Immigrant students’ processes of learning mathematics in mainstream schools may be understood as transition processes. They join in social practices that are already structured by social representations. Representations have a crucial impact on how immigrant schoolchildren construct their learning experiences and the ways in which they make sense of themselves as learners. A mathematics identity involves a student’s self understandings as well as how s/he is constructed by others in the context of doing mathematics. Through two different cases, that of Ronnie and his teacher Marta, and that of Carles and his students, we will show how mathematics teachers’ social representations, however consciously or not, mediate not only the actual content immigrant students may learn but also the identities they develop as mathematics learners and users.

IMMIGRANT STUDENTS CONSTRUCTING MATHEMATICAL IDENTITIES

Immigrant students’ learning mathematics as a transition process

Immigrant students’ processes of learning mathematics in mainstream schools may be understood as transition processes. Being an immigrant student in a “foreign” mathematics classroom implies a new context of mathematical practice, different relationships with people and knowledge, and different understandings of the actions and interactions that take place.

According to Zittoun (2007), transitions involve changes in the social, material or symbolic spheres of experience of the person and imply processes of relocation in all of them. These changes in position convey new expectations and new possibilities but also constraints on action and losses. Transitions also imply reconstruction of identities and require new forms of knowledge and skills and bring the need to engage in meaning-making to confer sense to what happens to the person. Zittoun establishes that “in youth, learning difficulties are often linked to the fact that the person feels his/her identity put at stake or cannot find a personal sense in the learning situation” (op. cit., p. 196).

We argue that transition processes require transactions of meaning between people and across contexts and are therefore limited and shaped by social
representations about the role and achievements of the person as part of a group to which s/he belongs or identifies with. Transition processes are co-constructed with other social actors. In the classroom the teacher is a key person in establishing new meanings and constructing new knowledge, but also in making available to his or her students certain mathematical identities.

Transitions originate in changing contexts of social practice, changes in persons, or changes in the relations between persons and objects (Zittoun, 2007). Transitions require processes of adjustment to new life circumstances and involve multiple changes in frames of reference and meanings, and in relations with people. These changes require people to modify routines and interpretations, explore new possibilities, and develop new ways of acting and interacting. Social representations, as a means of constructing reality, have a special impact on the transition processes of immigrant students, in particular on their processes of learning mathematics and the construction of mathematical identities.

**Mathematical identity**

The limited extension of this paper does not even allow for a short account of the work done in mathematics education in relationship to mathematical identity. For an initial definition, we want to note that Martin (2007) establishes that mathematics identity (as he calls it) encompasses the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. A mathematics identity involves a person’s self understandings as well as how s/he is constructed by others in the context of doing mathematics. Therefore, a mathematics identity is expressed in narrative form as a negotiated self, a negotiation between our own assertions and the external ascriptions of others. Mathematical identities are always under construction.

For the purposes of this paper, by the students’ “mathematical identity” we mean the academic identity that they develop as mathematics learners and users. Mathematical identities include how students view their own aptitude for mathematics and how they see themselves as users of mathematical knowledge both in school and beyond. Students develop their mathematical identity through their participation in mathematical activities, their interpretation of their own classroom experience, their expectations about future (mathematics) education and about their uses of mathematics both in school and outside. Students’ mathematical identities are dynamic rather than static, and are bound up in other social or cultural identities they may develop.
Mathematics lessons are patterned activities organized with reference both to social norms and values and to mathematical concepts and rules. Therefore, students’ mathematical identities also include their sense of affiliation with the mathematical practices in their particular classroom and their identification with the norms and values regulating it. The development of mathematical identities is shaped by students’ social positions in the mathematics classroom, their construction of mathematical knowledge, and how students understand their experiences as mathematics learners.

Students’ mathematical identities are constantly being reconstructed in relation to students’ perceptions of themselves as mathematics learners and how they are seen by significant others involved in mathematical activities. How students see themselves as mathematics learners, however, is as important as how they are defined by others, especially their mathematics teachers.

Cobb and Hodge (2002) established that the gatekeeping role that mathematics plays in students’ access to educational opportunities includes the difficulties that students experience in reconciling their views of themselves and who they want to become with the identities that they are invited to construct in the mathematics classroom.

