Prat report on what makes a valid math interlocutor according to some of the teachers in the study. They show that, as a consequence, non participation can be aligned with the classroom discourse hence jeopardizing some learning opportunities.

TEACHERS' ROLE, INSTITUTIONAL DEMANDS AND SPACE FOR THINKING AND LEARNING

We have just seen how the teachers' management of the classrooms defines who the legitimate participants are. The security and sense of respect offered by the pedagogical setting for self-image affect the possibility for students to engage into non-defensive reasoning (Perret-Clermont, 2005b; Perret-Clermont & Iannaccone, 2005). But the teachers are not always free to construct these settings, and they act according to different value systems. They are not independent but under contract with institutions that have different social and economical goals, and that might hold very different expectations.

Williams, Black, Hernandez-Martinez, Davis, Pampaka, and Wake compare the management strategies of teachers in two districts that assign different tasks to their staff, notably via the audit system. As a result, in the first district which has a competitively minded middle-class recruitment, the teacher is observed focusing on the preparation of exams and giving (procedural) tricks to succeed at these exams; whereas in the second district, the teaching is more subject oriented and fosters the joy of solving problems, testing one's reasoning, and learning to develop criteria for deciding who is right. The intellectual socialization of the children described by Williams and his associates is tightly dependent on the institutional rules that govern the school management.

These institutional (sometimes tacit) rules can also fail to provide support to teachers even when hired to fulfil specific goals. This is the case in the research presented by Hirst, Renshaw and Brown in which an Indonesian language teacher is seen having a very hard time gaining students' involvement. His lessons are considered very important for ideological reasons, but the pedagogical scene in which he intervenes does not give much value to his work and, in particular the head teacher does not support him in front of the students and even despises him at times. Beyond the weakness of his institutional position, a second problem arises that is not easy to negotiate in such a setting: the different cultural definitions of the role of the teacher as an educator. The Indonesian teacher expects self-control even from young students, while the Australian students and head teacher seem to be

used to having the teacher continuously in charge of controlling their desires to over-ride the rules and frames of action.

A quite different situation is the one observed by Kumpulainen, Toom, and Saalasti in which the set up foresees a special secure space for teachers to share their understandings, observe the effects of different practices and enhance the opportunities for reflexion around shared videorecordings of their teaching. Mutual respect among these adults, as in the case of respect towards students in César's research, is seen to enhance the person's availability for changes in attitudes and learning or professional development. Social recognition, both at the interpersonal and at the institutional levels, is a very important element for personal growth.

IDENTITY, MOTIVES AND AGENCY

Learning can be sustained by aspirations of the parents (see for instance the role of the father in the case reported by Alrø, Skovsmose, and Valero), and by vocational choices within a time perspective (Abreu & Hale; César). But these are not sufficient. The learners need to be able at each step to keep links with the past and a feeling of continuity. Some practices do not help at all because they are disruptive to language or other components of the self (Abreu & Hale). In this respect some students are caught in contradictory motives or even double-binds. This seems to be the case for the Muslim female student from the study by Alrø and her associates who was deeply committed to her studies and scholastic achievements, stimulated by her father who wants her to enter into "modernity" and in that perspective to succeed in school. But the school has no space to let this growing adolescent comply to her desire to imitate her mother's tradition in the public presentation of herself as a (veiled) woman. How can she deal with this contradiction in the very depths of her being? The religious group she belongs to makes this problem a question of faith. She is then entangled in contradictory forces active in herself, in her parents and emanating from both institutional frames (school and religion). The legitimacy as a learner has roots also outside the classroom and can be put at risk by the intergroup relations in society.

Alrø and her associates talk of a "process in which persons make the decision of engaging in getting to know". Activity must make sense. It should be compatible with the assigned roles in and out of school. It is important that the learning be meaningful not only in the classroom but also beyond for the young to become committed to these efforts. Moreira calls attention to the relations between school success and experiences of citizenship. The value of school for the parents is linked to their own experience of having taken successful responsibilities in the community, making therefore relevant a series of competencies that are enhanced by schooling. Similarly the Roma children studied by Chronaki involved their peers positively into the classroom activities once they had understood the newly created link between these and their daily lives. César enhanced the students agency by having them participate not only in the learning but also in the research process itself, an opportunity to feel respected, appreciated and a chance to develop metacognition in the learning strategies and their possible goals.

... BUT NEVER GIVE UP!

Agency in learning associated with discourse that creates room for initiatives and shared power is an important component of a learning scene both for students and for their teachers.

This book is full of descriptions of interesting cases in which children become actors of their own learning and lives, experiencing inner and outer conflicts and learning to deal with them. But as one of the students reported by Abreu and Hale so vividly states: “never give up!” Persistence seems to be a dominant trait. No magic stick ever definitely transforms a person into a successful learner: learning is at times an anxiety producing process that requires changes at all levels of the person (cognitive but also emotional, social and/or spiritual) within a timeperspective (Perret-Clermont, 2005a) that is partly dependent on societal changes but also on the capacity of the student to construct a sense of continuity (Zittoun, 2006b).

If the student in Abreu and Hale’s story is quite conscious of her aspiration to “never give up”, this might not suffice. Social support is required. Van Eerde and Hajer, Chronaki, and Kumpulainen and her associates and still others have all shown how their investigations are not only observations but that they have an impact on teachers and in children’s learning. César makes here a very important point: as researchers have an impact on students’ learning and projects, in close connection with their feeling of agency and life perspective, this also means that they have a responsibility in the long term. As a consequence, more should be learned about “the ethical awareness and care researchers need to have while they are studying minority cultures, being particularly sensitive to the ways in which they leave the stage when the research process is over” (César, 2009).

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INTER-VIEWING FOREGROUNDS: STUDENTS' MOTIVES FOR LEARNING IN A MULTICULTURAL SETTING

INTRODUCTION

In Denmark people of different ethnic ascendant than Danish have been target of political debate in a time when the dominant Western culture has come in conflict with non-Western worldviews. Nowadays the overall public discourse of mistrust and sometimes almost hatred against 'those-who-are-not-like-us' permeate many spheres of social life, among others schools and classrooms. In the educational arena 'immigrants' are constructed as problematic, and multilingualism as an obstacle that needs to be overcome. Assimilation perspectives seem to prevail against multicultural inclusive approaches to educational practice.¹ This general public discourse is not foreign to teachers and students, and in many occasions it gets embedded in and becomes reconstructed through the daily practices of people in schools. These discourses meet the lives of concrete people such as Razia, a female 8th grade student who recently migrated to Denmark from Iraq in the prelude of the 2003 war. Public discourses, social structures, institutional arrangements, educational practices and flesh-and-bone people's lives intermesh and give birth to concrete learning possibilities and life opportunities. It is this complex intermeshing that attracts our attention.

For us as educational researchers with a concern for social equity, studying the multicultural classrooms has become a must and a challenge. First, we see the necessity of unpacking practices and understanding them from perspectives that may represent an alternative to the homogenizing rhetoric of cultural assimilation of different peoples' values and worldviews into a dominant Danish culture. Second, we face the difficulty of researching practice from a multi-layered perspective that invites to the maintenance of complexity. Our research intentions in the area of multiculturalism are then to engage in both conceptual and empirical investigations that allow us to understand education in settings of diversity and to envision alternatives to existing practices. Even if we focus a great deal of our investigation in the context of mathematics classrooms, we have a broad approach

¹ See Alrø, Skovsmose and Valero (2005).

that transcends the specificities of mathematical cognition and enters the socio-political arena of (mathematics) education. Although we in this study refer to a particular Danish context, we find this could reveal many of the problems experienced by immigrants in other societies who are met by a those-who-are-not-like-us discourse.

In this chapter we want to concentrate on the notion of *foreground*, and on the empirical study of it. The notion of foreground refers to a person's interpretation of his or her learning possibilities and 'life' opportunities, in relation to what the socio-political context seems to make acceptable for and available to the person. Students' foregrounds are part of a *learning landscape*, which we define as a set of inter-related dimensions implicated in the constitution of mathematics education practices. Thus, we find that foreground can be helpful in illuminating students' participation in educational practices. Based on an empirical study of students' foregrounds in a group of 8th grade students (ages 14-15) in Mælkevejen Skole (pseudonym), a multicultural school in Denmark, we examine the case of one student, Razia (pseudonym), as a means of exploring the significance of the notion of foreground in understanding her intentionality for engaging in (mathematics) learning. We start the chapter by addressing the general theoretical and methodological framework that we adopt in our study of multicultural education. We continue with the examination of the notion of foreground and identify some of its characteristics. We then enter into a discussion of the particular methodological approach that we have developed for the investigation of foregrounds. We proceed with the presentation of Mælkevejen Skole and of Razia, and analyse and interpret her foreground in terms of a learning landscape. We conclude with reflections about the relevance and limitations of the notion of foreground for the investigation of students' learning possibilities in multicultural situations.

A MULTIDIMENSIONAL PERSPECTIVE ON MULTICULTURALISM

Cultural diversity has always been present in Denmark – as much as in any other society. However, the recent increase in the immigration of people from non-European, non-Western countries has exacerbated the discussion of cultural difference and multiculturalism. Unfortunately the tone of such discussions has not necessarily been positive. Rather, it has been loaded with expressions of fear, hatred and discrimination (Mørck, 2006; Staunæs, 2004). In such a context it has been important for us to clarify our understanding of notions such as culture, diversity and multiculturalism.

We adopt a conception of culture that refers to “the ever-changing values, traditions, social and political relationships, and worldview created and shared by a group of people bound together by a combination of factors (which can include a common history, geographic location, language, social class, and/or religion), and how these are transformed by those who share them” (Nieto, 1996, p. 390, cited in Nieto, 2002, p. 53). The term cultural diversity refers to the fact that there is not a single and homogeneous culture shared by all humans, but that there are many

different cultures co-existing and that one person or a group actually participate in many different cultures simultaneously.

Furthermore, we understand cultural diversity as a dynamic construction constituted in relation to activity. That is, a person or a group of people belong to and participate in different cultures in relation to individual or collective activity. In certain practices in a particular context, people may adhere to the values, traditions, relationships and worldviews that are defined by the field of practice within which the activity they engage in is located. This implies that individuals and groups may identify themselves with more than one culture at one given moment, that they may share one or more of these cultures, and that such an identification with cultures is changing not only with time (as suggested by Nieto), but also according to activity and situation (as suggested by Gullestrup, 2003).

A mathematics classroom, for example, is a space where several more or less well-defined cultures, literally speaking, sit next to each other. This means that participants in classroom activities, teachers and students, construct different groupings and share different cultures around a variety of elements such as their origin, mother tongue or second language, mathematical ability, gender, religion, political orientation, musical likes or dislikes, membership to sport clubs, future possibilities, etc. These cultures come in place in different times according to the activity being carried out in the classroom. The formation of different cultural groups is related to the collective dynamics of activity in that class, while the role that each person plays in those groups is related to the individual construction of identity through participation in activity (Stentoft, 2008). It is in this interplay between individual and collective construction of groupings and identity that the classroom interaction becomes a social space for cultural encounter.

If multiculturalism is seen not only in relation to diversity of people but also in diversity of activity, then the study of educational practices in multicultural settings should be carried out in a way that allows grasping the multiplicity of spaces in which such diversity is constructed and expressed. We devised the notion of *learning landscape* as a theoretical and methodological construct that takes hold of the dialectic constitutive relationship between a research perspective and a research object. As a research perspective the notion responds to the view that (mathematics) education is a set of complex social practices constituted in a multiplicity of sites of action.² This perspective implies the construction of a research field as a network of dynamically interrelated, interdependent sites of mathematics education. As a research object, the learning landscape allows pointing to the research foci of particular theoretical and empirical studies. Inspired by recent research findings about (mathematics) education in multicultural settings

² We are inspired in the concept of network of mathematics education practices (Valero, 2007) referring to the whole series of practices, in multiple sites and at multiple levels of action, where the social meaning of the learning and teaching of mathematics is constituted.

and based on our observations in classrooms and schools,³ we have selected the following nine dimensions of our learning landscape:

1. *Students' foregrounds* are the students' interpretation of their learning possibilities and 'life' opportunities, in relation to what the socio-political context seems to make acceptable for and available to them (Alrø & Skovsmose, 2002; Skovsmose, 1994, 2005a, 2005b; Valero, 2004).
2. *Students' construction of identity* in their participation in educational and learning spaces, in particular in relation to the diversity of cultural elements available in those settings (Abreu, 2005; Chronaki, 2005; Gorgorió & Planas, 2005; Sfard & Prusak, 2006).
3. *Teacher's perspectives, opinions and priorities of teaching* which format not only teachers' instructional activity but also their general role as educators of a group of students (Andrews, Yee, Greenhough, Hughes, & Winter, 2005; César & Favilli, 2005).
4. *The content of learning*, in our case the mathematical topics for classroom interaction, including forms and priorities for how mathematics should be taught and learnt (Chassapis & Chatzivasileiou, 2008; Powell, 2002).
5. *Tools or resources for learning* that students and teachers might have available and might consider relevant for the learning of mathematics (Borba & Villarreal, 2005).
6. *Classroom interaction* among students and between students and teacher through which classroom cultures are constituted and expressed (Alrø & Skovsmose, 2002; Gorgorió, Planas, & Vilella, 2002).
7. *Parents* who serve as role models or authorities for students' priorities in relation to learning and schooling (Civil, Planas, & Quintos, 2005; Hawighorst, 2005; Gutstein, 2003).
8. *Friends*, who are reference groups for the construction of students' identities (Baber, 2007; Bishop, 2002).
9. *Public discourses* about immigrants, schooling and multiculturalism and their repercussion in school practices (Baber, 2007; Martín-Rojo, 2003).

Each one of these nine dimensions can be an entry point into the study of (mathematics) education in multicultural classrooms. Since all dimensions are interrelated and interdependent, the study of one dimension will inevitably throw light into the other dimensions, to a greater or lesser extent. In Figure 1, we represent the learning landscape with a nine-petals daisy. Each petal bears each one of the nine dimensions above, and the flower head bears common contextual

³ In our project *Communication, conflict and mathematics education in the multicultural classroom* (Alrø, Skovsmose, & Valero, 2003; Skovsmose, Alrø, & Valero, 2005) we have carried out a diversity of empirical studies in schools and classrooms and we have found resonance between our observations and the nine elements selected for this landscape.

