Being a Girl Mathematician

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Being a Girl Mathematician: Diversity of Positive Mathematical Identities in a Secondary Classroom

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The construction of positive mathematical identities (MIs) is a complex and central issue in school mathematics, where girls are usually “counted out” of the field. This study explores positive MIs (high achiever and positive relationships) of three girls. We employed a nested model of identity based on a case study approach (e.g., female mathematics students nested
within a cluster of students nested within a mathematics classroom). The results highlight diversity in how these girls experienced mathematics: They valued different forms of doing mathematics (independent–collaborative, wider–complex, and straightforward–procedure oriented), showed different forms of engagement (detachment, protagonist–challenging, and compliant–support seeker) and narrated different MILs (efficient, different, and responsible). The role of mathematical practice and belonging to different peer clusters in these different forms of identification are also explored and discussed.

Key words: Classroom interactions; Gender; Mathematic identities; Narratives; Peer relationships; Positive identities

Several studies over the last few decades have documented how women tend to live conflicted mathematical lives, dealing with relative underperformance as a group and the social discourses documenting these differences, as well as participating less than men in post-compulsory mathematics and related careers (for example Lubienski & Ganley, 2017; OCDE, 2015). When attempting to explain these difficulties, studies have predominantly taken a psychological perspective, trying to identify what is “wrong” with girls or women in their relationships with mathematics—an approach that has been criticized as “blaming the victims” (Anyon, 1981, in Boaler, 1997, p. 284). A key critique of such work suggests that by focusing on girls’ individual psychological characteristics as inherent fixed traits, a naturalization process may take place wherein girls are seen as ill-suited to mathematics (Boaler, 2002a). In addition, this psychological approach neglects the fact that the process of learning mathematics does not occur inside an isolated individual in a historical vacuum but rather is embedded in a wider and particular social context (Boaler, 2000; Kaiser & Rogers, 1995). Consequently, some have suggested that in order to understand students’ relationships with mathematics (and with any other social activity), the emphasis needs to be placed on the relationship between the individual and the social context (e.g., Holland, Lachicotte, Skinner, & Cain, 1998). It is here where the concept of identity has been suggested as a useful lens with which to explore this relation between students and mathematics (Langer-Osuna & Esmonde, 2017; Sfard & Pusak, 2005), with particular power for understanding the
experiences of underrepresented and underperforming groups (e.g., Martin, 2012; Varelas, Martin, & Kane, 2012).

Recently, a growing number of studies in mathematics education have used concepts such as identity or mathematical identity (MI) from a social perspective (Darragh, 2016; Stentoft & Valero, 2009). In particular, when used for understanding girls’ relationships with mathematics, a strong contrast can be found between studies in compulsory and post-compulsory education (this is also the case with more general research on MIs; see Radovic, 2015). Research on post-compulsory mathematics has mainly explored women’s MIs by capturing the singularity of their experiences and their reflections on those experiences through the use of a narrative approach (Herzig, 2004; Mendick, 2005a, 2005b; Rodd & Bartholomew, 2006; Solomon, 2012; Solomon, Radovic, & Black, 2015). Several ideas have emerged from this line of investigation. For example, it has been noted that women with a positive identification with mathematics, those who decided to pursue mathematics as a career path, need to negotiate a series of complexities and conflicts in order to engage with mathematics. Some of the complexities described in the literature include the role of others in building a mathematical story (Solomon, 2012), the power of discourses that define mathematics as a male domain (Mendick, 2005a), and the positioning of women as an invisible minority in a male peer context (Rodd & Bartholomew, 2006). As a consequence, a main proposition of this line of research is that women need to perform complex “identity work” when engaging with mathematics (Black & Williams, 2013; Holmegaard, Madsen, & Ulriksen, 2014; Mendick, 2005a; Solomon, 2012), which suggests that becoming a female mathematician does not happen easily.

In contrast to studies on post-compulsory education that focus on a positive (albeit complex) identification with mathematics, studies in compulsory education have tended to focus on how girls interact with mathematical activity in schools, paying particular attention to how they disengage from it. This line of research has suggested that traditional mathematics teaching practices—where teachers have a central role, individual and competitive work is dominant, and rote repetition and rule-bound learning are encouraged—contribute to girls’ difficulties and disengagement from mathematics (Atweh & Cooper, 1995; Black, 2004; Boaler, 2002b; Boaler & Greeno, 2000; Solomon, 2007). Although both boys and girls have been observed as disengaging from these traditional practices (Nardi & Steward, 2003) boys have been shown to be better able to reposition their goals by pursuing competition and relative success without disengaging. Girls, in contrast, have been observed
to find this repositioning more difficult, thus tending towards disengagement and dis-identification from mathematics (Boaler, 2002a, 2002b). It is interesting to note that some of these studies have anecdotally reported the existence of girls with positive relationships with mathematics who engage in mathematical activity even in traditional mathematics classrooms (e.g., Solomon, 2007). However, accounts of how such “against the odds” positioning is made possible within traditional school mathematical practices and how it is experienced by such girls is an under-researched area.

The mediation of peer relations is an area of investigation that could develop our understanding of how girls’ positive mathematical identities are made possible in the classroom. In the activity of building intimate relationships with peers, adolescents form their personal meaning of life as social consciousness diverted inward (El’konin, 1971). Adult norms reproduced in peer relations become relevant identity resources during this period of life, constituting peer relations as the leading activity of this stage of development (Karpov, 2003; Leontiev, 2009). Peer relations in the classroom have been regarded as a source of social comparison relevant in the development of adolescents’ self-concept and self-efficacy (e.g., Marsh, 1987; Marsh et al., 2008; Zeidner & Schleyer, 1999) and as influential on the values and meanings that students give to education and engagement (Francis, Skelton, & Read, 2010; Jackson, 2006). In mathematics, recent studies have explored how belonging to different peer groups in the classroom can play a role in the process of MI construction. These studies have mainly considered how friendships and peer relationships are forms of capital (Choudry, Williams, & Black, 2016) that can help in negotiating access to mathematical resources (Gholson & Martin, 2014) or be used to negotiate more powerful positions when students perceive themselves as less powerful in mathematical practice (i.e., with less mathematical capital; Esmonde & Langer-Osuna, 2013). Although these studies have provided support for the existence of relationships between peer dynamics and the nature of mathematics in the mathematics classroom, they have conceptualized peer relationships as a form of capital but not necessarily as a source of identity. In other words, they have not explored how constructions of who we are may have a particular impact on notions of who I am in relation to mathematics.