**Identities in transitions**

Immigrant students’ transitions have the potential to change the ways in which they interpret themselves and their roles both in school and outside. The ways in which they experience and have experienced their learning of mathematics in the different contexts and how they interpret these experiences impact on their practices and in the identities they develop. The identities they develop as mathematics learners have also to do with their sense of affiliation with the mathematical practices in the classroom they attend, their identification with the norms and values regulating it and their possibilities to participate in the mathematical practices.

According to Abreu and Cline (2003) there are three complementary processes of identity development: a) identifying the other – how the individual understands the social identities of “others” that are dominant in the context of specific practices; b) being identified – how the individual understands the identity extended to them by “others”; and c) self-identification – how the individual internalizes and takes positionings in relation to identities that had previously existed in the social sphere. These three complementary processes are not fixed but evolve through the interaction between the person and the sociocultural world. Identities are constantly reconstructed by engaging in a practice and belonging to a
group, but also by wanting to engage in real or imagined practices and belong to real or imagined worlds.

Crafter and Abreu (2010) reveal how processes of self-identification, identification of others, and identification by other significant people play a crucial role in transitions and that such processes are linked with social representations. Self-identification coexist with identification extended by others and one process is a reaction to the other. “Being identified” is a process whereby individuals understand the identity extended to them by others. According to these authors, it is not uncommon that “others’” identification of oneself is based on dominant representations, which can be seen as part of the social context of practices.

Our focus is on immigrant students’ identity development in relationship with school mathematics. We are interested in identities associated with learning mathematics as part of a transition process and on how this development is influenced by social representations of immigrant children as mathematics learners held by their mathematics teachers.

IDENTITIES MADE AVAILABLE TO IMMIGRANT STUDENTS

Social representations and identity construction

The purpose of Moscovici’s theory of social representation is to explain a process whereby individuals and groups can manage to construct a stable and predictable world out of the diversity of persons, attitudes and social phenomena (Moscovici, 1984). This diversity is organized through social representations that carry previously constructed meanings concerning the past, and make these meanings available for new applications.

Social representation theory offers a way of understanding the social construction of reality that takes into account both the cognitive and the social dimensions of this construction (Ibáñez Gracia, 1988). Identifying the representations surrounding social phenomena is an approach that allows us to understand how persons both construct and are constructed by social reality through processes of communication and interaction. Social representation theory is particularly useful for understanding phenomena related to the teaching and learning of mathematics in classrooms in which immigrant pupils are present (Abreu & Elbers, 2005; Gorgorió & Abreu, 2009).

Among the functions of social representations Abric (1994) includes the following: a) knowledge of reality through an integration of information into a common frame of reference that is consistent in the values, social norms and practices of the group; b) definition of identity and group belonging, and identification and positioning in relation to other groups; c) guidance for forms of action and social practices through definition of the
purpose of a given situation, production of expectations and anticipations, and definition of what is normative and counter-normative; and d) justification of opinions and actions in regard to people and objects and, on a more general level, the maintenance of social differentiation.

The learner in transition belongs at the same time to different groups and participates in different practices. As in Duveen (2001), in the account of identity development we consider a fundamental idea that the individual in transition enters a social practice that is already structured by social representations of the specific community. In particular, teachers’ representations about immigrant children as mathematics learners will result in actions, discourses, and relationships that make available certain identities to immigrant students. This occurs in a context, the school, where power is not homogeneously distributed.

However, identities are not only constituted by labels that people place on themselves and others. Identity is about how people become who they are and how they come to understand themselves (Urrieta, 2007). It is about how they come to figure who they are, through the worlds they participate in and through how they relate to others within and outside these worlds.

In the following two sections, we illustrate how mathematics teachers, however consciously or not, make available certain mathematical identities to their immigrant students through the actual practices they promote in their classrooms. Through the opportunities they offer to their students, teachers contribute to shaping how immigrant students become who they are as mathematics learners, and how they come to make sense of themselves. For that purpose, we will draw selectively from two different ongoing studies, and we will present the case of Marta and Ronnie and that of Carles and his students.