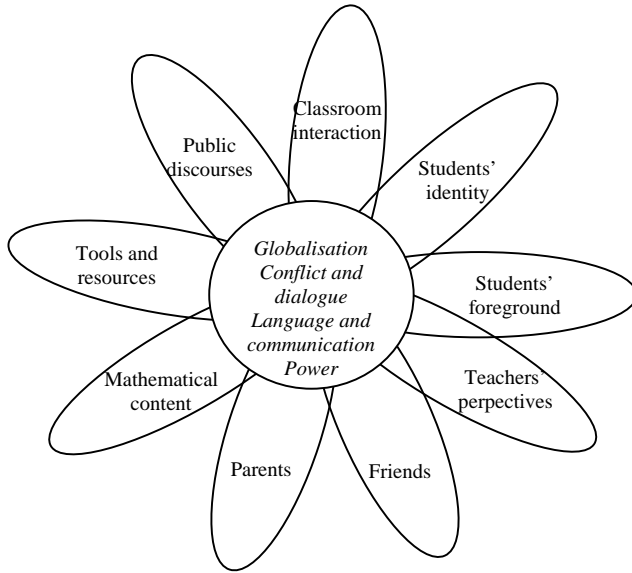


Figure 1. The learning landscape

factors such as globalisation, conflict and dialogue, language and communication and power, which we consider to be important in our socio-political perspective on multiculturalism.

In this chapter we concentrate on the dimension of *students' foregrounds*. We will present the conceptual definition of this element, and we will describe the way in which we have investigated it in relation to the whole learning landscape.

FOREGROUNDS AND DISPOSITIONS FOR LEARNING

The notion of *foreground* (Skovsmose, 1994, 2005a) refers to a person's interpretation of his or her learning possibilities and 'life' opportunities, in relation to what the socio-political context seems to make acceptable for and available to the person. Thus the foreground is not any simple factual given to the person; rather, it is a personally interpreted experience of future possibilities within the social and political frame within which the person acts.

We find this notion to be of relevance for educational research because it allows linking different key conceptual elements of educational theory. First of all, foreground is related to *learning* through the construction of dispositions. We consider learning a process in which persons make the decision of engaging in getting to

know. Learning, therefore, is an act. Learning-as-action can only take place on the grounds of the person's *dispositions*, that is, on the person's readiness to find motives to engage in action. Dispositions can be seen as the constant interplay between a person's *background* and *foreground*. The background of a person is the person's previous experiences given his or her involvement with the cultural and socio-political context. In contrast to some definitions of context which see background almost as an objective set of personal dispositions given by one's positioning in different social structures, we consider background to be a dynamic construction in which the person is constantly giving meaning to previous experiences, some of which may have a structural character given by the person's positioning in social structures. The foreground, as previously defined, is also an element in the formation of dispositions. The person is all the time finding reasons to get engaged in learning activities not only because of the permanent reinterpretation of his or her background, but also because of the constant consideration of his or her foreground. That is, the person connects previous experiences with future possible scenarios for action.⁴

Second, foreground is also a central element in the creation of *meaning*. A condition for a person making the decision of engaging in the act of learning is that the activity makes sense, that is, that the person finds and constructs a meaning. Much of the discussion of meaning in education is related to whether students can engage in cognitive and emotional processes that allows for the expansion of the referential basis of existing and new concepts and, therefore, lead to the construction of meaning. Some other trends emphasize the dimension of meaning of educational activities in relation to the utility and applicability of school knowledge in real life situations. The notion of foreground highlights the fact that meaning is not only a function of what the student has already cognised, but also and especially of the student's dreams, illusions, aspirations and perceived realistic possibilities for his or her future life.⁵

Third, foreground is a concept that emphasizes the *socio-political nature of education and learning*. A person's intentions and dispositions of learning grow in the tension between individual preferences and interpretations and socio-political framings and contexts for individual action. A foreground does not represent an unrealistic interpretation of dreams and desires of what the person would like to be or become in a future; rather, it is based on a realistic consideration of what the person perceives to be his or her chances in the future given what the context shows the person to be possible to attain. This does not mean that we see a structural determinism of socio-political structures on the individual. The notion points to the dialectics between individual agency and structure as one of the central elements in interpretations of people's engagement with learning, and for their association of meaning to what they might be engaged in Valero (2004).

⁴ For an extended discussion of these ideas see Skovsmose (1994, 2005c) and Alrø and Skovsmose (2002).

⁵ For further discussion of the issue of meaning and foreground, see Skovsmose (2005b).

Even if until now we have referred to the concept in singular, from now on we would rather talk about foregrounds in plural. Thinking about concrete students, we see that a person can actually develop *multiple foregrounds*, as a foreground can be acted out in different ways, depending on the situation. A person does not necessarily maintain a universal foreground, but he or she could switch between different foregrounds. To a 14-15 year-old teenager, dreamy and realistic elements may be switching. Depending on the situation different foregrounds could be brought in operation and in this way serve as motives for actions and for bringing intentions-in-learning. For a teenager, foregrounds could also include more provocative elements, in particular brought in operation when one of the parents is present.

Foregrounds then are changing, and we can observe a strong discontinuity. Suddenly a new way of looking at one's possibilities can emerge. This can, for instance, be due to change in the social environment or to becoming friends or to falling in love with a person from the neighbourhood. New motives for learning can emerge, apparently out of nowhere. This means that a foreground is not a particular 'thing' which we as researchers could hope to discover in a proper way. It does not make sense to ask: What is the real foreground of a person? We do not expect any particular psychological 'entity' to correspond with the expression 'foreground'. (In this sense 'foreground' is similar to the 'mood' of a person.) Foreground is a relational construct; it becomes acted out or manifested differently in different situations and with reference to different groups. Still, we see foregrounds as something 'real' in the sense that it has implications for motives, decisions and actions (just as a 'mood' is real).

Immigrant students' foregrounds might contain elements that are less common in the foregrounds of other students. This could be related to the possibilities that are unfolded in the meeting of backgrounds and new situations. As any student or any person immigrant students experience possibilities or lack of possibilities. However, immigrant students might experience that a different set of opportunities are available for them because they are socially positioned outside of the dominant culture. They might experience what we could call 'immigrant possibilities'. In a study conducted by Sikunder Ali Baber, immigrants' view of their possibilities appears to be polarised: either one becomes successful in school, or one gets to the bottom (Baber, 2007). There is no convenient middle road accessible to immigrants. We are not going to judge to what extent this statement might be 'true'. The point is, as emphasised by Baber, that it is a general experienced phenomenon among, for example, Pakistani immigrants in Denmark.

At the moment we are not able to formulate any clear-cut thesis about the foreground of immigrant students with respect to mathematics. However, we could imagine different possibilities. It might be that mathematics (not least in the school mathematics tradition) constitutes a neutral ground where cultural differences are not accentuated, meaning that immigrant students could find a refuge in the mathematics classroom. Or it could also be that the mathematics classroom represents a site for lost opportunities for learning from diversity. However, instead

of speculating let us give attention to our empirical investigations of foregrounds in search for more elements of analysis and conceptual clarification.

RESEARCHING FOREGROUNDS

When studying foregrounds we must consider the role of the researcher as well as the role of 'others' in a foreground investigation. Could the researcher and the researching disturb the student's foreground in such a way that it is not the proper foreground that is expressed? The use of the word 'disturbing' might be misleading. The concept presupposes that some particular (or 'true' or 'authentic') foreground can be excavated, and as we have pointed before, we suppose that foregrounds exist as constructions but not necessarily that they can be found in any 'true' or 'pure' form. It is also possible to think of 'disturbing factors' as being 'constructing factors' because foregrounds become experienced by being disturbed in interaction with others. This has implications for how we conduct our empirical research. We can think of engaging students in different manifestations of their multiple and dynamic foregrounds. This means that an active interviewing by the researcher need not be seen as a disturbance of what the foreground 'really' is, but could be seen as a way of revealing and co-constructing multiple foregrounds. Steiner Kvale (1996) has used the expression inter-viewing. We find that this elegant formulation of 'seeing together' condenses nicely our approach to researching foregrounds.

From the part of the researcher, we do not investigate students' foregrounds as an 'objective' phenomenon in order to obtain 'validity' in the research. The students in our research have an authority to construct their own foregrounds. His or her statements can be interpreted as manifestations of his or her foreground. This makes it possible to consider *dialogue* as an adequate research approach (see for example Stenoft, 2005). We are searching for perspectives, which are within the reach and capacity of the student. Through dialogue and collaboration perspectives can be stated, examined and challenged, and the participants can get to examine their own thinking more clearly. Therefore, we think of dialogue as a methodology for inter-viewing foregrounds.

Based on the previous general methodological principles, our foreground investigation follows some guidelines: The students participating in the study should be about 14-15 years old. This means that we look for the teenager's 'sensitive' preoccupation with where to go in life. Foregrounds are one of the dimensions of the landscape in which (mathematics) learning unfolds; therefore, the investigation of foregrounds is closely related to the investigation of some of the other components of the learning landscape mentioned previously. Researcher and participants engage in a dialogue through which future possibilities are under discussion. In this dialogue there are different possibilities. The inter-view can be carried out individually or in couples depending on the students' choice. The topics of conversation are not fully prescribed but can emerge from the conversation or from the active questioning of the researcher. For example, although crucial for our

investigation of foregrounds, mathematics may not pop up immediately in a foreground inter-viewing. This means that the dimension of mathematics may not surface so easily in the students' perspectives. A more active questioning can be important, and we do not see an active challenging as foreign to our research approach.

The particular material we want to present in the following is one of the multiple empirical investigations that are connected to our learning landscape and to the notion of foreground.⁶ This particular study took place in Mælkevejen skole in a city in Denmark. After establishing contact with the school and two mathematics teachers in 8th and 9th grades, there was an agreement on the participation in the study of two 8th grades classes, in total 42 students. Helle Alrø conducted the study during the Fall 2004.

This inquiry contained five phases. In a first phase of 'Getting in contact', the researcher, Helle Alrø, introduced herself and the study and asked students for their consent to participate in it. It was emphasized that the anonymity of students in the study would be maintained. The researcher joined their mathematics lessons for a period of two weeks and during the breaks she small talked with the students about herself and about the students' interests and what they were doing.

In a second phase of 'Looking into the future', the main issue addressed was how the students imagine themselves in the future. The researcher introduced this second phase by a series of guiding questions that were supposed to make the students imagine themselves and their lives in ten years: What would they look like? Where would they live? With whom would they live? Who would their friends be and what would they do together? Would they go to school or to work and if so which kind of school or work? What are their strengths and resources? Did they get any help to reach what they wanted and were there any hindrances in their way? After this guiding, the students were asked to write a short story about themselves and their lives as they imagined the situation in ten years.

In a third phase of 'Looking at the mathematical content of the imagined future', the researcher intended to explore if there were or could be any 'learning motives' that connect mathematics in school and possible out-of-school activities and practices. In this third phase students completed a questionnaire about how they value going to school and learning mathematics, if learning mathematics involves doing exercises, project work or working with computer, if they are good at mathematics, if their parents and their teacher think that they are good at mathematics, if they think that mathematics is important for their everyday life and for their future, and if they talk with their friends about their future and know of each other's future plans. The students were supposed to mark their answers at a 5 point scale.

⁶ We are also conducting foregrounds investigations in quite different contexts such as that of students in indigenous communities in Brazil (Skovsmose, Alrø, & Valero, 2007) and students in a Brazilian favela (Skovsmose, Scanduzzi, Valero, & Alrø, 2007).

In the fourth phase of 'Exploring the students' foregrounds', the researcher inter-viewed the students, individually or in couples, after having examined the stories and questionnaires of the students, produced in the previous phases. Together they explored different issues in the previously produced material that seem important to the students or to the researcher. As regards the questionnaires the students were asked to elaborate especially on issues that they had given either a high score (5) or a low score (1). In this dialogue the students also told about their present teaching and learning of mathematics, although they did not always use the term 'mathematics'. The point is that different notions of 'mathematics' get in operation in this phase: An 'ethnomathematical' understanding makes it possible to see mathematics everywhere, while a strict 'school mathematics' understanding identifies mathematics more or less with what is experienced in school. So instead of asking for 'mathematics' the researcher asks questions using terms such as 'counting', 'estimating', 'judging numbers', 'measuring', etc.

Finally, the research team inter-viewed the two teachers and asked them to give a guess of what the students would like to do after finishing 9th grade. The two teachers shared with us their views about each student, his or her strengths and weaknesses, and a guess of what they could be good at and would like to do in the future, based on their appreciation of students' capacities. The intention of this conversation with the teachers was having a background material about how the teachers see the students' foregrounds.

The material produced through the five stages of the inquiry has been analysed by all of us in order to identify elements in the foregrounds of students that give an indication of their relevance for the learning of mathematics. Our approach to analysing the inter-interviews refers to pragmatics in the philosophy of language (Austin, 1962; Searle 1969; Wittgenstein, 1953) and its interpretation in linguistic pragmatics and socio-pragmatics (Levinson, 1983; Wunderlich, 1975). Thus, the issue of analysis is the use and function of verbal and non-verbal language in context. This qualitative analysis of data includes descriptions and quotations as a basis for interpreting the meaning production in context. The data of analysis is language in use, and our interpretations can be validated in the quotations and perhaps be challenged or analysed differently from other research perspectives.

The analysis strategy has also been to connect particular elements of the foregrounds to the other eight elements of the learning landscape that we have defined in our research approach. In this way we expect to understand the notion and its significance in the study of multicultural settings. In what follows, we concentrate on the story of Razia, a Muslim girl from Iraq. When telling this story we want to include the context in which the inter-interview takes place, and we want to present and analyse the voice of Razia in this context. On the basis of the empirical analysis, we discuss how the dimension of foreground relates to other dimensions of a learning landscape.

MÆLKEVEJEN SKOLE

Mælkevejen Skole is a primary and lower-secondary school situated in a suburb of a bigger Danish city with about 200,000 inhabitants. This suburb, as in many other Danish cities, rooms a high concentration of immigrant and low-income population. However, the multicultural reality is the reason for our interest in that particular suburb and school. The school buildings are one-storey houses made of concrete during the 1970s. The school area is rather big consisting of several houses. In one we find the 8th grade. In this building there is as well a computer-lab, which at the time of the research was temporarily closed because of hooligan acts. In the middle of the building there is a hall with tables and benches that is used for group work during the lessons and for relaxation during the breaks. There are also two tables for table tennis available. The walls are decorated with students' art works, and there is also a table of rules:

1. You are allowed to stay in the classroom, in the hall or outside during the breaks.
2. The classroom doors have to be open, and indoor activities have to be quiet.
3. You are allowed to play music in the classroom during the breaks.
4. You are not allowed to play ball in the hall.
5. You are not allowed to have visitors from other houses [meaning other sections in the school, for example from the higher grades section].
6. You are allowed to go to the skate, soccer and hockey grounds during the breaks, but please remember to be back in time.
7. You are supposed to talk politely both to children and adults.
8. The building is a non-mobbing zone, and please tell an adult person if this is not respected.
9. The school area is a non-smoking area.
10. Students under the 8th grade are not allowed to leave the school area without permission.