In summary, previous studies have alerted us to the conflicts and contradictions that girls and women face in being or becoming successful in mathematics. Although studies in post-compulsory education have suggested that these conflicts are related to women’s difficulties in finding a narrative of themselves as mathematically successful, studies in
compulsory education have not consistently researched this issue. In addition, we hypothesize that these identity negotiations are related to girls’ peer relationships, which are dominant and lead activity in adolescence. Yet we found no research on the role played by girls’ peer relationships on how gender influences the dynamics of the classroom and how peer clusters can mediate the ‘becoming’ of positive MIs. Therefore, this paper systematically reports how a group of mathematically successful girls perform positive MIs in compulsory education during early adolescence (13–14 years old). In particular, this study explored how these girls’ relationships with their peers (and their peer cluster identity) mediated girls’ identifications with mathematics by examining how these relationships were used to maintain or negotiate different positions of engagement and success.

Theoretical Model of Identity and Methodological Rationale

We adopted a sociocultural conceptualization of identity following Holland et al.’s (1998) synthesis of Vygotskyan, Bakhtinian, and Bourdieusian approaches. This synthesis conceptualizes identity as a dynamic and relational process composed of a contradictory unit of discourses and practices wherein “others” are central. Identities develop in relation to others, using the voices of others, during a process in which individuals position themselves and are positioned by others as certain “kinds of people.” Others also become available figures or kinds of persons which students can identify or dis-identify with. In this negotiation process students often develop a sense of belonging to different peer clusters, which become an important resource for identity construction and also part of identity itself (Gholson & Martin, 2014; Lim, 2008; Renold & Allan, 2006).

With respect to the contradictory unit of discourses and practices, identities develop in a dialectical relationship between narrative stories and forms of participation or acts. Narrative stories are mediated by the use of symbols that are learned in practice—and which are therefore context specific—and become internalized through social interaction (Holland & Lachicotte, 2007). Students learn to identify themselves with different figures, cultural models, or types of persons, such as “nerd,” “geek,” “freak,” “capable,” or “at risk” (Holland & Skinner, 1987), which then become resources for further reflection in inner-speech (Holland & Lachicotte, 2007). In contrast, forms of participation or acts do not necessarily rely on internalization but are related to regularities and inconsistencies in the way people engage with others and are treated by others in practice (Williams, Davis, & Black, 2007).
However, both narratives and acts are expressions of the kinds of persons an individual sees themselves as being. As Holland et al. (1998) put it, “People tell others who they are, but even more important, they tell themselves and then try to act as though they are who they say they are” (p. 3). Similarly, one’s engagement with others, one’s acts (in joint activity, whether in the classroom, at home, or in interviews), and how they are seen and positioned by others also mediate the stories one tells about who one is (both to oneself and others). Although some consistency is expected, inconsistencies and conflicts between narratives and acts are also usually found, constituting a dialectical process of developing identity.

Both narratives and acts emerge from a process of self-positioning in relation to two main aspects of mathematical practice. First, based on the principle that an individual is always nested within a peer cluster, girls’ narratives and acts can only be understood in relation to the narratives and acts of the peer clusters they affiliate with and the peer clusters they distance themselves from (notions of “we are” and “we do,” and “they are” and “they do”; Lim, 2008). In this sense, cluster identities are also understood as particular narratives and acts built over time through engagement in activity and through social acknowledgement and recognition. Particularly relevant to cluster identities is the recognition of a (flexible) border or limit that defines who is and who is not part of the cluster—who we are and who the others are (that we are not).

Second, both narratives and acts will always be considered in relation to the wider context of the classroom and the particular society that will delineate the meaning of mathematics (and doing school mathematics) and gender (and being a school girl) in this particular cultural context (Atweh & Cooper, 1995). In other words, this study attempts to capture how each of the girls and their peer cluster engages, complies with, or resists classroom mathematical norms and practices (e.g., Cobb, Gresalfi, & Hodge, 2009; Solomon, 2008), how they relate to the particular participation structures in place (Langer-Osuna, 2011), and how they negotiate different notions of what being a girl or a boy mean in the mathematics classroom (e.g., Mittelberg, Rozner, & Forgasz, 2011).

In order to account for this complexity, this study used a nested model of identity based on a case study approach (Yin, 2003). Such a model proposes that a case (i.e., a female mathematics student) can be nested within another case (i.e., a cluster of students inside a mathematics classroom) which can be also nested within a larger case (i.e., the entire mathematics classroom), all of this in a particular social context. Through the use of a nested model of identity this study explored the process of identity construction of three girls
belonging to three different peer clusters in one mathematics classroom. See Figure 1 for a visualization of this MI model.

**Figure 1.** This model of MI shows how one student’s identities (both narratives and acts) are constructed in interactions with other peers in a particular peer cluster and in a particular practice and social context.

**Methodology**

**Chilean Context**

This study was based in Chile, a country where the relationship between girls and mathematics is still seen as problematic. Girls have been consistently shown as underperforming (Agencia Calidad de la Educación, 2014; Ministerio de Educación Chile, 2005) and studies have documented that teachers and students hold stereotypical expectations about girls’ attainment and dispositions in this subject (del Rio & Strasser, 2013; Mizala, Martinez, & Martinez, 2015). In relation to women in Chilean society, although this country has seen a dramatic increase in the incorporation in formal education and workforce over the last 50 years (Esteve & Lopez-Ruiz, 2010), important gender differences still persist. Participation in the workforce is still at less than 50% of the female population compared
with 70% of the male population (INE, 2012), wage for women is estimated to be 30% less than equivalent wages for men (Fuentes, Palma, & Montero, 2005), and working women are still highly concentrated in areas of service and trade (74%) and occupy less competitive jobs with lower salaries (Voz de Mujer, 2013). In addition, traditional gender roles predominate. It is still commonly believed that the most important role for women is to stay at home and take care of their families, with women tending to leave the labor market after having children or when their partners earn enough money to sustain their families (Stuven, 2013). In contrast, the most important role for men is to go out and work (Voz de Mujer, 2010). Such traditional roles are adopted more readily by women from lower socioeconomic groups, which have lower levels of female participation in the workforce (CASEN, 2013) and a higher percentage leaving the workforce after having children than women from higher socioeconomic backgrounds (Stuven, 2013).

Participants

This study was purposefully situated in a school that represented an average school for working class population in Santiago de Chile: privately-subsidized school with average attainment on the national census of evaluation SIMCE (Measurement System for the Quality of Education, for its acronym in Spanish). The current Chilean policy allows privately subsidized schools to be selective of their students and to charge a small tuition fee. Consequently, these schools are highly homogeneous in terms of the socioeconomic status of their students (Mizala & Torche, 2012). Families from this school can be classified as lower working class (AIM Chile, 2015), in which most adults did not finish secondary school and work in services and manual labor. Furthermore, despite the high level of socioeconomic homogeneity, a policy of mixed ability means that these schools contain high variation in students’ achievement inside the classroom (Ramirez, 2007). The school that is the focus of this paper was considered by teachers and students to be a demanding school where students were expected to reach a 70% mark in order to pass each grade, up to Year 8 (14–15 years old). Students who did not reach this score were held back a year.