**Marta and Ronnie**

Marta and Ronnie provide us with our first example. Ronnie is one of the participants in an ongoing study aimed at understanding the transition processes of immigrant students learning mathematics in Catalan schools (see Costanzi, Gorgorió, & Prat, in press, for more details). To date we have interviewed 33 Ecuadorian students in compulsory secondary school. In one of these schools, we have worked with 15 boys and girls, Ronnie among them. We have also worked with their mathematics teachers, and we have recorded several interviews with Marta, Ronnie’s teacher.

Marta’s representations about mathematics being a universal school subject and learning depending solely on cognitive abilities, led her to attribute to her students low achiever identities. During the different interviews, she told us repeatedly that she did not consider her students’ place of origin to
be relevant information for her teaching of mathematics. In fact, one third of the students in her class were immigrant, and she could not tell us how many of them were from Ecuador. She insisted that to her all students are equal. However, when asked, it was clear that she had a prevailing view of students from Ecuador as “working below grade level”, a fact that had important consequences for her immigrant students’ chances to participate in mathematics tasks with a high level of requirement.

Marta: There’s no room for activities that are challenging, mathematically speaking. They’re too weak; we can only do exercises if our goal is to get the students to pass. We can’t do problems.

In fact, during classroom observations, we never saw any problem solving situation, and during the interviews, her students confirmed this absence.

However, Marta’s students told us that she was a good and caring teacher. Ronnie is one of them. At age 16, Ronnie was in the third year of the four years of compulsory secondary education, one year behind where he should be. He told us that “when I got here I couldn't talk”, by which we understand that he means he could not speak Catalan, the language of instruction in Catalonia. He also told us that “since I was not up to grade level in mathematics because I came from Ecuador I was placed in a class a year behind” where he should have been according to his age.

Now, he speaks Catalan well and says that he wants to go to university, although he understands that it will require hard work. Despite this, although he still has one more year of compulsory education and two of baccalaureate to complete, he also believes that he will not have access to the university system because of his being weak at mathematics.

Ronnie: since I’m not good enough at math, I won’t be able to pass the entrance exam to go to university.

Ronnie is one of the cases that show how a student has limited possibilities as a mathematics learner because of what is offered to him as school mathematics. It also illustrates that he has accepted the identities made available to him, to the point that his narrative could be that of his mathematics teacher instead of that of a student who wants to succeed.

Carles’ and his students

The other example, that of Carles’ lessons, comes from Prat (2009). Carles is the mathematics teacher of a group in the second year of compulsory education, with students aged around 13. We have observed the development of the mathematics lessons during several weeks and interviewed the teacher, and the students have answered an open questionnaire about the social organization of the mathematics lessons.
During our first meeting, when Carles was asked about his students in class in order to organize the viedorecording of the lessons, he referred to those having learning difficulties or attitudinal problems. He only talked about the good ones if they had a behaviour that made them “too obvious”. When asked about the three immigrant students in his class, he told us:

Carles: (...) the three of them follow the lessons with no problem, they are good students. Other years, I’ve had some immigrant students that were not so …

From all the conversations we have had with him, it seems clear to us that he is ready to give opportunities to all his students, regardless of their place of birth. He commits to complete the prescribed curriculum each year and scaffolding learning is to him the basic strategy of mathematics teaching. From the very first interview he expresses that to him the person is more important than the mathematics content he is teaching.

Carles: When we teach, we are facing people that have to learn something, each one with their own ways of being and doing, (...) the basic issue is that they are human beings. (...) the most important thing is to educate them, even before teaching them mathematics.

Next, we want to share with the reader some moments in Carles’ lessons. We want to insist that, once again, our interpretation is based not only on the short vignettes that we are presenting now, but on a whole process of analysis of an ample set of data.

In one of the sessions we observed, Carles’ students were solving problems. The students were facing the blackboard and the teacher was the one leading the task. They were solving the following problem:

In a rectangle, the length is 3cm longer than the height. The area is 80cm². Determine its dimensions.

Carles: (to all the students) What’s the area in a rectangle?

10 (JR): (not asked individually) Length times height

Carles: (to 10(JR)) Before answering, you have to be asked.

We want to note that Carles had described 10(JR) as “a bright student that likes to be paid attention too much”.

Later on, when using the formulae to solve the problem, 10(JR) prompts, without being asked:

10(JR): when one of the solutions is negative, we cannot use it as a solution, since lengths cannot be negative.
Nobody is paying attention to 10(JR) except the teacher that tells him that his thinking is correct. Then, the teacher explains it to the rest of the group. As observers, we noticed that the time for the lesson was running short, and Carles wanted a right answer to finish the problem before all left.