Arriving to the school the researcher, Helle, enters the big hall, crowded with students during a break. A quick view of the multitude indicates that there are lots of immigrant students. A couple of girls from the 6th grade approach the stranger and show her the painting on the wall reading 'Welcome' in very many languages. Mælkevejen Skole hosts students from 29 countries from all over the world. When immigrant students first arrive to the school they start in 'receiving classes', from where they move on to 'normal classes' whenever their teachers consider that they have sufficient language and subject-matter skills. "Immigrant students have very different school experiences. Some are not able to read and write in their mother tongue while others are way ahead of the educational level they are supposed to join", a teacher explains.

In one of the 8th grade classes there are 24 students of which half of them originates from other countries than Denmark. They come from Somalia, Iraq,

Greenland, Lebanon, Turkey and Vietnam. In the classroom, however, there are no artefacts that indicate the manifold of a multicultural classroom, except for the names on the students' pigeon holes. Sitting as a stranger in the classroom for at couple of weeks, it has not been possible to observe any explicit focus on cultural diversity, neither from students or teacher. There is a serious climate of work and a good sense of humour among the students and between teacher and students. A Vietnamese boy replies (in Danish) to the observer's asking to borrow a chair at his desk: "Yes, please, but you cannot sit next to me" he says with a smile, but in order to explicate his sense of humour he promptly adds: "Of course you can sit here, I was just joking."

Two girls from Turkey sit next to each other and chat in their mother tongue, and so do the two newcomers from Greenland. Razia, a Muslim girl from Iraq, sits at the back of the classroom next to Fatima (pseudonym), a Somali girl. The teacher begins the lesson by checking if everybody is present. Then he goes to the blackboard and begins to lecture. After introducing the subject the students work individually with exercises in the textbook, while the teacher facilitates their efforts. The classroom interaction and the teacher's practice share many of the characteristics of what we have called a traditional mathematics classroom (Alrø & Skovsmose, 2002, p. 24).

DO NOT LIVE IN DENMARK! RAZIA'S FOREGROUNDS

Razia is a short girl with dark brown eyes. Her hair is covered by a black headscarf. At Mælkevejen Skole dress code is free except for head clothing that is only allowed for religious reasons. Razia has a kind of grave look in her face, and she does not speak very much in class. When the teacher asks her a question she gives a polite and short answer. Helle thinks that maybe Razia does not speak Danish very well, and she seems to be confirmed in this interpretation when she looks at Razia's story about her future life.⁷ She wrote one thing only: "Do not live in Denmark!" In contrast to the answers by other students, even those who may not know so much Danish, this statement without further explanation puzzled us. This short but apparently confident answer was the reason for our special interest in inter-viewing Razia and coming to know about her story. What does the exclamation mark indicate?

With these impressions in mind Helle meets Razia in the hall. They have to walk from one end of the school to the other to get to the room that is available for the inter-view. Razia seems eager to start talking about herself right away, and Helle asks her to wait a little in order to get everything taped. Helle asks her if she remembers the questionnaire and the story telling she made two weeks ago, and she is very well aware that she wrote: "Do not live in Denmark!"

⁷ The story produced by students in the second phase of the foregrounds investigation.

Razia has lived in Denmark for 1 year and 7 months. She started going to school in the 'receiving class', and she has been in a 'normal class' for 3 months only. Razia speaks Danish perfectly well. She moved to Denmark with her parents, four brothers and an uncle. They moved because of her father having political problems in Iraq and because of the war. Razia is 100% certain that she will not stay in Denmark. She wants to go back to her family in the northern part of Iraq (she is Kurdish). But she will not return now because of the war.

There are many things that Razia does not like about Denmark, she says, but after a while she corrects herself:

Razia: The only thing I have is the headscarf [...] Well, this is the only problem I have.

As we will see in the following analysis this problem has serious consequences for Razia's foregrounds. In the following, we present fragments of the inter-viewing between Razia and Helle, not in chronological order, but in a reorganisation that allows illuminating the other dimensions of the learning landscape as we have presented them previously. Although the whole investigation is a foreground investigation, we structure the following according to the dimensions of our learning landscape. So, first a few remarks about foreground.

Student's foregrounds

Razia likes to go to school. She is especially fond of learning Danish. And she really is incredibly good at speaking it! From the questionnaire⁸ it can further be seen that she considers school in general and learning mathematics in particular as very important for her future. At the same time she has low estimates of her own competencies in mathematics and she thinks that both her parents and the teacher agree with this.

Razia likes school, because she wants to follow further studies, she says. So going to school seems to be closely connected to her foregrounds, although she does not exactly know what kind of education she wants to pursue. However, the idea of becoming a nurse shows up late in the inter-view. Razia is well aware of the importance for a Muslim woman of being educated. Her parents have a big say in this question. Her father has directly told her to get an education. Her father's opinion must be of big importance, since Razia elsewhere claims that in her culture it is not possible to say no to one's parents. More important, maybe, is her perception of her mother's situation. In some sense, she does really not want to be like her mother:

⁸ See description of the third phase of the foregrounds investigation.

Razia: ... my mother, she has no education. So she says, “I do everything for you. You are having an education. You should not become like me.” [...] Because in Iraq, if you don’t get an education, then you marry early. My mother got married when she was 14 years old. And therefore she is afraid.

Getting an education is very important to Razia. And she is very realistic in speaking about it. In Iraq it is rather difficult for a woman to get educated, especially in the part of the country where she lived. So she is quite clear of the fact that she wants to get educated in Denmark before she goes back to Iraq in the future.

Students’ identity and cultural diversities

The headscarf is a symbol of religious diversity that Razia has chosen herself and that she wants to maintain: “It is in *my* religion. I have chosen myself to wear it.” In this condensed formulation, the word ‘it’ refers to the headscarf and to religion. The headscarf becomes a marked symbol of religion, indicating that a prohibition against the use of headscarf can be experienced as a prohibition against a religious belief. The headscarf is the physical expression of Razia not being a Dane, and this is part of her argumentation towards people who do not seem to like her headscarf:

Helle: What do you say then?
Razia: Nothing. Then I just say I am *not* Danish.

Razia emphasises that she is *not* Danish, and she wants to maintain her religious and cultural identity by keeping the headscarf. It is her conscious choice. However, she is perfectly well aware of the consequences it might have for her future life in Denmark:

Helle: Yeah. ... But is there more to it than the headscarf? Are there more things where you don’t think people accept you?
Razia: Work!
Helle: Work?
Razia: I have also thought about that. [very quietly]
Helle: How?
Razia: That one can’t get a job.
Helle: That one can’t get a job?
Razia: Yes, we have talked about it with Susan [...] We have talked about it in the Language Centre with a teacher. She said to me that I can’t get a job or a good education maybe ... that I can’t get an education and so. Then I just said hum, well... I have chosen myself to wear this...

Razia is coping with big issues. Her headscarf might cause her troubles getting educated and getting a job in Denmark. Her headscarf plays an important role for how she constructs herself and for her foregrounds. Razia is well aware that keeping the headscarf is her own choice of holding to her religion and national values and she is not willing to give them up. To Razia the headscarf symbolises her personal and cultural identity in different ways. And she literally insists on maintaining this identity and showing diversity. What makes her very sad is her experience of non-acceptance of diversity: “There are many, very many who don’t like head scarves. [...] Then I get *very* upset and tell it to my mum. And sometimes I start to cry.”

Teacher’s perspectives and priorities

Razia has the impression that many people dislike her headscarf, among them some teachers. One of them has even said that it might influence her possibilities of getting an education and a job. But the teacher’s perspective does not seem to influence her behaviour. “I don’t listen to anybody. It is in *my* religion. I have chosen myself to wear it.”

In a talk with her mathematics teacher about how he sees the future of his students, he characterised Razia as a nice girl who has good educational possibilities because: “She is positive and she works very hard. She does not reach any big results at the moment, which is logically connected to language and maybe cultural barriers.” He thinks that she will be able to go to high school in 3 years if she keeps making progress the way she does until now. He is impressed by the way she has learned the Danish language in a very short time and she has done an incredible work.

Teacher: There is nothing wrong with her intellect, and her attitude towards work is really all right.

The math teacher thinks that she could easily become a pedagogue or a teacher: “... she will choose something like working with human beings. It would suit her mentality in relation towards other people in general.” So he is not surprised that Razia herself probably wants to become a nurse.

Mathematics

When asked about her resources and things that she is good at and interested in, Razia hesitates a lot before answering: “Danish, definitely, I like that.” And she adds: “Danish grammar.” When asked directly about mathematics she says:

Razia: Yes well, I’m just not good at it. I understand it, right? ... But now I have learned more and better. Now I can learn it better. But before I

thought I would never ... I thought I could never learn mathematics, but now I can.

The difficult part for Razia in learning mathematics is definitely to complete her 'blækregning'. ('Blækregning' has turned into an institution in Danish mathematics education. The word 'blæk' means ink, and 'regning' means calculation. Also 50 years ago the students had, on a weekly basis, to complete their 'blækregning': selected exercises the solutions of which must be written nicely by a fountain pen and then handed in for the teacher to correct. The fountain pen was later substituted by the ball pen, and many other things have changed in mathematics education. But the word 'blækregning' remains, and so do some educational practices related to this 'institution'.) However, other kinds of homework do not seem to cause her any problems. The homework we get, it's easy. I know how to do that." There are no specific topics, which she finds especially difficult, she says.

Helle: But you have written in the questionnaire that you don't think you are very good at mathematics

Razia: Well, but I am not getting 10.⁹

No doubt, Razia wants an education. A good one! And for Razia 'a good job' has certain connotations. It is not about a lot of money, it is more about an interesting job: "It could be becoming a nurse." This choice has certain other reasons: "My father is a nurse, and therefore he can tell me many things." The father's position has a major role to play in Razia's dream of a future job. And this dream is certainly not out of reach.

Razia is not sure what it would take to become a nurse, but she suggests biology, "and then you use mathematics, I think [...] You use mathematics almost for everything." It is not sure if the mentioning of mathematics has to do with her knowing the context of the inter-view and interest of the researcher in mathematics education. As a matter of fact Razia is not able to point to any mathematical content of this job, but she agrees with Helle's suggestions of measuring and weighing (medicine for instance). In this way, it could be said that mathematics *per se* plays an inferior role in Razia's foregrounds. But being good at mathematics and doing well in school are certainly important parts of her educational plans.

Tools

The inter-view with Razia does not contain references to tools. She did not mention anything by herself and the researcher did not pick on this issue either. This could reflect two points. First, it could indicate that tools and artefacts for learning are available and do not constitute any big issue with respect to the social context of

⁹ The mark 10 signifies 'very good' at a scale from 00 to 13, where the average is defined as 8.

immigrant students in Denmark. Second, it could also reflect that in the context of learning mathematics, which Razia is experiencing, neither computers nor other more advanced technologies are recognised as relevant resources for learning mathematics. As mentioned before, the computer lab available for these students in the school was closed due to ravage.

Classroom interaction

Wearing a headscarf is a sign of identity and cultural diversity, which Razia herself experiences as a conflict in many ways. One thing is that it influences her contact and interaction with her classmates as she states three times during the inter-view: "... they don't like my headscarf. I don't really have contact with them either."

- Razia: No, they don't say it, but I can see it.
 Helle: How can you see it?
 Razia: Well, ... we don't really talk with each other. ... we have little contact [very quietly] ...
 Helle: Can you see in me, if I like it or not?
 Razia: [laughs] I don't know.
 Helle: [laugh together]
 Razia: I know that...most Danes do not like the headscarf. There are many, very many who don't like headscarves.
 Helle: Yes.
 Razia: Yes ... it is about racism and so on.

The students in Razia's class have not actually said to her that they do not like her headscarf. But she can see it, she says. Helle tries to challenge her a little by asking "Can you see in me, if I like it or not?" This intermezzo makes the two of them laugh together which we interpret as they are 'getting in contact'. It is amazing, though, how confidently Razia talks about her life being a young Muslim girl in Denmark.

Razia may interpret some of her classmates' nonverbal expressions as dislike, or maybe she just imagines that they do not like it because: "(...) most Danes do not like the headscarf." And she transfers this claim to a more generalized interpretation of racism. Later on she adds that she has the impression that many of her teachers do not like her headscarf either. The question is not whether Razia is right or wrong in presupposing that her classmates, her teachers and Danes in general do not like her headscarf. The important thing is that she experiences it in that way.

Parents

As indicated previously, Razia's parents seem to play a major role in her foregrounds. It is her mother who comforts her when she gets sad about reactions to her headscarf:

Razia: Then I get *very* upset and tell it to my mum. And sometimes I start to cry. Then my mum says "don't worry, we will go back."

The mother promises her a future life back home in Iraq, and she explains the conflict as a natural consequence of diversity between countries: "That is the way it is. It is not our country." The mother also plays a crucial role in Razia's identity as a Muslim woman. The mother is the only person who supports her in wearing a headscarf:

Helle: But in your family, who likes the headscarf?

Razia: My mother.

Helle: Your mother.

Razia: My brothers don't like it either.

Helle: They don't like... ?

Razia: And they tease me about it.

Helle: Okay. [sounds surprised] So in your own family, it is actually your mother and you?

Razia: Yes.

Helle: Yes. You are together on this issue?

Razia: Yes, yes. But my brothers they have girlfriends and so, so then they don't believe in headscarves. [mumbles] But I am just... I don't listen to anybody.

Helle: So that you have just decided?

Razia: Yes.

Helle: Yes. ... So now I understand why you wrote on your paper; that you don't want to live in Denmark.

The men in the family think that Razia should take off her headscarf and try to be like the Danes. The difference in perceptions between men and women in the family appears to generate a conflict through which Razia navigates with her own choices and priorities.

Friends

Razia does not talk much about friends during the inter-view. And Helle does not happen to follow this issue directly. However, Razia has some comments on the contact with her classmates, as we showed in the analysis of 'Classroom Interaction'. When Razia does not talk to her classmates and they have little

contact, it is difficult to imagine that they make friends outside school. Again, the reason she gives is the headscarf:

Helle: No. ... OK... What about your friends?

Razia: That doesn't work either. They don't like the headscarf...

Helle comes to think of something she observed when sitting in the class:

Helle: But I have noticed there are others than you who wear a headscarf in class.

Razia: Yeahh, but she takes it on and off and so...

From Razia's body and paralanguage it is obvious that she does not respect the person that takes the scarf 'on and off'. The two girls sit next to each other in class, but Razia's expression about the other girl's way of wearing the headscarf makes it clear that the two of them cannot be friends.