This study focused on a Year 7 (13–14 years old) mathematics classroom with 39 students. The teacher (Ms. P) had 2 1/2 years of previous experience teaching mathematics. She had completed a general (not mathematics specific) teacher training course at a non-traditional university and had relatively limited experience and preparation in mathematics.
Despite her relative inexperience, Ms. P was considered by the Head of Department and her students to be a very good teacher.

The three girls chosen for this study (pseudonyms Maria, Carla, and Katia) were purposefully selected in order to represent girls who were developing positive relationships with mathematics but who belonged to different peer clusters inside the classroom (see Peer Clusters interview below). All three girls were among the highest achiever students in the classroom and all of them reported in an initial survey that mathematics was their favorite subject. In addition, all of them were mentioned by their teacher and by some of their classmates as students with good relationships with the subject (see the Mathematical Groups interviews below).

**Data Collection Procedure**

Data collection was performed during the second semester of the academic year between September and December. In order to gain knowledge of the classroom and to cultivate the trust of the students, the first author visited the class regularly and participated in their mathematics lessons and some of their class meetings. During these visits, she walked around the classroom and frequently talked with all of the students. Four observation and interviews protocols were either designed or adapted in order to consider both social and psychological (subjective) perspectives in the analysis of students’ identities (Cobb, McClain, & Gravemeijer, 2001).

**Lesson observations.** The purpose of the lesson observations was to describe the predominant mathematical practice in the classroom and also how students’ participation was exercised and distributed. Observations were distributed throughout the semester. Field notes and audio recordings were collected. Low inference information (every public intervention that each student made in public class discourse) was also gathered from four lessons of the unit of Data Management and Probabilities (the final unit of the year).

**Mathematical Groups Interviews.** The purpose of this instrument was to identify which different ‘kinds of mathematical students’ were perceived in the classroom, how mathematical competence was understood, and to explore where and how each of the three girls positioned herself and was positioned by others in relation to these groups. Students who participated in this interview were sampled from the whole class to represent different levels of achievement. A total of 16 students were interviewed both individually (7 boys and 9 girls) and in groups (a group of 7 boys and a group of 7 girls). In addition, the teacher was asked the same set of questions during an individual interview. All participants were asked to group
students by answering the following question: “Are there groups of students that show a similar relationship with mathematics?” They were asked to build as many groups as they could. It was explicitly stated to them that students in a group should be similar within the group and different from other groups. After this procedure, the participants and the teacher were asked to elaborate on the criteria they used to group their classmates to explore cultural models in relation to mathematics.

**Peer Clusters interviews.** This interview was adapted from Cairns, Xie, and Leung’s (1998) protocol for mapping the classroom peer group structure in terms of naturally occurring—i.e., by peer friendship rather than academic—peer clusters. Students were purposely sampled in order to represent different peer clusters. The teacher selected students for initial Interviews and information from these interviews was then used to select students for further interviews, until new interviews did not provide more clusters. A total of 12 students were interviewed (5 boys and 7 girls). Students were asked to cluster their classmates by answering the following question: “Are there people in this classroom who hang around together a lot?” Interviews lasted about 10 minutes on average. As with the Mathematical Groups Interview, students’ responses were explored further in order to capture meanings associated with each cluster.

**Mathematical Narrative Identities Interviews.** Individual interviews were employed to capture students’ narrative MIs. Seven girls and seven boys from the classroom were interviewed following this protocol, including the three girls focus of this paper. These interviews were an adaptation of two existing instruments: the Mathematical Life Story (Lewis, 2013) and Identity Mapping (Ylvisaker & Feeney, 2000). The Mathematical Life Story was used to engage each girl in building a narrative regarding her historical relationship with mathematics. Each girl was asked to think about her “maths story”—how she came to develop her current relationship with mathematics and how she imagined this relationship to develop in the future. Critical moments in this story (moments in which the girls saw their mathematical relationship changing) were marked in a map, identifying highest (positive emotions) and lowest (negative emotions) points in their mathematical life (Following Lewis, 2013; see Figure 2). The Identity Mapping was employed to describe the feelings and behaviors that each girl associated with herself when doing mathematics as well as her perception of how others saw her while doing mathematics. After talking about these feelings and behaviors, each girl was asked to think of a name (a mathematical character or metaphor) that portrayed her unique relationship with the classroom mathematical activity (see Figure 3). Both the Mathematical Life Story and the Identity Mapping lasted about half an hour and
during the entire interview the researcher encouraged the girls to think of people who influenced their stories and current relationship with mathematics. In other words, the interviews focused on how others had shaped or were shaping these girls’ MIs.

*Figure 2.* Mathematical Life Story. Each of the girls was asked to tell her mathematical story and to mark her highest and lowest points on the graph. Numbers indicate grade levels.

*Figure 3.* Identity Mapping. Each girl was given this instrument without prompts. Guiding questions are inside the squares.
Data Analysis

Mathematical practice. Through analysis of the lesson observations and interviews we sought to understand how mathematics was described and practiced in this particular classroom, unveiling the participation structures in place, students’ positionings within these structures and how competence was constructed. For the analysis of participation structures Lesson observations were coded in terms of 1) lesson activities and tasks in order to describe lesson structures (Wells, 1993) and 2) students’ participation in classroom public discourse (any utterance that was somehow accepted or acknowledged by the teacher). For the first type of coding, activities and tasks were identified, their duration was recorded, and they were described in terms of how the activity was structured (whole class discussion, individual or peer group work, and teacher guided) and its purpose (introduction of new content in the unit, formalization, revision, reinforcement). For the second type of coding, the first author made notes during lesson observations on every public participation of each student in whole class public discourse (e.g., the question or affirmation that was made and who made it). Students’ private interactions were not coded. A seating plan with students’ names was used to mark each student’s response to all of the teacher’s questions. All spontaneous student interventions and signs of disruptive behavior were also marked on the seating plan. After the lesson, the seating plans with the notes were compared with the audio recordings, and each interaction (usually a question from the teacher) was coded regarding what response was expected (considering the response given and if it was accepted; for similar approaches see Hiebert et al., 2003; Radovic & Preiss, 2010; Wells, 1999). These codes allowed us to identify open questions (often personal experiences, opinions, and justifications) and closed questions (usually defining or naming a concept, analyzing an example or information given, or applying a concept or procedure to an example) and how they were distributed between students in the classroom.

For the analysis notions of competence in place in the classroom, information gathered with the students’ Mathematical Groups interviews was coded thematically, identifying criteria to differentiate groups (predominant cultural models in relation to mathematics). This coding procedure was highly driven by the data following an iterative method and constant comparison analysis suggested by Strauss and Corbin (1998). Particular attention was given to the gendered aspects of groupings and cultural models used by students.
Map of the peer culture. Different peer group clusters were identified using the Composite Social Maps software (SCM 4.0). By including information collected in the Peer Clusters interviews (each group reported by each student interviewed), the software computed a co-occurrence matrix and then identified groups in terms of similarities between co-occurrences of individuals using a correlation matrix (Cairns, Garepy, Kinderman & Leung, 1996). After groups were identified, a new matrix was created contrasting descriptions that the interviewees gave about their own and other groups. With this information, a general account for each peer cluster was constructed.