In fact, we observed a repeated pattern in the interaction between Carles and 10(JR). When the teacher wanted an efficient answer, he would ask him or allow him to prompt his answer. However, he would not accept his non-invited contributions, even when they were right and useful, unless he was short of time. It was like on the one hand, he wanted to teach him that there were norms on how to contribute. However, on the other hand, by asking him when efficiency was needed, he was pointing him out as an able student.

From the interaction with another student we recorded the following:

Carles: (to all the students) It’s always important to clearly establish the “x”. If you know what “x” means here, raise your hands.

Carles: (several hands are raised) 16(DM), tell us.

16(DM): the length.

Carles had described 16(DM) as a student whose “attitude... well, it has to improve, right? But, well, he is starting.” From classroom observation and our conversations with the teacher, we understand that the teacher’s intention was to have the student involved in the lessons’ development. However, the pattern we observed was that he only asked him simple questions, like the one above. This was pointing the student out as one that was less able than average and that could only be asked about simple facts. This is especially obvious in the vignette, when he pretends the question to be an important one.

Later on, during the same lesson, he gave them a list of equations to be solved. He told them that if anyone has a doubt s/he had “to stand up and come to ask me”. Once they were finished, and before correcting them, he gave them the solutions of the equations and asked “who got all the answers right? Raise your hands!” In other occasions he asked them to raise their hands when they had the exercise or the problem wrong. This was a pattern that repeated itself throughout the time, to the point that the students described it as a natural part of the lesson.

According to his explanations about how he organized the lessons, the teacher’s intention was to follow both each student individually and the whole group. However, requiring them to go and ask him when they had any doubt or raise their hands whether they have the answers right or wrong, was also a way to distinguish those who do well from those that do not.
DISCUSSION

Immigrant students’ transitions imply processes of identity reconstruction that could afford as well as constrain. How students see themselves as mathematics learners is as important as how they are defined by others, especially their mathematics teachers. Grades are an obvious mechanism through which students come to figure out how good they are thought to be at mathematics. Explicit praise or criticism is also a way to let students know whether they are doing what they are expected and how much they are expected to do. However, there are more subtle ways through which teachers extend identities to their students.

In Ronnie’s and Marta’s case, we have seen how identities were made available to students, wholesale, through everyday classroom practices, by leading them to construct a very restricted kind of mathematical knowledge, a fact that suggested constraints in their possibilities for their academic future. How could they become good at mathematics, or how could they think they were, or would be good, at school mathematics if they were offered no mathematical challenge? Marta, with an honest intention to make them feel that they succeeded at the tasks she offered them, she only proposed routine exercises, reinforcing her a priori image of them as low achievers.

Through Carles’ case, we have seen how identities were extended to individual students, retail, through an honest effort to follow each student’s progress. We have seen how, in everyday classroom practices, the way the teacher orchestrated participation in the classroom, and his pursuit of scaffolding learning provided evidence to all of who needed help and who succeeded without it. This way, in the actual developing of classroom practice, students could make sense of themselves as good or bad in mathematics.

Our work is still a work in progress. In this paper, we have neither discussed how acceptance or rejection of the attributed identities take place, nor how students position themselves in relationship to normative identities in class. There are many other questions still open, such as what is the role played by agency and power in the realisation or contestation of social representations, or how students negotiate with themselves and others the different identities they construct through their participation in different practices.

We have illustrated how social representations play a role in the attribution of identities through the mathematical tasks that the students are offered to participate in, and through the interactions that take place between teacher and students. It could be asked whether there is a way for teachers not to attribute identities to their students. We are convinced that the answer to
this question is no. In the same way that we all have representations of the world around us, when relating to others we all identify them, while being identified by them and take positions in relationship to them.

At the beginning of the paper, we said that we would present our argument to show how mathematics teachers’ social representations, however consciously or not, mediate what the students learn and the identities they develop. The crucial issue here is the awareness of this mediation. As mathematics teachers it is our responsibility to engage in reflexive practices to critically examine our social representations and how they impact on the identities we make available to our students.

REFERENCES