The conversation seems to indicate that Razia has no friends in school. We do not know for sure, however, whether she has friends outside school, with whom she can discuss her situation and future life. It seems like her mother is her closest friend.

Public discourses

Some evenings Razia distributes commercial pamphlets, and also in this case the headscarf is mentioned:

Helle: Okay. So you have a job!

Razia: Yes. Yes!! [laughs]

Helle: Oh!

Razia: Yes, they can't see if I have a headscarf or not. [laugh together]

Her idea is that she can only get a job when people cannot see her scarf. And Razia tells a scaring story about her distributing advertisings 'in the middle of the night', in the typical darkness of the Danish Winter.

Once she delivered the pamphlets to a Danish man who opened the door of his apartment to get them himself. Then she walked up the staircase to the other apartments in the building. Running down again she saw the man from the ground floor apartment coming up to her with a knife in his hands. She managed to escape, screaming and calling for her father:

Razia: I screamed as loud as I could. I thought that all Denmark could hear me, but there was nobody. I could not open the door. It was first, it was on the ground floor right. Then I just opened. Then I came [sound of heavy breathing] Dad there was someone after me. Then my dad

- said “no, no it’s not, you are just scared”. Then I said “No! It was a man who, who wanted to kill me.” Then he said “ok, then I will do it if you are scared. ...” It has definitely happened many times.
- Helle: But, but your dad didn’t really believe it?
- Razia: No, no.
- Helle: No?
- Razia: Then he just said: “It is your headscarf”, because he doesn’t like my headscarf. Then he just said: “hmm it is because of your headscarf. So take it off.” Then I said: “No, I won’t do that.” [...]
- Helle: Why do you think he said that; that you should take it off?
- Razia: Because he thinks that when we live in Denmark we should behave like Danes. But I don’t agree with that.

Even in this scary story the headscarf is taking the leading part. It is a signal of cultural and religious diversity that Razia wants to maintain. However, this provides her a lot of troubles: difficulties in having contact and making friends with her class mates, difficulties in being accepted by the teachers and in the Danish society, difficulties in being educated and getting a job, difficulties with the male part of her own family. This is the price Razia is willing to pay for keeping her integrity and identity. The identity part may also be closely connected to becoming a woman. And in this part her mother plays an important role in supporting her, as we have seen before.

Not only to Razia, the headscarf serves as a symbol of culture and religious values. It does so to many other people, including (we assume) to the man who threatened Razia with a knife. The headscarf represents dignity to Razia, but it serves as well as a symbol of cultural difference. The discussion of scarf has been a heated issue in Denmark and in many other European countries. It is part of the discursive construction of ‘otherness’ and difference that is part of the way in which ‘Europeans’ and ‘Immigrants’ relate to each other. It makes part of the processes of inclusion as well of exclusion, so dramatically represented by the man with the knife.

CONCLUDING REFLECTIONS

We conclude with some reflections particularly related to the conceptual framework that we are using in inter-viewing foregrounds.

First, we think that the notion of learning landscape, including its nine dimensions, might prove to be useful. We have introduced this construct to preserve the complexity of multiculturalism in relation to a learning situation in our analysis. Furthermore, we find that there is a richness of interrelationships between the nine dimensions. Thus, our attempt to inter-view Razia’s foregrounds includes references to the most of dimensions of the learning landscape. This is important as we see a construct like ‘learning landscape’ as having at least two functions: on the one hand, it makes it possible for us to see things and to make a richness of

observations possible; on the other hand, it provides a restructuring of what we are seeing. In particular, it is important that the constructs we use make it possible for us to grasp connections among the different spaces of action in which multiculturalism and (mathematics) learning unfold.

Second, some concepts are important for our investigations although they do not feature as particular dimensions of a learning landscape. These concepts, instead, refer to general features of the landscape. One of these concepts is 'conflict' another is 'racism'. These are complex notions, which possible content could be addressed through a careful analytical examination; but at the same time 'racism' also makes part of a great variety of daily-life uses of language with different meanings. In particular, the notion can be used to express experiences with respect to exclusion, as done by Razia. The notion of conflict refers to more general forms of disagreement with respect to opinions and positions, and we consider it important to include 'conflict' as an underlying construct for dealing with learning landscapes. Razia's story emphasises this.

Third, we can make some conclusions with respect to the notion of foreground. We have included students' foreground among the dimensions of the learning landscape. However, as is illustrated through the inter-view with Razia, an inter-viewing of foregrounds brings us to a variety of dimensions of the learning landscape. Furthermore, we must notice that we can use 'foreground' in plural. We have talked about multiple foregrounds, as a foreground can be acted out in different ways, depending on the context. Razia's foreground need not be considered as one particular entity. It is a relational entity. It can be acted out in different ways depending on the context. And here the context could refer to both the particular context of the inter-viewing, as well as the socio-political contexts, in which Razia might find herself. It is also important to notice that Razia expresses strong and clear opinions about her possibilities, ambitions and hopes; and when we compare her formulations with the teacher's comments about her possibilities, her formulations appears very realistic. Razia's formulations of possibilities include direct references to religious and cultural views. She is well aware that diversity in these matters might provoke a limitation of opportunities, if not a direct exclusion. In general we find that it is important to consider the multiplicities of foreground, also with respect to a particular person, and that this multiplicity reflects conflicts. We should not expect the foreground(s) of a person to make up a uniform and homogeneous entity. Motives and incitement for learning could easily contain conflicting elements. Foreground, and also foreground(s) for an individual person, is a site for diversities.

Fourth, we want to see opportunities for 'learning from diversity'. Razia expresses diversities (with respect to religion and culture) in a powerful way, but could such diversity constitute resources for learning, also in the mathematics classroom? It appears to us that there is no effort in the mathematics classroom to locate learning resources from diversities within the classroom. Thus, we did not hear any hint from Razia to make us aware on such efforts. Nor in conversations with teachers from Mælkevejen Skole, did we hear indications that diversity could

provide resources for learning. Instead the dominant teacher discourse emphasised 'sameness' as an adequate precondition for learning.¹⁰ So, based on what we have seen so far, we are in no position to claim that learning form diversity is of particular significance with respect to mathematics. This conclusion, however, we are going to reconsider in light of different types of empirical material.

Fifth, it is not clear to what extent mathematics (in a broad interpretation of mathematics) plays a significant role in a learning landscape of mathematics. This might appear a bit paradoxical, but the point is that many other issues than mathematics play important roles for the incitement for learning mathematics. So, if we should make a strong conclusion from such rather diffuse observations it could be that learning theories with respect to mathematics should address many other issues than mathematics.

Sixth, a learning landscape is a site for inclusion and exclusion. As already emphasised, a foreground is not any objective given, but it represents a person's interpretation of possibilities. This mixture of subjective and objective elements is also represented by the 'the man with the knife'. He was certainly active in Razia's scaring story, but if we consider her father's reaction, the man was not to be taken that seriously. Instead he provided an opportunity for Razia to consider taking off her scarf. The drama of inclusion and exclusion makes part of students' foreground and of the whole landscape of learning.

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¹⁰ At Mælkevejen skole, this was combined with a great tolerance of diversities. Anyway there is a difference between tolerating diversities and seeing diversities as resources. See also Alrø et al. (2005) for a discussion of 'sameness'.

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REPERTOIRES OF ASPIRATION, NARRATIVES OF IDENTITY, AND CULTURAL MODELS OF MATHEMATICS IN PRACTICE

INTRODUCTION

In this chapter we will draw on work from our project, *Opening doors to mathematically-demanding programmes in Higher Education*¹ and in particular on four of the project's recent papers (Black, Davis, Hernandez-Martinez, Pampaka, Wake, & Williams, under review; Hernandez-Martinez, Black, Williams, Davis, Pampaka, & Wake, 2008; Williams, 2007; Williams, Black, Hernandez-Martinez, Davis, Hutcheson, Nicholson, & Wake, 2007) to demonstrate three distinct methodological frameworks, based on 'discursive psychology', a narrative approach to identity, and cultural-historical activity theory (CHAT) respectively. The first two of these papers analysed interview data to gain insight into how different students formulate different aspirations and identities in regard to mathematics. The latter two increasingly draw on a broader set of case study data that includes observations of classrooms and interviews of observed students and their teachers, and indeed managers and principals in the colleges where the learners were studying.

In addition to grounding these three methodological approaches in the project's data, we aim to evaluate the adequacy of these approaches to understanding and explaining how identity is produced in practice. Although the substance of our results are of interest to mathematics educators, our main aim in this paper is to illustrate the different theoretical and methodological approaches and what they can offer researchers interested in identity. We finally will argue the need for discursive and narrative methodologies to be complemented by ethnographic-style case studies of social practice in order to produce 'explanations' of trajectories of identity. In particular, we argue that this requires a 'boundary' concept between the activity of doing mathematics (the mathematical practice) and the activity of storying one's self (narrating a biography) and accounting for one's aspirations.

¹ We acknowledge the support of the ESRC-TLRP programme of research into widening participation, funded by ESRC.RES-139-25-0241.

We show how we use ‘cultural models’ in this regard: indeed we show how cultural models arising from classroom mathematical practice can be instrumental in students’ accounting for their aspirations and in their narrative identity work.

PROJECT CONTEXT

The project *Opening doors to mathematically-demanding programmes in further and higher education (FHE)* (www.lta.education.ac.uk/TLRP/) explores students’ dispositions for further study, particularly in higher education, and particularly to study courses in which mathematics might be relevant. One part of the research involves a survey and *quasi experiment*, in which measures of ‘disposition to study in HE’ and ‘disposition to study more mathematics’ are constructed as outcome variables (as well as attainment grades), while process variables include ‘teacher-centred-ness of pedagogic practice’ (as reported by the teachers themselves) and courses studied, and background variables include ‘pre-test’ measures (dispositions including grades) as well as gender, socioeconomic status and ethnicity. Thus for instance, we have been able to report that teacher-centred pedagogy has a significant negative relation with learners’ disposition for further mathematical study (Pampaka, Black, Davis, Hernandez-Martinez, Wake, & Williams, 2007). Such measures can provide evidence of statistically significant relationships that may influence policy makers and the ‘State’, but do not necessarily help practitioners in terms of gaining insights into how, when and why pedagogic practices ‘work’.

Thus, to complement this quantitative study we conducted multiple case studies of students as they progress through a year or so of further education (usual age 16-19 years). The data analyses from the students’ interviews are complemented in later analyses by data from case studies in their colleges including classroom observations and interviews with their teachers. So, we are pursuing interviews with 40 students (at least three interviews each, transcribed) over the course of a year or so during which their early pre-university course studies gather pace and when they make decisions about university applications (the full interview sample, including the pilot group, used in some cross sectional analyses, is more than 50 students). This student sample was constructed to ensure that we included students likely to drop out of maths at advanced level due to ‘risk’ factors such as low previous mathematics grades, ‘first generation into higher education families’, following mathematics courses that are planned to end in one year rather than the usual two years, and so on. In interviews we (two full time research assistants and four of the main investigators were involved) ask about their biography, their dispositions and future intentions (we also have survey instrument data including dispositions that serve to locate these students against the canvas of a larger population). We also ask about their engagement in mathematics classes (some of which we observe).

It may be helpful to the reader to understand our rather particular study and sample: we focussed our questionnaire survey (initially N=1700) and interview subsample (main study n=40) on students who were studying (and so had opted to

study) mathematics in the post compulsory stage at pre-university level, (normally aged 16-17 years). But the sample was constructed with a particular aim to include targeted students who are – according to statistical indices, involving demographics, prior grades and maths course chosen – prone to drop mathematics before they get to university and so likely not to choose mathematically demanding courses at university. The sample comes from the classrooms of AS² level teachers in 5 case study colleges, which were chosen to represent inner-metropolitan, ‘deprived’ and ‘competitive’ city, and rural colleges, ‘open access’ 6th form and further education colleges, and some diversity of teaching and programmes. Thus our target student sample over-represented students with relatively weak mathematical prior attainment, from populations in poor or inner urban contexts and so on. Some of the demographics are visible in Tables 1-3 below. Because we focussed relatively strongly on urban, deprived and metropolitan colleges, ethnic minorities were also over represented, especially in the interview sample. Nearly half the total sample is ethnic minority: this can be compared with English average of less than 10%, but a London average of nearly 30%, according to the 2001 census (see National Statistics Online, 2008 data). (It is believed that this has increased since 2001, with large influxes of migrants from Eastern Europe. Some estimates also exist of millions of inhabitants who do not register in official censuses). Even more significantly, half the sample is classed as ‘hard pressed’ demographically, which corresponds to the poorest sector of UK society. Finally, the sample combined class, gender and ethnicity in ‘intersectional’ ways. Thus, there was a significant group of male students following a vocational engineering programme that was largely immigrant or ethnic minority, and another large group of white working class students from a deprived and somewhat isolated city ‘estate’ that was largely female.

For the purposes of this study, then, UK ‘culture’ is multiple by virtue of being ‘represented’ by a diversity of students with very different social and cultural backgrounds. The inclusion of aspirational migrants and middle class students (geodemographic areas 1, 2, and 3), by contrast with those from white working class poor backgrounds, is especially important in the UK educational context today, as there is increasing political interest and concern that British white working class culture is being marginalised. In regards to educational performance in general and university and higher education in particular, students from poor working class backgrounds are under-represented, but when poverty is controlled for, whites are even more disadvantaged than other ethnicities. To this also, gender disadvantages can be added: boys generally do less well than girls, and the difference is much stronger in some ethnicities than others (see DFES, 2008 data).

Willis’ (1977) ethnography showed how schools fail white working class ‘lads’ in the Midlands, and how working class culture plays its part in this: the charismatic performance of leading lads who mature early, who ‘take the piss’ out of the pompous, the powerful, and especially the ‘earoles’ (peers in school who

² AS or advanced subsidiary is the first half of an A level (advanced GCE) as well as being a stand-alone qualification.

passively and effeminately ‘listen’ to teachers). He provides a rich description and perhaps causal explanation of their growing dissociation from education. Evans (2006) goes further, showing how heterogeneous white working class culture actually is, even in very strong local and historic communities. Bourdieu (1984) showed convincingly how a class can ‘distinguish’ and recognise itself culturally from generation to generation: for Evans (2006), the poor whites recognise themselves in part through their rejection of the upper classes – ‘not being posh’ – and of all educational or religious authority in general (the white poor are strongly secular, in stark contrast to the incoming migrants and largely religious ethnic minorities). But this is conflicted: the parents want the best for their children’s own education, ideally to ‘get on’, even while this entails ‘getting above oneself’. Working class distinction then may involve expressing contempt for those that get on in the world, especially as this involves moving away from the estate or ‘manor’ to ‘other’, posher areas. To this Evans adds a vivid description of the ‘levelling’ of working class children, that is, bringing them down to their ‘proper’ level. Thus, we are told, ‘Anne’, tells of a levelling incident (Evans, *ibid*, 71) when her boy Tom, aged 5, during his christening ceremony in church was bribed by his uncle for five pounds (about 7 Euros) to “go up to that man in the black dress (the priest), and call him a f***ing c**t” – whereupon the boy promptly earned his first fiver presumably to huge guffaws from his uncle. Bringing the powerful and pompous down also goes hand in hand with ‘standing up for yourself’, but ‘not getting above your station’, ‘having a laugh’ and using rude language, or ‘being common’. The contrast between the home (and later, especially for lads, the street) class culture and that of school, especially the values, rules and language of schooling, can then be stark: and it is especially so for the boys. Needless to say, Tom is difficult for the teachers to manage at school, and when taken on an excursion it is one of the mothers Sharon – who describes herself as ‘common-as-shit’ – who undertakes the job of controlling him using language and ‘manners’ that the teachers can’t adopt – “we don’t swear at the children here”. Thus, the culture clash between home and school, which Bernstein (1996) argued accounts for class reproduction and educational under-achievement, should be seen as taking particular local, gendered, classed, ‘multicultural’ forms.