Girls’ Mathematical Identities analysis. In line with the theoretical underpinnings of this study, we considered identity in a dialectical process of development that can have moments in various forms: stories, names, figures, models, ways of participating and relating in practice, and so forth. To address this complexity, different data sources were organized into a single case document (one document per girl). This document included: (a) a description of their individual participation in whole class public discourse (lesson observations), (b) their own definitions of competence (Mathematical Groups interviews), (c) their own positioning regarding these definitions (in which group they classified themselves), (d) their definitions of membership in their peer clusters and how they distanced themselves from others (Peer Clusters interview), and (e) their interviews regarding their mathematical stories and relationship with mathematics in the present and imagined futures (Mathematical Narrative Identities interviews). In addition, information from other students and the teacher (quotes in which each girl was mentioned) were included in the document as a way of gaining access to how they were positioned by others in classroom discourse and practices. All of this data was transcribed in its original language (Spanish) and relevant quotes were translated by the first and third authors (fluent in both English and Spanish) and reviewed by the second and fourth authors (who speak English as their first language).

Each document was first analyzed individually and only later were comparisons between the three girls explored. Comparison between different sources of data was central, in particular for the identification of potential tensions and conflicts. A tension was regarded as an opposition between different aspects of MIs (e.g., self-positioning versus others’ positioning, narrative versus acted, past versus present versus future) and conflicts were identified when these tensions were associated with a negative affect. Tensions and conflicts were analyzed exploring the identity work that the students did in their narratives, particularly what cultural models students used in trying to resolve conflicts.
Results

This study aimed to contribute to the literature on MIs by exploring in detail the singularity of experiences of three girls that were seen, and saw themselves, as successful (high achievement) and engaged in their compulsory mathematics classroom. We present the main results of this study as follows: First, we offer a general account of the predominant mathematical practice in the classroom and how gender was involved with this practice. Second, we describe the process of developing MI for the three girls we chose to focus on.

Mathematical Practice

The analysis of the lesson observations and students’ Mathematical Groups interviews suggested a traditional pedagogical practice (see, e.g., Boaler, 2002b), where curriculum, content, and interactions were highly controlled by the teacher. New contents were introduced gradually, with large amounts of time being dedicated to rehearsal of previous contents. The teacher commented that she followed this gradual approach because she was concerned with making mathematics accessible for all students in the classroom, especially those who found it particularly difficult.

In terms of participation structures, most whole class public discourse was organized following the initiation-response-feedback (IRF) pattern (teacher’s question \(\rightarrow\) students’ answer \(\rightarrow\) teacher’s feedback; see Mehan, 1979; Sinclair & Coulthard, 1975). Most (63%) teacher elicitations were identified as closed questions (students were expected to find a correct answer), with only 22% being open questions. Most lessons revolved around memorization of concepts and algorithms, with students using these to solve simple, routine problems. In addition, a large variability was found in students’ participation. Although most students participated on only a few occasions (25 students participated only once or less per lesson), others were considerably more active (e.g., one of the focus girls, Carla, averaged close to 7 questions per lesson; see Figure 4).
Figure 4. Histogram of mean participation in whole class public discourse per lesson; $n = 38$ students, mean = 1.3, SD = 1.5 questions per lesson per student.

Different Kinds of Students

Three different kinds of students were identified from the Mathematical Groups interviews: the Effortless group, the Effortful group, and the Lazy group. A boy described these groups as follows:

The first group [Effortless group] is the smart one. This group gets high grades even if they don’t study, even if they don’t come to class. This one [Effortful group] comes second after the smart ones (...) In this group they have to study more and if they don’t come, they get worse grades. And this last group [Lazy group] is the one that always do bad, even in sports… they are the lazy ones.

The description of the Effortless group resembled the shared cultural model of mathematics as requiring natural ability (e.g., Walkerdine, 1998). This, since members of this group did not have to put effort in order to achieve; they were simply ‘good at it’. In fact, the student who was perceived by everyone as the best in the class (Christian), and belonged to
the Effortless group was often seen sleeping at his desk in the last row. In addition to Christian, three girls and another boy were consistently mentioned as part of this group.

In contrast, the Effortful group was characterized as having a positive relationship with mathematics but needing to put forth some effort in order to be successful. Students described members of this group as frequently participating in class and showing interest. Mainly girls were identified as part of the Effortful group, with only a couple of boys mentioned. When discussing this in a group interview, two boys identified themselves as Effortful and the rest of the boys started laughing and bullying them because of this identification. It is possible to conclude from these observations that the Effortless position was regarded as an imperative for high achiever boys in this classroom but not for girls, who could position themselves as either Effortless or Effortful when being high achievers.

Finally, the Lazy group was consistently described as being comprised of low achiever boys who exhibited a bad relationship with mathematics and who did not make an effort to achieve. Most of the interviewees (including some of the students self-identified as ‘lazy’) regarded this group’s lack of effort as due to laziness and lack of interest. Three girls, friends of these boys and part of the Adolescent group (see below), said that their achievement was not related to lack of effort but to an actual difficulty in understanding and staying focused during lessons.

In addition to this gendered dimension in the definition of different kinds of mathematical people in the classroom, a relationship between mathematical groups and peer clusters was observed. In particular, the peer clusters to which the three girls of this study belonged to (Adolescent group, Normal group, and Korean group; see below) were comprised of contrasting mathematical people. The Adolescent group contained most of the boys who were identified as part of the Lazy group (4 out of 5) and all the girls regarded as part of the Effortless group (3 out of 3), including Maria. The Korean and the Normal groups were mixed in terms of achievement and participation. High achiever girls from these groups (i.e., Carla, Daniela [one of Carla’s friends], and Katia) were considered Effortful by their peers (see Figure 5).
Figure 5. Student participation in whole class public discourse (as measured by observations) and achievement (as measured by grades). Only focal students (Maria, Carla, and Katia), their peer clusters, and students who were consistently named as “Effortless high achievement” and “Effortless/Lazy low achievement” were included ($n = 23$). The figure shows how Effortless girls were clustered with Lazy boys (in the Adolescent group—Girls O, Boys △ ) and how the Normal group (Girls Δ; Boys ▽) and the Korean group (+) were diverse in terms of achievement and participation.

Girls’ MIs in the Classroom

The three girls who are the focus of this study belonged to three different peer clusters and identified with their respective groups’ identities. In addition, they contrasted largely in how they were viewed as mathematics people by their peers, how they participated in
classroom public discourse (acted identities), and the cultural models they identified with and used in their narratives mathematical identities. These differences are summarized in Table 1.