So in our study, the ‘multicultural’ backgrounds of the students should really be understood as the manifold socio-cultural and cultural-historical contexts, which equally includes gender, class, ethnicity, religion, nationality, and the many permutations and intersections of these. In this scheme of things, white working class masculinised backgrounds are of at least as much educational interest as – and in some ways more so than – ethnic minority or migrant backgrounds.

Another important feature of the study context was that the interviews with the students (spread over more than a year to allow time for a ‘trajectory’ to emerge) were mostly conducted while we engaged in fieldwork that included observations of their classroom practices and interviews with their teachers and leaders of their institutions (so-called heads of departments and sometimes principals). Many students were also following an innovative mathematics course which is designed to widen participation of students who might not otherwise be studying

mathematics at this level, but which terminates before the students leave college and go to university (called “use of mathematics” AS level.) Additionally, two colleges became known to us because of their innovative work. Thus we aimed to triangulate distinct classroom and institutional practices with their different students’ accounts and trajectories of identity.

However, the point is also that this is a rather particular student sample, and we do not aim to generalise substantive results to the UK population of students of this age. Rather the research strategy is in each case ‘multiple case study’, albeit with different units of analysis in the three cases, and we aim to generalise to theory, analytically (Yin, 1989). In this chapter we focus on illustrating the merits of three methodological positions in coming to understand students’ mathematical identities, and the reader is advised to consult the project’s other papers for more substantive details.

ANALYTICAL OVERVIEW

Our first analysis (drawing on Hernandez-Martinez et al., 2008) of interview data is cross-sectional, thematic, and draws parsimoniously on the concept from critical discourse analysis of an ‘interpretative repertoire’ of Potter and Wetherell (1987). This reveals learners’ ‘ways of talking’ about their educational and life aspirations (and how mathematics fits into these) and are interpreted as categorising students’ ways of interpreting this ‘aspirational’ aspect of their world, or of telling this aspect of their realities, their experiences, this social identity. The fact that these are ‘told’ (that is, to us, in interview) of course implies that they are ‘common sense’, or at least that they are taken by the students to be socially acceptable, social representations of themselves. By categorising these repertoires across the data set we ‘map’ these linguistic resources against background variables (of our special – it must be admitted – sample) and thereby provide an ‘existence proof’ of repertoire ‘styles’. By repertoire style we refer to the dominant repertoire adopted by a student in this context (when there is such a dominant use).

In this analysis the concept of ‘repertoire’ is understood in the discourse analytic sense, after Potter and Wetherell (1987) and others, rather than that due to Wenger (1998) in that we do not need to assume that these repertoires are in any sense (even partially) constitutive of any particular ‘community of practice’ or even a ‘social group’ (of learners, say). This is important because the validity of the empirical results does not require such theoretical commitments, and so can be accepted as such. This principle of parsimony is, we argue, worth preserving where possible.

The result of this first analysis is that we identify four distinct repertoires and that each of these turns out in fact to provide ‘styles’ for most of the sample, though there are some students who use more than one repertoire in their interviews and are therefore not classifiable using one style. More importantly, these styles are social-culturally related to the background of the student: for instance, we find that the ‘idealist’ style is predominantly a white working class repertoire style, while ‘becoming a success’ is the predominant style of immigrant

or minority ethnic students. Each aspirational style has some implications for mathematical identification, and the empirical fact that these styles are socioculturally marked is therefore pertinent to understanding how mathematical identity may be intertwined with social, cultural background factors. But this analysis does not yet *explain* how background factors influence or mediate mathematical aspirations or identity.

The second analysis of some of the same data is then narrative/biographical, after Bruner (1996). In this analysis we hold on to the ‘whole’ story of the individual student and try to make sense of their trajectory of identity, their cultural history, their present experiences and their imagined futures (drawing on Williams et al., 2007). Each individual story is a holistic construction by the interviewer/research analyst and the student. The coherence of the narrative relies, *inter alia*, on its temporality and plot (Bruner, 1996; Kaasila, 2007). The story can also be thought of as an ‘account’, in the discursive psychological sense (Potter & Wetherell, 1987) but it is more, in that its structure demands a narrative, biographical form that weaves together many elements into a whole. Bruner (1996) has outlined the essential elements of the narrative form of construal of cultural ‘reality’: temporal structure, generic particularity, reasons, hermeneutic composition, canonicity, ambiguity, ‘troubles’, negotiability, and historical extensibility (pp. 133-143). Temporality, reasons and troubles are most significant for gaining purchase on a trajectory of mathematical identity and its attendant conditions, which is of particular concern to our research project. In these narrative analyses, then, we argue that it is possible to understand how aspirations can evolve, how identities grow, and how key moments are said to deflect trajectories in significant ways for the students. This then begins to produce the ‘explanations’ we found missing in the first analysis, but they are still essentially discursive constructions, and can be criticised as suffering from being after the event, and self-serving.

However, our project seeks further to understand how student engagement in practice, for example, in classroom mathematics, might partially explain the significant attendant conditions and critical moments that students tell of in their stories of self-identification. We therefore look for key cultural elements that students use to account for their trajectories into or out of mathematics and for their mathematical identities, and how these might be found in the practices in which they engage – particularly in their classroom mathematics practices. We adopt the framework of ‘cultural models’ in ‘figured worlds’ to achieve this, borrowing from Holland, Lachicotte, Skinner, and Cain (1998). This choice was adopted as it is most obviously consistent with cultural-historical activity theory (CHAT), in that these cultural models may also mediate classroom practices and pedagogic discourses.

CULTURAL-HISTORICAL ACTIVITY THEORY, CULTURAL MODELS AND SOCIAL IDENTITY³

We take a cultural-historical activity theory (CHAT) perspective on identity in practice. The founding corpus of CHAT is usually attributed to the original Marxist troika of Vygotsky, Leont'ev, and Luria (see Daniels, 2001), as interpreted and developed in multicultural contexts in later generations by Cole (1996), Engestrom (1999) and others. While for Vygotsky the key unit of analysis of mind is action mediated by cultural tools, Leont'ev (1978) extended this unit to collective, joint 'object-oriented' activity, mediated also by the division of labour in the community and its attendant social norms and rules that position subjects in their actions and coordinate them with those of others in the activity. This 'positioning' is important in relating subjectivity to power into the analysis. Latterly also, Engestrom, Cole and others – in what they called 'third generation activity theory' – expand the focal unit to 'interacting' activity systems, where boundary objects and crossers may interface two or more activity systems. This introduces contradictions into an activity system from outside, which is apt to our analyses. Thus, meanings and even social identities brought into school from home or elsewhere can be seen as boundary objects that can introduce contradictions in schooling activity and vice versa (see Roth & Lee, 2007; also Roth, Hwang, Lee, & Goulart, 2005; Stetsenko & Arieivitch, 2004; Williams & Wake, 2007a, b; and www.edu.helsinki.fi/activity/people/engestro/). Scholars such as Wertsch, Wells and others have also incorporated Bakhtinian and even Hallidayan discursive and dialogical constructs of voice into CHAT theory (see Holland et al., 1998; Gee, 1999, 2001; Wells, 1999; Wertsch, 1991). Even Bruner's account draws powerfully from the Vygotskian perspective (Bruner, 1996).

Identity is here seen as emerging from engagement in socio-culturally mediated activity, specifically in collective, joint object-orientated activity. Because 'collective' activity requires intersubjective coordination, implicated in the division of labour, all 'actions' imply a subjective orientation that must itself be culturally mediated, usually and most obviously through language. But such subjectivity then implies an engagement with 'social identity', and with its 'cultural models' (more on this later). Being positioned, and especially positioning oneself in activity, then, constitutes a work of identity. In CHAT we say that the acquisition of a social identity involves a subjective orientation in an activity which is mediated by that social identity in joint work with others. This social identity may then be progressively internalised. Thus, being positioned by others leads to self-positioning.

This happens because the use of 'psychological tools' in communicative activity is always double-edged. Concepts and identities adopted in social interaction come reflexively to be used internally, on the self. Thus, one 'becomes' what one 'does' and, importantly, one comes to 'think' what one 'says': reflexivity and self- and

³ This account is a redraft of the CERME conference paper Williams et al. (2007) and informed by our papers in the IJER special issue on 'subjectivity'.

social positioning ensures that we become the player that we perform (Jenkins, 2004). While ‘activity’ is always driven by a ‘community’ motivation, the individual is always ‘positioned’ (by self and others) in a division of labour, held in place by ‘rules’ governed by cultural norms and expectations. But we must beware seeing this too mechanically, this internalisation always involves a transformation and should not be understood as a copying of the social onto the mental planes. This is because internalisation involves the activity of reflection, and this is mediated by cultural models in figured worlds that are not just reducible to the activity system at hand – reflexive activity draws on reflections of the self in other activities too.

Holland and Quinn (1987) developed the notion of ‘cultural model’ to describe the culturally derived nature of models, rules and schema such as those used by students in their identity work (for example, undergraduates’ dating identities). Gee and others have expanded the concept to include everyday cultural concepts and conceptual frameworks that govern what we can perceive, but also what we can tell, that go to make up ‘discourses’ that mark out identities. Thus, cultural models provide resources for reflective identity work.

We find the more recent metaphor of a landscape of ‘cultural models in figured worlds’ even more helpful (see Holland et al., 1998); one’s narrative of identity can be told as a path through our available ‘figured world’ of cultural models, ideal figures and so on. Thus, a male student, thought to have Asperger’s Syndrome told us of their identity as someone who “likes to work alone ... and always needs to know there is a ‘right’ answer.” Such self-identification might lead to such a student being regarded as a budding mathematician – and so they might come to regard themselves as such. That is always assuming the dominant cultural model of mathematics as a ‘right/wrong’, ‘black-and-white’, solo activity. Many tell of mathematics as a ‘hard’ subject; a student who wants to position him/herself at a distance from mathematics may say “mathematics was too hard for me”. But for another, it turns out, mathematics is hard ‘but challenging’. Thus, the ‘cultural model’ of mathematics that includes ‘maths is hard’, may be turned this way and that as a story is negotiated though a complex, figured world.

Thus, in our theoretical framework, students may learn cultural models in practice from social activities in general and classroom practice in particular, and these can provide tools for students’ construction of an identity. Students are presumably not totally free to narrate themselves as they wish using these models, first because they may not wish to align themselves with a particular positioning (for example, ‘being a geek’ may not be good for a social life) and second, because positioning oneself is always a ‘claim’ that may be subject to social confirmation, or dispute by others (for example, being ‘good at maths’ may not survive a poor examination grade).

Thus, essential empirical questions to answer are then: “how can/do students draw on cultural models in telling stories about their identity (in relation to mathematics)?” or “how can/do these stories produce/reproduce a disposition to study mathematics, or not?” and “where/when in practice do students access/learn these cultural models and dispositions?”

RESULTS

1. Cross sectional analysis of 'interpretative repertoires' of learners' aspirations

Having outlined our project's choice of 'cultural models in figured worlds' as the cultural resources for narrating the 'self', we should explain why we adopted the alternative, less theoretically loaded perspective of 'interpretative repertoires' for use in our cross sectional categorical analysis of the students' aspirations. The analysis was conducted on the interview data cross-sectionally at one point in time, focussed on themes related to the learners' explanations of their aspirations for higher education, why they have formed these aspirations and how mathematics fits into their imagined future HE courses and choices. Thus this initial analysis had no prior commitment to categorising models known to us to arise in classroom practice or in the culture, no temporal analysis or trajectory and initially no analysis by 'learner' demographics (this came later). As such it seemed parsimonious to stay close to the phenomenon in the data set as a whole, and to initially adopt as little theoretical baggage as possible that policy makers or others might be inclined to dispute.

Thus, the term 'repertoire' implies no particular commitment to analysis of any factors and data from social practice, 'outside' the discourse. Methodologically, this can be considered either an advantage or a disadvantage, depending what one wants to achieve and what data is available. In the event, from this cross-sectional thematic analysis of our students' utterances in interviews, we were able to identify four categories of 'repertoire' (see Hernandez-Martinez et al., 2008). These were as follows:

The repertoire for **"becoming a success"** is adopted by students when they say "I will go to university... because ... I want to become someone". Education is seen here as a means to the end of social progression, "if you don't do nothing, you won't become no-one" (José). Usually such students plan to go to university to develop a career in areas such as business, medicine, law, accountancy, and so on where the university course clearly marks out a professional, successful career trajectory. Money or other indications of status may be mentioned specifically, as in Takeshi's comment: "I would like to be in my own office in charge of a company, driving a really nice car and ... I don't know where I'll be like living but I know I'd be travelling, doing business around the world and stuff." Parental encouragement is strongly visible in the typical account, "My mum and dad have really high expectations... [of me] to go to university ..." (Takeshi) though such students will usually have internalised this ambition themselves. In this repertoire mathematics is instrumental, a means to an end, though it may also be seen as useful as well as a necessity (for example, for an engineering course, or even accountancy).

In sharp contrast, we find a repertoire **'for personal satisfaction'**, wherein aspirations are described as being for development of the self. In this repertoire the students will choose a course that interests them, or even go into 'music' or the

‘army’ if that is their ‘thing’. Pressure from parents seems absent, “They [parents] are the same as me – if I want to go I can go but at the end of the day I don’t think it would ultimately achieve what I want to do with my life ...” (Alice) The choice of mathematics is here associated with maths being fun: “I’m really enjoying maths. Maths has to be my favourite subject now...”