### Table 1

*Summary of Case Study Girls’ Identities*

<table>
<thead>
<tr>
<th></th>
<th>Maria</th>
<th>Carla</th>
<th>Katia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer Cluster</strong></td>
<td>Adolescent (mature, hyper femininity, popular, social)</td>
<td>Korean (weird, loyal)</td>
<td>Normal (girls are quiet and boys are loud and act like kids)</td>
</tr>
<tr>
<td><strong>Main Acted Identities</strong></td>
<td>Detachment</td>
<td>Protagonist and challenging</td>
<td>Compliant and support seeker</td>
</tr>
<tr>
<td><strong>Mathematics Group</strong></td>
<td>Effortless</td>
<td>Effortful</td>
<td>Effortful</td>
</tr>
<tr>
<td><strong>Mathematics Cultural Model</strong></td>
<td>Mathematics as a natural ability</td>
<td>Mathematics as different</td>
<td>Mathematics as male</td>
</tr>
<tr>
<td><strong>Main Narrated Identities</strong></td>
<td>Efficient</td>
<td>Different</td>
<td>Responsible</td>
</tr>
<tr>
<td><strong>Valued Forms of Doing Mathematics</strong></td>
<td>Independent and collaborative</td>
<td>Wider–complex</td>
<td>Straightforward and procedure oriented</td>
</tr>
</tbody>
</table>

**Maria: Balancing mathematics and “the normal life.”** According to data from the Natural Peer Clusters interview, Maria belonged to a peer cluster of four girls and four boys named the Adolescent group. This group was seen as popular because “they acted as if they were older, thought they were the coolest, showed off about what they owned [clothes or
technology] and appeared not to be especially concerned about school.” Some classmates from other groups mentioned that girls in this group were too preoccupied with their appearance—wearing skirts that were too short, using makeup, and always hugging and kissing each other. Some of them, they said, even had boyfriends. The boys in the group were described by all of their classmates as exhibiting low achievement, with peers from other peer clusters attributing this low achievement to laziness, but with the girls of the Adolescent group attributing it to low ability. This low achievement was persistent in these boys’ mathematical stories, with three of them being held back a year or more. During the interviews, boys and girls from the Adolescent group described themselves as “the most mature group in the class.” They commented that other clusters (especially the Normal group) behaved childishly.

Data from classroom observations showed that Maria, her female and male friends rarely participated during whole class public discourse (see Figure 5). She was never observed offering an answer or raising her hand. Her participation was limited to direct questions from the teacher, never engaging in prolonged exchanges with her. When observed doing peer–individual work with her group of friends, they worked together as fast as they could in order to finish the mathematical activity and then engage in off-task conversations. We interpreted this acted identity as a detachment from the mathematical practice.

Maria's observed behavior was highly consistent with how she was described in the Mathematical Groups interviews by her peers. She was frequently mentioned as an example (by 13 of 16 students) of the Effortless group, for whom “mathematics comes easy” like a natural ability, a position that she assumed with no conflict:

Maria: I am in the first group and the three of us [two female friends] are in this group, because I think we are the ones that understand the most. . . . Ah, and Christian is also in this group. I think we . . . I don’t study, I just pay attention during lessons and it gets recorded in my head, but I don’t study.

The absence of conflict in Maria’s account is also clear in how she described her emotions when doing mathematics. She did not describe strong positive feelings despite naming mathematics as her favorite subject. On the contrary, she mentioned emotional states related to the absence of discomfort, using words like comfortable, tranquil, and placid: “I feel comfortable because I understand, because if I didn’t understand I wouldn’t probably feel comfortable.”
When constructing her Mathematics Life Story Maria stated that this sense of tranquility had accompanied her throughout her school life. However, she commented that during the last few months these feelings had changed slightly and that she had felt “less positive about it… or less worried about it.” She linked these feelings to the fact that, to her, mathematics (and school) had lost significance in her life because new activities had acquired more relevance:

Maria: What is happening is that I don’t like to keep only with school, because when I was younger I cared only about school. But now I would like to do sports, or participate in a workshop (...) I’m the president of my class and I did swimming, but I left it because so much swimming was making me look bigger. Now I’m also dating, so things are changing. School is still important, but I don’t know if it is adolescence or what, but it is like you start to feel lazy.

It is interesting to note here that new activities appeared to be somehow gendered: she was starting to date and she had to choose activities that allowed her to be feminine and beautiful (and not big).

It was the tension between different activities (socializing versus doing mathematics) that appeared to shape Maria’s definition of her mathematical character in the Identity Mapping. When discussing which name she would use to describe her mathematical personality, she chose to be called “efficient”:

Maria: That’s why I try to be quick doing the exercises, because if I do that I can think in maths for a moment and then I can return to the “normal life” [Both laugh]. . . . That’s what I like to do . . . to do my work and then relax … I’m gonna write efficient here as the name of my character.

Consistent with their way of participating and her desire to balance mathematics and her social obligations, Maria valued a certain freedom given in the class to work independently and in collaboration with her peers:

Maria: Ms. P. gives some time for doing the sheet and this time is like a little free time because you can. . . . I mean, not a free time in a bad sense, but you can work with your desk partner, or talk the exercises with your group . . . that’s dynamic and that’s why I like maths more than other subjects.

The links between Maria’s mathematical positioning as an effortless high-achiever girl and her belonging to a particular peer cluster in the classroom could be seen in two
different ways. First, she defined her positioning as effortless in alignment with her girl friends, as noted by the use of “we” in her description of the Effortless group above and by how she shared activities during mathematics lessons with them (to work and to chat). In addition, it can be hypothesized that Maria’s identity was also resourced by her relationship with the boys who belong to her peer cluster (the Adolescent group) in two different ways. First, she presented her negotiation of effort as part of growing up and being “mature.” Given that the boys in this group were older than the rest of the class, their friendship supported the girls’ notions of being mature. Second, by positioning the boys in her group as “having difficulties” (as opposed to being lazy), Maria does not recognize the cultural model of “natural ability as male”, allowing her identification with an effortless identity without perceiving it as conflicting with her female identity.

Finally, it is interesting to note that the metaphor of “balancing” was also present in Maria’s account of the future and how she foresaw her relationship with mathematics. Here, for the first time, the tension she was living with became a conflict since she believed she would need to lower her expectations in order to balance mathematics and life. This is exemplified in her shifting from aspiring to study engineering to administration:

Maria: Engineering is like . . . everything is mathematics, so I don’t want to start something for two semesters and then not being able to pass anything… I don’t want to get stuck.

Interviewer: Why do you think it is going to get this difficult? Have you ever felt this kind of difficulty in mathematics?

Maria: No, never, because I have always had good grades, so for now I am relaxed, but I don’t know if it’s gonna be like this forever and I don’t want to end up in a bad university and I also don’t want to end up only doing mathematics all the time, because I like it but not that much, so administration is a balance between life and mathematics.

Interviewer: And how do you see life in the future?