Another repertoire we call ‘**idealist**’ involves the pursuit of an ideal or ‘dream’. Gemma (see below in the holistic analysis) identified a dream to become a mammalogist after seeing the film “Free Willy” at the age of eight. Their ideal or dream quite often was inspired by the media (another example: the TV programme ‘CSI’ was cited by Adele in regards to wanting to become a forensic scientist). Gemma’s ambition seemed to develop and grow with time, and she has quite a good idea what she will need to do to achieve this (having had careers advice in secondary school). In many cases, however, there was a lack of practical awareness of what might be involved: Sonia for instance declared an ambition to study computing, but had little idea about programming or what this might involve. Many of these students spoke of their families being supportive of their ambitions despite (or because of) not having been to university themselves, but their parents ambitions for them seemed not to be stressed in this repertoire. In fact Gemma specifically says she wants to go to university so as not to end up like her Mum.

Similarly mathematics is incidental in this repertoire. Thus Adele says of her ambitions to become an architect and, specifically, to build houses in California:

Just a dream I have [had] for a long time ... I’ve ... watched programmes and things and I like interior design as well and I thought – designing houses – I like that as well... I need maths and other subjects I am doing, but I think when I go to university it will all be in one [course].

Finally, we identified a strongly distinct ‘**vocational**’ repertoire that was adopted mainly by students on vocational engineering programmes that were studying mathematics as part of and also separately from their engineering course. This was the only repertoire in which mathematics was described clearly and convincingly as ‘useful’ rather than instrumental. Malik for instance says: “Maths is the main part of electronics... you need maths to calculate stuff, that’s why if I don’t do maths I can’t do electronics.”

In addition it was possible to categorise most of the 40 students using these repertoires as predominantly using one repertoire (we used the term ‘repertoire style’ to describe the repertoires of these students). It transpired that the students adopting a particular style had specific demographic, ethnic and gender characteristics: in Tables 1-3 we show the styles crossed with (1) geodemographic area: this is the so called Acorn classification of postal addresses into 5 socio-economic classes, with class 5 being ‘hard pressed’ financially, and 1-3 being various grades of middle class; (2) self-reported ethnicity, where here we grouped the Indian sub-continental countries as ‘Asian’, and Black Caribbean, African or British as ‘Black’; and (3) gender.

Table 1. Repertoire types by geodemographic area

Repertoire type	Geodemographic Area					Totals
	1	2	3	4	5	
1 (success)	0	2	2	2	4	10
2 (satisfy)	2	2	2	0	0	6
3 (voc)	0	2	0	0	6	8
4 (ideal)	0	0	1	1	8	10
unclassified	1	1	1	1	2	6
Totals	3	7	6	4	20	40

Table 2. Repertoire types by ethnic background

Repertoire type	Ethnic Background					Totals
	White British	Black	Asian	Chinese	Other White	
1 (success)	1	4	3	1	1	10
2 (satisfy)	6	0	0	0	0	6
3 (voc)	2	3	1	1	1	8
4 (ideal)	10	0	0	0	0	10
unclassified	2	3	1	0	0	6
Totals	21	10	5	2	2	40

Table 3. Repertoire types by gender

Repertoire type	Gender		Totals
	Male	Female	
1 (success)	7	3	10
2 (satisfy)	5	1	6
3 (voc)	8	0	8
4 (ideal)	3	7	10
unclassified	3	3	6
Totals	26	14	40

Thus, we concluded that repertoire ‘styles’ were strongly associated with certain socio-cultural background characteristics: in this perhaps unusual sample these were ‘classed’ (as in the largely female white working class ‘idealists’ contrasted with the mainly middle classed ‘personal satisfaction’ repertoire). The ethnic minority preference ‘for success’ is also striking, and resonates with findings about immigrant, aspirational communities elsewhere (Sfard & Prusak, 2005). Unfortunately it is not easy to disentangle background factors of class, ethnicity and gender as so many of our small samples were black, male and also vocational

(and similarly another numerous percentage were white, working class and female).

The analytic conclusion is that: (1) the 'repertoire' methodological approach yields a particular abstract, analytic thematic generalisation from students' talk which in this case allowed categorisation of most of the individuals' interviews in the sample into 'styles' (that is, few use more than one repertoire in their interview); (2) there is an empirical relationship between students' background variables and the repertoire styles they display in interviews when telling us of their aspirations and identity; and (3) each 'style' is associated with a different perspective on mathematics, which may be connected to how mathematics serves this 'style'.

The empirical relationship between 'style' and 'class/gender/ethnicity' is suggestive, and we argue that this line of work needs to be completed (a) over times and occasions with the current sample; and (b) with other samples (including some more 'mathematical' cohorts for instance). The notion that different students perceive mathematics in qualitatively different ways related to their wider or 'leading' aspirations and identity may also have significant practical implications for pedagogy.

However, what this methodology misses is a truly 'concrete', 'societal' and 'cultural-historical' explanation of how these students' discursive styles have become established, and what they might mean for identity. This would involve a genetic explanation, and suggests that a deeper analysis of the production of narratives may be needed over time. To achieve this, a discourse (perhaps a repertoire) has to be understood in a wider context, as a cultural-historical artefact, and as the result of a particular discursive activity. This is the purpose of adopting 'cultural models in figured worlds' as the unit of analysis, which provide a resource for identity work that has a cultural, historical and social source which involves activity outside of the specific community of discourse in focus. Indeed some social learning theorists (for example, Wenger, 1998) use the term 'repertoire' in more or less this same sense: a repertoire is a set of discursive and other resources for identity work in play in (and so borrowed by members from) a particular community of practice.

However, the emplacement of cultural models (CMs) within CHAT does highlight some differences with Lave and Wenger's social learning theory. Specifically, CMs must be seen as artefacts with a cultural history. Thus, we recognise that CMs do more than provide resources for identity work as such, and they may not obviously 'belong' to a community of practice. Gee (1999) cites 'coffee' as an example of a CM: he suggests that it threads together many different meanings across different, connected cultures, from the grower of beans in Brazil to the consumer of lattes in Starbucks. He suggests though that there is a recognisable trace of the object (and its ideal conceptual form) across these cultures (Gee, 1999). To this one might add the historical context: such threads connect cultures across time as well as space. The connections across time are critical to narrative construction, as we will see in the next section.

2. Results: Biographical narrative analyses of identity⁴

In the following we examine two cases of students who both chose to do advanced mathematics despite having a difficult time at their previous secondary school: in their interviews they used some of the same models as resources but in very different ways, partly reflecting their very different experiences in their current college mathematics programmes. They would both be categorised as white working class, from areas with low rates of participation in HE. Though one comes from a relatively homogeneous, isolated ‘white enclave’ on the edge of a city where minority ethnicities are barely visible, the other mixes in a multi-ethnic, inner city area. They are chosen for report because, despite having similar demographic categories, they provide a sharp contrast: one engages with mathematics in her classroom as a sociable activity in which she is always ‘having a go’. Despite many difficulties and a weak background, and despite ‘dropping out’ for a while, when we leave her Gemma is still hanging on with her studies of mathematics. The other, Lee – despite having a stronger mathematics grade to start with – is withdrawn and even isolated in his class, positioned as being ‘struggling’ by the teacher; when we last interviewed him he has dropped mathematics and gone on to university to study non-mathematical subjects. One might think that the common cultural model ‘maths is hard’ is one that is used by low attaining students to speak of their dropping out of the subject, and this is the way the model comes to be used by the student who is becoming isolated from mathematics. However, for the ‘engaged’ student (Gemma) it becomes used as a positive resource for narrating herself as an engaged mathematics learner.

Gemma says she will be the first from her family to go to university. In fact she cannot name anyone she knows in her circle of friends and family who has been to university. But there is no question in her mind that she will go, she says, “I’ve been going to uni since I was eight”. She has lived ‘locally’ all her life in a community that has all the ‘poorest’ social indicators. Her principal and teacher described, with almost ironical pride, the local community as sitting regularly at the bottom, or near the bottom, of every league table of performance and social index of deprivation the government has produced. Gemma tells us that her mother’s work as a cleaner and shop worker is stressful, which has helped to motivate her as “I see my mum, like, working in a shop and cleaning and I don’t want to do that, so that’s kind of influenced me in my own work not to follow that path cos she gets stressed out and stuff”. Gemma tells us several times that her mum has been very supportive of her and encouraged her ambitions all her life (as has her mother’s partner). She did well at Primary school: “I was always into books at school and I was always levels ahead”. She said that getting level 5 – a very high grade – at age 11 in the National tests was an important marker for her. She experienced her catholic primary school as relatively, compared to secondary, ‘inspiring’.

⁴ This section of results is developed from the CERME paper by Williams et al. (2007).

At age eight she decided she wanted to become a marine biologist so she could work with orca whales: “I’ve just always taken a fancy to orcas, ... Killer whales, ... Free Willy is my favourite movie [laughs].” Even though her mother thought she would ‘get bored’ with this particular ambition, Gemma has stuck with it and her mum has continued to support her; she had advice during secondary school from the ‘connections’ service and knows exactly what she has to do in her AS and A level grades in science and maths to get to university and then to do a PhD in marine biology. She knows she will spend six years at university and which one she wants to go to for her studies, as it has a connection with research into Orcas. In fact she tells us that the field she will need to follow to get to work with Orcas is more specialised, those who study big sea animals are called marine mammalogists, and “you have to be one of the top ones” to get into it.

Her experience of secondary school was very mixed, with classrooms being boring and classroom behaviour off-putting. The teaching was often uninspiring and she lost interest for a while: “From when I went to secondary school I lost interest in quite a lot of my study (...) at [primary school] there was more passion in it while at secondary school it was just “you’ve got to get through this.” In contrast to her self-ranking in mathematics at Primary school, she says now “I wouldn’t class myself as that good but maybe a bit above average”. However, she describes maths as being ‘challenging’ rather than hard: “... there was a lot of noise in the class ... [Int: disruptive?] yes; but I enjoyed it and it was a challenge as well ...”

Gemma got a modest grade in her final mathematics examination at age 16, and then did a statistics course, not being allowed to do the higher mathematics course for some reason. She would be considered a ‘high risk’ according to statistical trends at post-16, and in many colleges she would not be allowed onto the advanced mathematics course. She says she was worried she might not be able to cope with the algebra on her current course but actually feels she is doing well, and is enjoying maths now, “... it’s a good system here: it gets the whole class involved and you get to hear how others do it and if it’s better you can learn”, which she compares to the dominant teaching practice in secondary school which was “boring and you forget it ...”

Her attitude to mathematics seems to have undergone a transformation since going to 16-19 college: “I am liking maths as much as I like biology which is my favourite subject ... so I’m getting really ... liking it compared to before.” She explains why: Maths is more ‘engaging’ and she can express her opinion and hear what others have to say – she even mentions the interactive work with white boards and posters ... and maths is now described as ‘fun’.

This story – we call it a ‘restorying’ as it has been constructed by us from her interview – tells us several interesting things about her identity in relation to further study, higher education and mathematics. While her family background does not provide any ‘role models’ of people who went to university, she has developed an ambition that her family supported, and her mother’s ‘stressful’ experience of work has influenced her positively. Her childhood ambition has been nurtured by family and shaped by the education service, and has matured into a career ambition. She

knows she will need maths, challenging/hard or not, to achieve her ambition. But recently her enjoyment of mathematics seems to have returned and we can speculate that this will help in some way: we will see when we meet her again in six months time.

The model of a marine biologist and the inspirational film “Free Willy” seems central to her particular story. Many students of this age, just beginning at 6th form of further education (FE) college, simply say “everyone I know is going to university” or even “I like science so I’ll probably do something in the sciences but I am not sure what yet.” However, the principal of Gemma’s college told us that stories such as Gemma’s are not unusual: one boy who had been on a work placement developed a specific ambition to work on a particular machine in an aircraft laboratory, and had worked it out that he would need to have a degree in aeronautical engineering to get into the necessary training programme in the aerospace industry. Thus we speculate that this might be a more common characteristic of some narratives of students from class backgrounds that do not provide many personal ‘models’ of university graduates in their community or family circle.

The particular way that Gemma constructs herself as having a positive relationship with mathematics might be relevant here, we speculate: her early imagined lifestory of ‘becoming a marine biologist’ comes together with her success in primary school, and “getting a level 5”. As she develops her plan in secondary school she finds out that mathematics will be important to becoming a science student at university. This apparently positive synergy could perhaps have been expected to be dampened or even destroyed by a dull experience in secondary school, but (i) she is at least as good as the average of her peers in mathematics, and (ii) her family – especially her mother – encouraged her, and she finds energy from the thought that she does not want the stress of her mother’s life as a manual worker.

We have speculated here that Gemma’s positive disposition to study mathematics is in part at least sustained by her imagined lifestory of a university science career leading to a career as a marine biologist. We see other important sustaining resources as well, such as her success in primary school, her relationship with her peers and her recent positive experience of maths learning. These resources are important in providing her story with energy, and we imagine some were central to her in Primary and others later in secondary school. But we suggest that in her story now there is a prominent central ‘leading thread’ in her work-ambition: this seems to be the central element that provides for a ‘positive disposition’ towards mathematics, which in turn encourages her to see maths as a challenge rather than too hard.

Let us consider for a moment the way a life story like Gemma’s comes to be imagined: and also, by way of contrast, let us consider how the story, with much the same resources, might have been different. Gemma accepts, but makes use of the notion that mathematics is ‘hard’ for her: she posits maths as ‘challenging’ and she likes a challenge. But we know that for other students, mathematics is ‘hard and dull’, or ‘too hard’ and thus becomes something to be avoided. Within another

lifestory, Gemma might well have adopted this notion as a means of representing a different disposition, of telling a story of a different person and imagined life. Lakoff and Johnson (1999) analysed the metaphor of ‘life as a journey’ and this seems apt to our present analysis. The ‘imagined journey’ in Gemma’s case has a clear beacon in the distance, envisioned for her initially in film, and through other media later. In her narrated ‘troubles’, she meets many obstacles along the road, but also resources: she avoids the secondary school abyss and identifies a challenging climb there. There is an imagined slough of despond in future manual labour that she strives to avoid. In some cases perceived obstacles turn out to be friendly, what was said to be ‘hard’ to do becomes perceived as ‘challenging’. Yet each ‘resource’ has a potential downside: if one experiences failure too often perhaps ‘challenging’ will become ‘too hard’, and the immediate part of the journey too difficult.

On the face of it a ‘cultural model’ seems to afford a way of overcoming an obstacle on one’s life path through one’s cultural landscape or ‘figured world’ and as such is a bridge for all who want to pass that way. But some models are not like that; turning an obstacle like “maths is hard” into an affordance as in “maths is challenging and I like a challenge” may be more possible for some students than others. It is as though different students are offered different landscapes to do their life journey through, that is, different social groups are offered different figured worlds. The educational institution and classroom, and pedagogy appear to provide different tools also.