Maria: I wouldn’t like to leave home too old, so my idea is to finish university, have a stable job and then leave… or maybe leave before, but go outside… into the real world, start my life… in general it is like living alone. I mean, I don’t expect to marry too young, no grrrr, maybe marrying, yes, but not young, and
not having kids young… it is like having everything that normal people have…

Interviewer: What you mean normal people? Does this happen with the people you know?
Maria: Yes and no . . . I know people that do this, but for example my mum has always been dependent and I don’t want to be like this, I don’t want to depend on nobody.

As the above transcript suggests, there is a gender dimension in how Maria envisions her future. Compared to her mother, she would like to challenge the traditional role of a dependent woman and wife by being a young independent person. Independence would require a career but the career would have to allow her to have this independent role before taking on the wife and mother role; thus, it would have to be quickly acquired and not a demanding engineering career.

In sum, Maria appeared to be developing an MI which had high consistency between the way she acted, how her classmates positioned her in the classroom, and how she perceived herself. All of these different sources of identification resourced an emerging MI based on the cultural model of mathematics as a natural ability. The resources provided by her classroom mathematical practice (which did not challenge her) and her relationship with her friends (aligning with her female friends and positioning her effortless engagement as consistent with her group maturity) seemed to allow Maria to experience this as a positive MI that contributed to her feeling comfortable when doing mathematics. The main tension to manage in maintaining this identity seemed to be related to balancing mathematics and what she called normal life. Although in the present, this normal and gendered life involved being social (e.g., partying, dating, hanging out with friends), in the future it seemed to be related to becoming independent (e.g., living alone before marrying and having kids). Although her balancing of mathematics and normal life was not experienced as a conflict in the present, she anticipated the future as being rather challenging because she would have to manage her expectations in order to be able to cope. The potential conflict that she anticipates appeared to suggest some form of contradiction between pursuing a demanding career involving mathematics and at the same time conforming to the gender role of being a wife and a mother.

Carla: The math that I am taught and the math that I like. Data from the Natural Peer Clusters interviews revealed that Carla belonged to a peer cluster comprised of four girls
and no boys. All of their classmates identified this group as the Korean group because members of this group liked Korean and Kitch-Pop music. They were the only cluster in the classroom that liked this type of music, were described as “weirdoes”, and some of their classmates said that sometimes they got bullied because of such interest. However, one of their classmates said that the Korean group girls did not care if they were bullied: “They don’t mind—they feel strongly about liking Korean music.” The girls themselves did not talk much about their interest in music; for them the important thing about their group was that they were “inseparable” and that they did lots of different things together. They said they cared about each other. One of their classmates said that if someone said something to one of these girls, the others would defend them, especially Carla, who was described as the leader of the group.

The analysis of classroom observations showed that Carla participated actively during whole class public discourse (see Figure 5). Every time there was an episode of multiple questions and answers between the teacher and students, she contributed with answers. Furthermore, Carla was one of the few students who made spontaneous contributions to the public discourse. On a few occasions she commented on what the teacher was saying or answered a question with an unexpected answer. Thus, Carla’s participation was rather different from that of her classmates and from what her teacher was sometimes expecting. This constituted a main acted identity that we characterized as protagonist and challenging. The result of such behavior was that it forced the teacher to transform her usual evaluation follow-ups into more extended interactions. In addition, in some of her interventions, Carla risked giving incorrect answers (which were uncommon in the classroom), which also led the conversation with the teacher into more extended episodes.

Carla’s behavior was more difficult to categorize by her peers as a particular kind of student in the Mathematical Groups interviews. Although she was mentioned by four classmates and her teacher as having a positive relationship with mathematics, this positioning was not associated with ability but with interest and participation. However, due to the fact that students commonly linked participation and interest with effort, it was difficult for them to recognize Carla as a “good mathematician”:

For example, Carla supposedly knows a lot, but then in tests she doesn’t do as good, or sometimes she makes silly mistakes. Maybe she gets nervous or she does not care about making these mistakes. (Girl, Adolescent group, Mathematical Narrative Identities interview)
Carla’s self-positioning in relation to this public identity was rather positive and somehow not conflicted. She perceived that her relationship with mathematics went beyond “being right” or having to use and apply “one main technique” In this sense, Carla described herself as different compared to her classmates:

Carla: I feel good when doing mathematics, not like the majority who feel neutral about it. We see mathematics as wider, not like others who have one main procedure and just apply it. I have more techniques and I reflect more when doing mathematics. Mathematics has certain confusion that I like . . . it is more like understanding it than simply applying a procedure.

It seems that, unlike her classmates, Carla did not relate her participation and behavior to effort but to engagement in an activity that went beyond obtaining the correct answer. This perception shaped the way she described her relationship with mathematics in the Mathematical Life Story, where she referred an increasingly positive relationship with mathematics, which at the beginning was extremely easy but became increasingly complex with time. The most negative moment in her Mathematical Life Story was described as experiencing a problem with how mathematics was taught to her during Years 3 and 4 (ages 8–10):

Carla: The teacher was too square; she did not give us the opportunity to open up to mathematics. She used to give as a technique and we had to apply it. But then in Year 5 I felt that my mind opened up . . . I had to remember contents from previous years and in order to think about contents that were going to come in the future.

In the present class she said that Ms. P’s lessons gave space for developing ideas, engaging reflexively and understanding a type of mathematics she valued because it was complex and wider: “And this year I am with this teacher, and if I give her an idea, she says yes, but you have this error, and she helps me to develop my own strategies with mathematics.”

It could be argued that Carla used spaces offered by the teacher in the classroom to develop the kind of mathematics she liked. In this sense, she considered that this kind of engagement was partly the student’s responsibility: A student can either comply with repetitive practice (which she linked with some sort of disengagement) or use the spaces provided (as consequently observed in her forms of participation).
Carla did not make direct links between her MI and other members of the Korean group. However, she appeared to use the shared peer cluster identity [“being different” or “being weird”] to support the way she preferred to participate when doing mathematics. One girl from the Korean group [Daniela] offered a compelling example of how belonging to this peer cluster can function as a resource to sustain its members’ MIs:

Daniela: Sometimes it makes you feel anxious when the teacher asks you something because some of the guys bully you and that makes you feel stressed. For example, if this happens to one of them, they don’t say anything. For example, if Mario [low achieving boy from the Adolescent group] says something silly, you have to stay quiet because if you didn’t all the class shouts “forever alone!,” even if you shouted with your four friends, they still shout you “forever alone.” … If we don’t understand something, we just ask as many times as we need. Sometimes we get bullied, but we don’t care.

As with Maria, therefore, it can be argued that Carla was also developing mathematical identifications that showed high levels of consistency between her acts and narratives. She valued a “wider mathematics” that goes beyond rote techniques and she risked forms of participation that allowed her to shape practice to the mathematics that she liked. Carla therefore constructed a MI based on a cultural model of “mathematics as special or different.” Two tensions were observed when managing these identifications. First, a tension between the opportunities provided by the teacher and the kinds of opportunities Carla wanted to take. Here she actively participated and even monopolized exchanges that supported “the mathematics that she likes” A second tension was observed between Carla’s secure identification with mathematics and the unclear positioning of Carla as a “good mathematics person” by her classmates. Such misalignment can be exemplified in the bullying episodes and how peers from other groups ignored her relatively good achievement. Again, however, Carla seemed not particularly conflicted by this tension, at least in the present, as she did not recognize difficulties or effort in her engagement. Considering these two tensions it can be argued that maintaining and managing positive and good identifications with mathematics for Carla required an important amount of self-confidence, which was mainly resourced by her peer cluster shared identity.

1 “Forever alone” refers to a popular meme used to express loneliness and disappointment with life (see http://knowyourmeme.com/memes/forever-alone). Students in the classroom shouted “forever alone” in English when they disapproved of or rejected some of their classmates’ behaviors or comments.
Katia: The complicated math and the simple math. The analysis of the Natural Peer Clusters interviews showed that Katia belonged to a large mixed-gender cluster that was comprised of six girls and four boys. Other students in the class described the girls in this group as “the quiet ones” because teachers never told them off. Girls from the Adolescent group also described these girls as childish, contrasting them with their own social self-identity as mature. One girl and one boy within this cluster named themselves as the Normal group and noted that they enjoyed childhood as appropriate to their age and did not want to grow up too fast. As one of them said, “we live what we are supposed to live.” In terms of their relationship with mathematics, members of this group were highly diverse with respect to grades, but none of them were regarded as lower achievers or lazy. In contrast to girls in this group, who were described as quiet, boys were seen as disruptive and noisy.

In terms of frequency of participation, as revealed by the analysis of lesson observations, Katia was located somewhere between the high participation of Carla and the relatively peripheral positioning of Maria (see Figure 5). In contrast to Maria and her friends, Katia usually raised her hand and offered answers to the teacher’s questions, but compared to Carla, she was never seen making spontaneous contributions during whole class public discourse. She sometimes responded to questions that required an opinion or justification, however, her answers were much more related to what the teacher was expecting or what had previously been said, an approach that we interpreted as a main acted identity of compliance with the teacher’s pedagogy.

Another feature of Katia and her friends’ participation was evident during peer–individual work and strongly contrasted with Maria’s detachment. Katia worked with her desk partner but was also very active in looking for support. She was frequently observed raising her hand, calling the teacher to check on her answers, or asking other students.

In the Mathematical Groups interviews, four classmates and the teacher described Katia’s positive relationship with mathematics as a product of her interest and participation, but not ability. Like Carla, Katia was seen as having to put in effort in order to achieve. Although it could be argued that Carla and Katia were offered the same position in terms of how their peers and teacher saw them in the classroom, their response to this positioning was rather different. In contrast with Carla’s comfortable identification, Katia presented a more conflicted experience: she found it difficult to see herself as part of the “smart” group (i.e., the Effortless group) since she perceived herself as slow and without intrinsic ability, a trait that according to her only a few males had:
Katia: I’m in this group, but it is not like we are fast, because for example, Christian, he is like the smartest in the class . . . in general, he is good at everything . . . it is like in the personality of each of us. For example, Andres [one of the boys from her peer cluster], I see he has been continuously talking and I ask him if he did his work and he has it all done and he is even doing the second one and we haven’t really finished the first one.

In order to solve this conflict, Katia positioned herself and the girls of her group as ‘the responsible ones’ since they placed work before social interaction. She also linked this behavior with maturity, and offered a gendered opposition to justify her behavior:

Katia: I think I am responsible, and I think it is related with maturity because you need to be conscious of what is going to happen, you need to be responsible and do what you have to do (...) Women are more professional, like more focused. Boys are not mature enough. It is like they are not aware of causes and consequences. But women it is like “no . . . if I don’t do it I would have a bad grade so I am going to do it and I’m gonna responsible”.

Another key aspect of Katia’s MI was her experience that mathematics was often presented as difficult and complicated but, in reality, it was simple and straightforward. To Katia, learning mathematics involved applying a method taught by the teacher and then waiting for the teacher to offer a new method if the first one was inadequate or too challenging.

Katia: I would like the teacher to teach us techniques that weren’t difficult so we could understand them in the moment and then we could move quickly, like the magic formula, easy procedures to understand. . . But in mathematics the teacher is like too serious and she explains everything as if it is very complicated.

Katia’s positionings were clearly framed by her relationship with her peer cluster. She shared a dutiful and compliant approach to mathematics with her girlfriends and contrasted herself with the approach adopted by the boys. Although she proposed this as a generalization (boys versus girls) she used one of the boys in her group (Andres) as an example. To her, Andres represented the idea that you don’t need to be responsible in order to achieve. In addition, she assumed responsibility in terms of helping those friends who (as boys) were not responsible and did not have the ability required to be effortless: “I think we are four girls and we will
have to be with the boys and we will have to help the boys to focus, we will have to be responsible, because I want to get a good grade.”

In sum, Katia’s positive relationship with mathematics was populated with tensions that were leading to conflicted identifications with cultural models available in the classroom. Although Katia was trying to maintain the positive relationship that she declared, she failed because she did not fit the available cultural model of mathematics as a natural ability. Katia managed this conflict by displacing the source of difficulties outside. It was not only her who struggled in maths, but all women, and she struggled because the teacher was not able to simplify math enough. In other words, the relationship that K had with math, and the emotional states that emerged from it, were heavily mediated by gender oppositions and by the teacher’s scaffolding. This positioning was supported by her relationships within her peer cluster, by her alignment with her female friends and with women in general as responsible for others, and by her opposition to the immature, irresponsible male friends in her peer cluster.

It is possible that by constructing a view of mathematics as something simple Katia was trying to gain some sense of control over the activity, thus also enhancing her sense of efficacy. She could be an “effortless good mathematician,” but only when mathematics was stripped from its unnecessary complexity. However, because the mathematics offered by the teacher was not straightforward, her expectation was not met and she found herself somewhere in between a “good at mathematics student” (who has it in himself or herself and therefore does not need support) and a “good compliant student” (who needs support and confirmation), figures that apparently do not fit together in this classroom.