To illustrate this, we now present Lee’s story, a less positive account of his experience in studying mathematics and his disposition to continue doing so. This account is an abbreviated form of the story told in full in Williams and associates (2007) and within a different analysis in Black and associates (under review).

Lee also hopes to be the first in his family to go to university, although unlike Gemma, he says his mother has a fairly high status job which he describes as ‘quite up there’. Lee is also less clear than Gemma regarding his future career trajectory stating that he wants to “get a good job” but “to get a good job, you got to go to Uni” – thus there are resonances with ‘becoming a success’ in his story. However, he is unclear regarding the subject he will study, proposing that this will be “... one of the subjects I am doing now at A level probably” [politics, psychology, sociology and maths]. Prior to secondary school, Lee describes his relationship with maths as fairly positive, stating “Yes. I was always good at maths, pretty much. (...) I got like top levels and stuff, in primary.” However, this changed at secondary school where he says he lost interest due to a negative relationship with his maths teacher (nevertheless he achieved grade B in his higher GCSE). Despite his lack of interest, Lee chose to do AS level mathematics because “I wanted to do like a traditional subject, that would look good for University” but he says he struggled with the subject and by the end of the first term, it was suggested by his teacher that he change course to the ‘easier’ option of AS use of mathematics.

Within his account, Lee rationalises his ‘troubles’ with the traditional AS level by explaining that his difficulties emerged out of his inability to keep on top of the workload. He states “it was like, loads of homework, and I just couldn’t cope with

that. So it's my fault pretty much, for not going over my notes and stuff. But I didn't think I had to do that because I didn't have to do that at secondary [school]". However, despite use of mathematics being presented to him as 'easier', Lee has found the course to be "just as hard as the other ..." stating that "I don't get anything" and he predicts that he will fail.

When asked why his relationship with maths deteriorated, Lee draws on the cultural model of 'maths as too hard'. He says "it was like, you got all like harder stuff coming up obviously, like formula, and stuff like that" and "I was not getting anything, I was stuck. I can't do it." Furthermore, a central part of his narrative is his conjecture that he was 'misled' about the difficulty of the use of mathematics course – a key reason for why he is going to fail.

The way Lee constructs his story regarding his relationship with maths illustrates that not all students are equally positioned in terms of the cultural models they can draw on. Although, both Gemma and Lee view 'maths as hard', Lee uses this cultural model to position himself away from maths because it is 'boring' and 'not relevant'. We argue that his negative use of the cultural model 'maths as hard' may in fact be linked to his positioning in college and the classroom as marginalised from maths. He notes how he has been identified by his teachers as a 'struggling' student and at one stage he notes his lack of social integration in the use of maths class due to being seated on his own on the outskirts of the class (as a latecomer to the group). Thus, we argue that the way Lee uses the cultural model of 'maths is hard' in his lifestory is an attempt to position himself away from such a marginalised social position afforded by his teachers.

Consequently, both Gemma's and Lee's stories highlight how students' use of cultural models in their life stories may also be mediated by how they are positioned in the learning activity, for example by teachers and institutional policies (for example, institutional policy regarding who 'is' and 'is not' able to do mathematics). Gemma is given the space to construct her narrative around the notion that mathematics is 'challenging', providing potential energy to 'maths as hard' that could otherwise become 'maths is too hard'. This is despite only attaining a modest grade in GCSE mathematics which in another college (such as Lee's) would have prevented her from choosing to study AS level. In contrast, Lee's identity in college as a 'struggling' student has led to a sense of marginalisation from mathematics and his narrative is used to maintain a certain distance from the subject and thus reconcile his feeling of 'not belonging'. However, in another sense, the idea that mathematics as 'too hard, irrelevant and boring' may also provide potential energy to Lee's identity work – as one who does not see any 'use' for mathematics, as a non-mathematician, perhaps one who will study politics instead. Although there is not enough of a biography in the above account to see how this might work out positively yet (see Black et al., under review, for a follow up to his story): after dropping out of maths, he says in interview that he might be willing to study more mathematics (actually statistics) as he is now intending to study psychology at a top university and this may be required.

Furthermore, the two accounts also show us that institutional conditions are clearly not the only source of difference that learners experience. Both these students were in a sense also positioned by their own personal experiences and histories – for instance as being the ‘first’ generation intending to apply to or attend university. This context had a manifestly significant impact on Gemma’s account if not on Lee’s. Additionally there may be elements of the two accounts that are gendered: we speculate that Gemma’s relationship with her mother impacts particularly on her narrating that she doesn’t want to ‘end up like Mum’. We did not hear Lee say that he did not want to be like his Mum/Dad: but we must allow that he might bring something similar into his own story in some circumstances.

In similar accounts of other students’ biographies, we have encountered narratives that make sense of class, ethnic or other factors that are known to be statistically salient (for example, working class students often choose to go to a local university, and ethnic minorities choose to go to those where the ethnic mix is friendly). So, for instance, Walter, another white working class student, tells of his family’s health and housing problems – he lives next to a delinquent family who threaten violence against him and his kin – and how he as the oldest male in the family feels responsible for protecting his family. Consequently, he foresees himself studying at his ‘home’ university, even though this university does not offer his preferred mathematics course.

In summary, these narratives illustrate how in understanding life stories we need to look at how the cultural models used by students afford and constrain certain positions and dispositions towards or against mathematics. We also need to consider how and why such cultural models are drawn on by some to overcome ‘troubles’ and how they may be used to resource future dispositions. We suggested that one leading social influence might be a career ambition, social status or family kudos; in other cases we have tried and failed to detect any ambition or motive, with students apparently ‘living in the moment’.

We have seen some indications that such students – that is, those without a driving ambition – may be particularly susceptible to local influences, including their social experiences of the mathematics classroom. For instance, some students told us that maths lessons were ‘sociable’ and ‘fun’, and one said this was the main reason for attending, as she had no intentions of progressing to university. However, not all students have access to these positive cultural models we have identified. While they have some agency in shaping their positioning, or disposition, students are not all equally positioned in society, in their institution or in their classrooms. One student finds herself with no ‘real’ graduates in her family to serve as ‘models’, but looks instead to the imaginary, fantasy world of films for a marine biologist graduate. Another student told us she has just one example of a graduate in her family, and that the person concerned had a bad time, ending a course with huge debts. She is unsure as to whether she should risk the experience, but is continuing at college anyway because there is nothing else to hand other than working in a shop. Thus background factors ensure that students may be unequally positioned even by the ‘same’ set of college and classroom conditions. We observe that only a holistic narrative of the students’ trajectories can interweave these

background factors with mathematical positioning and identity in an integrated, grounded account.

The college institution too offers students differential access to maths. Some are accepted even though they arrive with a relatively risky, weak, previous mathematics grade whereas others are denied this by their college. Our case study fieldwork provides possible explanations: some colleges are themselves positioned differently from others in terms of funding and their student 'market'. In order to maintain a high reputation (through league tables of performance indicators) some colleges refuse to recruit weak students to mathematics courses, while other colleges opt out of this competition (or for other reasons are not so competitively positioned) and go for an 'open access' institutional policy that then puts a premium on making mathematics accessible to a wider group of learners. Similarly some classrooms offer a 'sociable maths' that is 'fun' and interactive, where for others the dominant model involves 'working on your own'. In this respect many students' narratives have suggested there is hope that pedagogy can really make a difference: apart from providing role models, the classroom or college institution may also offer multiple models of learning and hence 'ways of being' a learner of mathematics.

So, in conclusion, the stories of students show very different trajectories into or out of mathematics for students with very similar backgrounds: the students use cultural models in very different ways, and they position themselves differently according to (i) their 'leading ambitions' (if they have one) and (ii) the positions offered them by their colleges and teachers. The narrative analysis also shows how these diverse elements are interwoven and can build on their social, cultural and economic backgrounds. There is also a hint that college policy and pedagogy influences their trajectories. In the next section we will draw on a wider evidence base and theoretical framework to develop causal explanations.

3. Results: Cultural models as boundary objects between classroom practice and the narrative of identity

In this section we draw on case studies of two teachers' classroom practice in the two contrasting institutions where Gemma and Lee were taught. The aim is to understand how these institutions and their pedagogies provided different cultural models of mathematics and offered different positioning to these students in virtue of their pedagogies and practices, and how it is that students adopt these in their narratives of mathematical identity. As such, this analysis closes the loop between narrative/biographical identity work and the social practices that resource this work.

Colin is a teacher of twenty years experience, and one that has won great respect from the college's senior management because of the results his students get. He was interviewed several times, and observed teaching the relevant mathematics students. His teaching might be described as 'interactive' but formal: this is how he described his teaching:

I mean normally, I, maybe I spend too long, you know, you know my sort of methods, it's nothing, it's old fashion methods, there's a bit of input from me at the front and then I try to get them working, practising questions as quickly as possible, and normally I'd spend quite a lot of time, but it tends to be now literally no more than twenty minutes on an exercise, I mean, some people say that's enough, really, and then, you know, move onto something else. Where in the old days I might have spent more time and have some harder questions at the end consolidating it, but not now. It tends to be as long as they can do the basics, then we'll move on, and we'll come back to it.

One thing that was striking in the observed lesson was the way he had simply 'told' the class the key idea for the topic: the formula to add together the terms of a geometric series, without any development, discovery, connection-making or motivation for the topic. Colin simply said "This is it, believe me, and this is what the examiners want ... now let's do these calculations". He often says he is 'in a rush', both in the lesson and in the interview:

Int: you talk about rushing. I mean, did you feel you were rushing today?

Colin: Oh yeah. This is typical. This is what it's like all year.

Int: All the time...?

Colin: This is what it's like all the time. Because I feel the pressure on, I've got 25, 26 weeks in a year to get through 3 modules and this is how I feel, which is what I've got to do. You know, I would not call that teaching, what I did today. I don't think it is anyway. There might have been one or two good things in there but most of it is just trying to cram things in as fast as possible. And it is a nightmare but this is how it is. You know. Because at the end of the day, what I get judged on now is results. In September, results. You know, have they got the grades? And if they haven't, my head's on a block.

So it seems that Colin believes he cannot teach as he might wish because of the pressure of exams, grades and results – the instruments of audit. The institution holds him accountable for these, awards him praise for his performance.

Colin: Yeah, the results are everything.... it's not necessarily what you as a maths community would want, I don't think. I mean, this is me speaking here. This is not my department, necessarily, but I do tend to teach to the syllabus now. If it's not on, I don't teach it. I mean, I do try to bring some interest and explain things, if I can, but I do tend to say this is going to be on the exam, it's going to be worth X number of marks, that's why we're doing it.

There is in the above an interesting distancing from the 'maths community' (represented by the 'interviewer') by Colin: he sees the interviewer/observer as a

member of this community, and thinks perhaps that his pedagogy is not what 'you' would want: he thus reflexively positions himself at a distance from the 'subject' culture here, in pressing his point about the significance of the institution's audit culture. He continues:

(...) the main thing is the shortage of time, but also we have a lot of students, I mean, maybe it's me over the years and it's worn me down, who are only doing maths because they have to do it, even at A level, because if they're doing medicine or whatever course, they need to have maths. And, although you try and get some interest, a lot of them, at the end of the day, the only way I can persuade them to do anything is – well it's worth ten marks on the exam paper.

To the institutional pressures on him to perform he now adds the pressure from the students, who he feels pressure him to stick to things that 'count' for them. Thus, the audit culture is again mediated through the students' own 'community culture': that is the community of students for whom performance on their exam is a passport to a university place. This audit culture is not attached to any particular community then, but is more like a Foucauldian, discursive 'regime of truth' that many communities can adopt to express their interests in the exchange value of the knowledge they expect to be created through pedagogy.

But exchange value cannot exist without use value (see also Williams et al., in press): audit can only maintain credibility if it is 'coupled' with a practical 'useful' evaluation that, in the last analysis, has some use-value (Power, 1997). Indeed, when pressed, Colin himself expressed ambivalence about the exams, as regards the development of a mathematical 'understanding' in particular.

His recollection of his own experience with 'not understanding' as a means of making sense of the 'tricks' pedagogy that he applies now: in part this involves an identification of himself as 'not a brilliant mathematician' and so presumably not unlike many of his students.

Colin: Yeah, ... and it is really teaching them the tricks. I mean, I admit, it's a bit like, I teach it the way I was taught really, which was teaching them the tricks. Because with me a lot of the understanding didn't come for maybe years and years and years, and (I) suddenly thought well that's why. I mean, in theory I've done a maths degree, and I'm not a brilliant, I still wouldn't say I'm a brilliant mathematician, and I think a lot of understanding does actually take years. And we haven't got years. I've got 26 weeks with the lower sixth and maybe a little bit more with the upper sixth. So I teach them the tricks. I mean, we do try to put the understanding, but you know, some of it is going to be, you take my word for this, it's going to work.

Int: You actually said that at one point in a lesson, I seem to remember...

Colin: I say it a lot, "Take my word for it."

Int: “We haven’t time to prove it”?

Colin: Yeah, “even if you don’t believe me, it’s true”, is one of my standard phrases. “Even if you don’t believe me, it’s true, it works, and it should work every time, hopefully... I could show you a proof of this, but they’ll never ask you it, it’s what you do with it that the exam board are interested in.” So that’s a classic thing now. In the old days I might have spent a bit of time trying to prove it to them.

In this explanation it seemed that Colin’s personal history and relation to the ‘subject culture’ – mathematics as something that took years to understand, and he got by in the meantime as he hopes his students will now – by learning ‘tricks’. But there is the problem with this approach, involving an inescapable contradiction:

Colin: Well it is, yeah, I mean, it does lead, a lot of the time, it does lead them up the garden path. It tells them what to do, but even despite that some of them still can’t; you know, they struggle with it. And unless it’s set up exactly as the question was that I’ve shown them, they can’t do it, and that’s because they haven’t got the deep understanding, and that’s my fault, that is, in a sense. Because we’ve not given them the time to really learn how to, you know, when the question’s slightly different, they can’t cope with it.

Int: You’re a bit ambivalent about understanding.

Colin: Sometimes you say you haven’t got the time for it; that it comes later, but other times you say you actually do need it. ... Well, they do need it. For some of the questions they do need it. I teach them the tricks and hope that most of the time, that’s enough to get them to do the exam questions, but, you know, if they set it in a slightly different way, they haven’t got that understanding. Well, some, obviously the better ones pick up on it and they know how to adapt, but the weaker ones just haven’t got a (clue?)... It’s been going over their head a bit, certainly since Christmas it’s been going over their head.

Thus, it seems in the ‘end’ tricks will not do, and understanding is needed to manage the harder parts of the course: on the one hand it is an unhelpful impedance of the performance his students must produce, but then it suddenly re-emerges as a requirement for later units. ‘Understanding’ turns out to have potential exchange value after all.

Colin seems here to be working out a professional identity at the nexus of several communities and cultures: the culture of institutionalised audit, where the exchange value of the knowledge is converted by the institution into resource and hence applies a very direct pressure he cannot ignore; the students’ community and culture also mediates some of this same pressure to direct pedagogy at the test and hence to optimise the exchange value of their knowledge; and a rather under-represented (by the researcher) subject culture that he uses as a counterfoil.

His own personal cultural history is also drawn on in the story from time to time, working his own experience of learning and understanding into his narrative alongside these community discourses and cultures. But there is conflict in his account, as he is presented with the ‘fact’ that for many students the performance of tricks eventually proves problematic. However, the end result, for the moment, is that the learners and their knowledge are objectified as exchange values, and use value is marginalised.

It was in this context that Lee was persuaded to drop out of Colin’s class into one where the work would be found easier. Lee, you will recall, blamed himself because he could not keep up with the non-negotiable pace of work expected in Colin’s class. (Bernstein and others researching in this framework, such as Morais (2002), have identified such ‘strong framing’ of pedagogy as a significant source of educational disadvantage).

Now, let us consider a ‘successful student’ from Colin’s class: one who did quite well at GCSE and is set to do well in AS and A level: Steve intends to become an engineer. He says he enjoys maths, likes its ‘closed’ black and white character, and especially the fact that he can *do* it:

Steve: It’s just something to do. I enjoy it more than any other subject
Well, I like physics ... maths and physics ... [are good for engineering]

Int: So what do you like about it?

Steve: I can *do* it. ... I [like] the questions that have got an answer...whereas in like, English literature or something, there’s no answer as such. You can write anything as long as ... you can get away with pretty much anything, can’t you? [Int: Yeah?] I don’t like doing that because I prefer it if there’s an answer there. [Int: ... how does it make you feel?] Well, it’s easier to do.

Int: Easy. Yeah. Yeah. I mean, and these subjects like English, whatever you say in answer to a question, somebody might argue with you...

Steve: Yeah. And if you justify it, anything could be right

Steve’s discourse is dominated by a ‘positive maths identity for engineering’ that in this case makes use of a cultural model of maths as ‘black and white’, non-negotiable. It seems to make Steve feel safe, and it seems to be instrumental in two senses: on the one hand he ‘feels he can do it’ and so it has value for him in successful performance. On the other hand it is salient for engineering both in terms of ‘use’ and in terms of grade requirements, his future intended course and perhaps leading, imagined identity (at the moment).

In concluding the ‘case’ of Colin’s pedagogic culture – we argue that this pedagogy that mediates the ‘black and white’ mathematical identity of Steve’s and that this is a cultural artefact that is itself the outcome of a combination of (a) Colin’s professional identity work and (b) the culture and discourse of various communities (the mathematical community, the institution of the college, and the

student community). In Colin's case the culture is dominated by a discourse of 'audit' that foregrounds the exchange value of knowledge. But this is not without contradictions, and the professional cultural history of the teacher – and perhaps the intervention consequent on a research intervention such as ours – provokes some of this conflict in the teacher's discourse. We see the root of this conflict in the contradiction between use value of mathematics (understanding that will be useful to the student's engagement and performance later) and exchange value (getting the best performance on the test now, or soon).

In the next case we come via a similar analysis to a very different conclusion. Katrina is a student in Sonia's classroom, where Gemma had herself developed recently a positive disposition to maths. While Colin scored one of the highest scores on our 'teacher-centredness teaching scale', Sonia scored one of the lowest! (see Pampaka et al., 2007). So these two cases represent two extreme pedagogies in our study sample.

Here is part of Katrina's narrative, in which a very different pedagogy is implied:

Katrina: ... not only you think for yourself but like we can ask other people why they got that and it's not just black and white, like you get to a different way to work it out.' To give another example, 'yeah that's what I like as well, you can do it one way, somebody else can do it a different way, but you can still be both right and that's what's good, you find your own way. It is like a bit of independence as well I think in maths whereas other subjects you are taught what it is and everything, whereas maths you will go off and find what you want, it's good'. And alternatively, 'maths it's like really good, I didn't think I would enjoy it at all, I thought it would be boring, like at school it was pretty boring sometimes but, it's really good.'

It is interesting that this expression of a mathematical identity so closely contradicts that of Steve's on every main point: maths is characterised as *not* 'black and white', and is different from other subjects precisely because it is negotiable, arguable and in fact 'sociable'. Clearly, a different mathematical identity is being positively constructed here.

Observations of Sonia's classroom have been made on a number of occasions: we now have a very consistent picture of this pedagogy as being interactive, negotiable, connectionist, and for want of a better word 'mathematical' in the sense of expressing a 'mathematics culture'. A not untypical lesson has been analysed in Wake, Davis, Black, Hernandez-Martinez, Pampaka, and Williams (2007). As a snapshot we show the whiteboard in Figure 1 at the beginning of a lesson developing the concept of histograms. The teacher has put two rectangles on the board to represent the score of the upcoming world up match between England and Ecuador, and she asks 'what score might these represent?' As expected the responses include 1:2 and 1:4, and dealing with this conflict between linear and area representation seeds the notion of area representing frequency later in the lesson. (Incidentally, the provocation of key errors that suggest conceptual conflict is one of Sonia's general strategies).

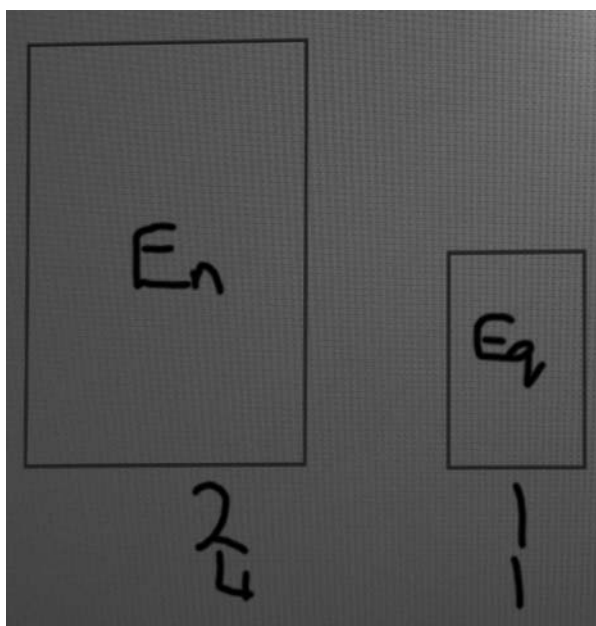


Figure 1. Sonia's start to the lesson on histograms

In another typical episode of a lesson on functions, she asks the class for suggestions as to the formula for a graph she has put on the board. She collects five different responses and reflects “Well, they can't all be right I suppose... how will we decide which are right and which are wrong?” The emphasis here is on the mathematical productions of the students themselves, who she often appeals to as ‘mathematicians’: they are exhorted to ‘think like mathematicians’. The use of the collective ‘we’ in the quote above is also reflective of her appeal to the class to act as a mathematical community.

In the following section of interview it becomes clear that Sonia's view of her own pedagogy is mediated by a ‘maths subject culture’: she wants her students to think like mathematicians, to enjoy solving problems and – in the end – to be mathematicians:

Yeah, that is really important. But they don't think ... there's the self-esteem. Just general self-esteem, not just Maths, but also from the maths point of view, because I mean let's face it ... you know ... Because there are a lot of maths you get things wrong, (don't) you? But I want them to realise that's how mathematicians work. ... Because I want them to realise that, yeah, they are mathematicians. They are not just students who are struggling with maths. I think this is really important for them ... Whereas, every time you get stuck you don't have to ask the teacher for help. You are not a baby trying to learn

something ... I don't want to think about the people I met at university, certainly ... But I think of mathematicians as somebody who enjoys solving problems and who will keep going on with a problem until he gets something out of it. And they don't mind getting it wrong and they don't worry about how many sheets of papers they use and they just enjoy solving problems.

There are clear signs in the interviews that the institutional culture mediates an audit culture, for instance in the need to optimise league table results, but for various reasons this does not come to dominate Sonia's discourse or her pedagogical practice. Some of these reasons lie at the door of the college institutional and community context: being geographically situated in a place where they do not directly compete with other colleges for 'good students' – at least the competition is not as severe as at Colin's college. But also, serving a very poor, isolated and deprived community, the college is obliged economically to recruit less well prepared students and help them succeed to be economic.

But in addition, our analysis shows some clear threads of cultural history in her narrative: her own experience of 'coming from round here', becoming an excellent and very confident mathematician by having to think things out for herself as 'lectures never made sense', and recently gaining kudos as a leading member of her 'subject' culture, the mathematics education community. There is not sufficient space to develop all the evidence for this here, but we note these factors are prominent in supporting her pedagogical narrative and capacity for action in negotiating between 'audit' and 'subject' cultures in her particular college.

In the end however, while we point to factors, we cannot really know definitively how the two professional identities of Colin and Sonia have historically emerged: perhaps the complete narration of the cultural-historical development of identity can never be fully and definitively told.

In conclusion, we have shown how distinct pedagogies can help position learners in different ways and provide different cultural models of mathematics in social practice and how they resource the identity work of the students who engage in these different practices. These different pedagogies can position students in relation to mathematics in distinct ways, for example for understanding rather than for performance, as 'struggling' or as mathematicians 'having a go', and these can be internalised by students. The cultural models of mathematics as "black and white/not black and white", "lonely/sociable" or "hard/challenging" perform at the boundary of two activities: the classroom activity mediated by the pedagogy and the narrative activity in which the students account for their aspirations and narrate their identity. So we see pedagogy as providing for at least partial explanations of how students' trajectories of identity can be differently resourced. But we note here also how pedagogy is not simply an act of free will of a teacher and their beliefs. A teacher's cultural history seems in itself to combine with a college's institutional and community culture in mediating pedagogy. We recognise and value the professional identity of the teacher, and regard their cultural history as a critical explanation of this identity. But we also doubt that this professional self-identity

would be sufficient to determine pedagogy in itself: as pedagogy is itself essentially mediated by the local institutional and community cultures.

Methodologically, we here note that these two cases relied not only on the learners' discourses and narratives, but also on the observations of lessons, and the interviews of the two teachers involved. This approach is sustained by the CHAT framework that suggests that we need to examine mathematical identity in relation to joint mathematical activity (and vice versa). Thus the self-identity of the teacher and student – as witnessed in interview activity – are bound up through the activity of classroom, in teaching-and-learning practices. Pedagogy is a product of the cultural history of the teacher that is crystallised in their professional identity, the teachers' professional habitus. But not only that – it is also mediated by the complex of institutional, community and subject cultures that may reflect the power of audit as well as the use value of mathematics. But the community culture reflects as well as engages with the identities of the learners, so that pedagogy is at the nexus of a constellation of teachers' and learners' identity work (in Wenger's, 1998, terms) or is an activity that bounds a series of institutional, 'home' and professional activity systems that are in various ways in conflict with each other.

CONCLUSION

We began this chapter by suggesting that the three analytical approaches used here should offer different affordances. Our approach to 'interpretative repertoires' was parsimoniously and deliberately limited theoretically, and we find this appropriate to the empirical project of mapping the repertoires used cross-sectionally across our data sets. Some would call this a 'grounded theory' approach: themes are defined by a 'common sense' interpretation as befits a 'common sense-ical' interpretation of 'interpretative repertoires'. This makes the observation that aspirational styles are socio-culturally related a powerful empirical finding (albeit with our special, small sample). The implications for policy in terms of widening participation in mathematics seem clear: policy needs to address youngsters in the languages they understand if they are to receive an interested audience. But the 'language they understand' is different for different groups of students and is related to this in complex, intersectional ways involving at least ethnic, gender and class backgrounds: for some students mathematics needs to offer personal satisfaction here and now, for others its exchange value is vital to motivation, and for yet others vocational 'use' is significant. We know the media can be important too in providing models, perhaps for students that have few alternative aspirational resources. Unfortunately we are not convinced this 'mapping' is complete, and we are aware that the results of this small sample have revealed 'intersectionality' of background factors that need further research. Nevertheless this work is promising in suggesting the potential efficacy of developing such an empirical map.

The analysis of biographical narrative on the other hand provides much more complexity 'in the whole' at the cost of focussing on fewer students: it becomes clear that narratives can be constructed from cultural models in different ways according to how the subject seeks to position themselves, and that this relates to

how others position them in various other salient activities. Then there are the consequences of this self- and other- positioning for their other identities: inevitably one's engagement in different activities in which one is differently positioned provides us with contradictions. We suggest that the narrative is a way of reflecting on and working out such contradictions, or repairing the troubles. For instance, if one is a 'sociable' person in general, say in one's home life, one may find it difficult to self-identify with mathematics unless it is presented as a potentially sociable activity. Similarly Katrina liked the fact that mathematics was an argumentative subject, in which everyone can express their point of view. Recall, though, that Steve liked mathematics precisely because it was 'black and white', and so could not be used to challenge his answers. Thus it might be inferred the presentation of cultural models of mathematics and mathematicians has an important self-selecting effect on the kinds of people who will take up mathematics and what sort of mathematicians they may become.

However, a CHAT analysis of the activity of narration as we constructed it raises fundamental epistemological questions about this analysis and its findings (see Roth et al., 2005). Quite apart from the essentially *post hoc* storying of the students accounts, as interviewers do we not co-construct the narrative with the student in ways that we find 'satisfying'? Can we convincingly draw conclusions for identity and classroom practice based on these narratives alone?

Finally the analysis of cultural models at the boundary between mathematical practice (mediated by pedagogy, professional identity of the teacher, and in turn subject-, institutional and community cultures) and narrating the self allows us to explain trajectories of identity into or out of mathematics. We argued that positioning of the self in narratives is also critical and that this positioning is explained partially by the way learners are positioned in the institution and the classrooms in which they engage in practice, for example by pedagogy and institutional practices. The result was substantively powerful for mathematics education, as the contrast between two pedagogies could be seen in the narratives of the students, via the mediation of cultural models of ways of being mathematical and ways of doing mathematics. This explanatory power comes with a price in terms of the complexity of the data and analysis it demands, however, and even in this lengthy chapter we have not had the space to develop our analyses of the two teachers own narrative history – that is another story.

Still, this investment seems to be essential for getting at the teaching and learning practices that can really make a difference to student disposition to engage, which is the key aim of our research project. Although the additional perspectives from the classroom, the college and the teachers can perhaps never be fully told (one has to stop somewhere) we argue that a minimal account must engage with the teacher and the student engaged in 'joint object orientated' practice.

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