**Conclusion and Discussion**

The main purpose of this paper was to systematically study three girls in compulsory education who presented a positive relationship with mathematics. This paper addresses three relevant gaps in the existing literature on MIs: a focus on girls’ engagement and positive identifications with mathematics in compulsory rather than post-compulsory mathematics, an interest in their developing narratives about themselves in relation to mathematics (a methodology also neglected in compulsory education), and an exploration of how this identification process is negotiated in relation to the peers and peer clusters which appear to be so significant in early adolescence.
In general, the findings of this study confirm that among girls who share a positive relationship with mathematical activity (high level of achievement and engagement with the practice), there is an important variability in how their MIs are experienced in the classroom. Although all three girls recognized some level of tension in managing their positive identification with mathematics, the nature of these tensions and the level of conflict attached to them were very different in each case. Maria and Carla experienced positive emotions when doing mathematics and showed confidence and consistency between the way they acted and the way they talked about mathematics. In contrast, Katia seemed more emotionally conflicted, trying to understand what was expected of her and how to deal with the unfair situation of being effortful but not successful. In addition, as shown in Table 1, the three girls valued different forms of doing mathematics (independent and collaborative, wider and complex, and straightforward, procedure-oriented mathematics), showed different acted identities while doing mathematics (detachment or engagement on the margins of practice, protagonist and challenging of the teacher’s practice, compliant and support seeking) and positioned themselves differently when narrating their identities as mathematicians (effortless or efficient, different, responsible). This confirms that when understanding marginalization from mathematical practices of any population, studies need to consider diversity within groups and resist essentialist accounts (Gutierrez, 2013).

One conclusion that can be extracted from these three cases is that peer relations had a central role in mediating each girl’s MIs. Their participation in classroom activities was cognizant of their relations with other girls from the same cluster and their peer cluster identity was used as a resource for supporting their MIs (and vice versa). These results provide further support for the argument that MIs are intertwined with students’ peer relations and the peer group culture (Gholson & Martin, 2014). This is also consistent with the theoretical models that consider peer relations as a leading activity in adolescence (El’konin, 1971; Karpov, 2003) and key source for identity development (Erikson, 1968). According to El’konin (1971), peer group relations lead adolescents’ development as they pave their trajectories to adult life. Although for some girls these relationships will be rather strongly gendered (e.g., figured as sexual relations or as caring or mothering), for others they will be figured in other ways (e.g., figured as being different; for example, liking Korean music).

A second conclusion of this study relates to the rather dominant presence of the cultural model of mathematics as requiring natural or innate ability in this classroom.
Effortless attainment, something innate or natural, has recently been described as a common aspiration of many students in schools (Jackson, 2006). Some authors have suggested that mathematics as requiring a natural ability may be valued among students because it helps in negotiating and maintaining popularity inside the peer culture (Francis, Skelton, & Read, 2010). As a consequence, students can either identify themselves as “natural mathematicians” (which requires recognition from others) or attempt to find alternative ways to negotiate success with popularity and belonging in the peer culture. In this study, whereas identifying with an effortless position provided access to status in the peer group (i.e., Maria’s example of being popular with her popular friends), finding an alternative MI required negotiating peer relations on the margins of the classroom peer group structure (i.e., Carla’s example of being different) or in opposition to those who seem effortless (i.e., Katia’s example of her relationship with Andres as an opposition between being effortless and being responsible). Finding these alternative MIs appeared to be more conflicted than the relative alignment associated with Maria’s effortless position.

It is interesting to note that the observed relationship between the cultural model of mathematics as requiring natural ability and gender differs from other studies that focus on post-compulsory mathematics education. While the post-compulsory literature has described this cultural model as one explanation of girls’ dis-identifications from mathematics—because it is linked with being male (Mendick, 2005a)—data from this study suggests that, in this specific compulsory mathematics classroom, the effortless attainment model is also a possibility for girls’ identifications. One possible explanation for this discrepancy may well be that mathematics can have different meanings in compulsory and post-compulsory education. This case study suggests that in a compulsory mathematics classroom it is possible for students to see mathematics as something that is not masculine because it is not marked as different or special (Damarin, 2000). In some way, the teacher of this classroom is trying to make mathematics available for all and she achieves (or tries to achieve) this by slowing the pace of the lessons and by lowering the difficulty of the mathematics taught.

With respect to gender, the data from this study suggests that gender appears to mediate girls’ relationships with mathematics in at least two ways. First, through interaction with peers, these girls are preparing themselves for future (gendered) relations which influence their relation with mathematics “in the moment” in classrooms as well as their choice of mathematics as a career path - peer groups are not only a space of belonging but also a space for becoming (El’konin, 1971; Karpov, 2003). Maria is an example of how these
peer relations are gendered and how this may have an effect on her aspirations for the future: Balancing her “efforts” and work was important in showing that she could acquire femininity for future gendered practices like dating, partying, having several different interests, and looking pretty. Her aspirations also suggest that this balancing involves adjusting her expectations in the future and therefore adjusting her role and place in the social world. It can be argued that through gendered peer relations Maria is exercising social roles and working out where she belongs and where her place is in the Chilean gendered labor market and society. Mathematics and mathematically demanding careers become places where she feels she won’t belong or where she won’t be able to achieve her (gendered) goals. Her self-identification as “mature” in the Adolescent group is consistent with this consciousness of such imagined futures or places where the Normal group may be less inclined to go.

Another interesting gender-related finding from this study is that the discourse of natural ability as male seems to be a resource from which some girls might draw upon to negotiate their difficulties. This finding is consistent with evidence from post-compulsory education suggesting that “math as a male domain” discourse can be used not only for counting girls out of mathematics but sometimes also as a resource (“having a male brain”) to enter the practice (Solomon, 2012). This phenomenon was mainly observed in Katia’s story, which showed a highly gendered discourse about natural ability as a male attribute. It is interesting to note that in her discourse, the effortless ones who “have it in their personality” were exclusively male (e.g., Christian or Andres), which is surprising considering that in this classroom there were girls who also fit this definition (e.g., Maria). This omission begs the question of why Katia adopts a gendered narrative in which men are skilled at mathematics but women need to be responsible. A possible explanation is that such a narrative has a regulatory function in Katia’s identifications; that by linking the cultural model of mathematics as natural ability with being male, she can sustain a positive relationship with mathematics despite not being talented (“not fast like Andres or Christian”). By attaching this natural ability to being male she can normalize herself and preserve a positive relationship with mathematics that is not as threatening to her gender identity. In other words, it is not her problem if she finds mathematics difficult, it is simply a struggle that all women have to face. However, this discourse is not disembodied but is deeply embedded in her peer relations and is therefore resourced by her belonging to her particular peer cluster: a position that is required for the high achieving boys of the classroom, performed in practice by one of the boys of her group (e.g., Andres), and
confirmed by her effortful girlfriends and by her own positioning as a “responsible and not necessarily talented girl.”

With respect to the limitations of this study, we must mention the idiosyncratic nature of each mathematics classroom and how processes within them may be highly classroom dependent. Despite this idiosyncrasy, this study provides evidence of the conceptual generalization that peer relations can be pivotal in students’ developing MIs during early adolescence. Following this and previous research on peer culture and social influences on self-efficacy and self-concept (Francis, Skelton, & Read, 2010; Marsh, 1987), we argue that future research and summary readings of research (meta-analysis or reviews for policy, etc.) may need to pay careful attention to the structure of peer clusters within classrooms.

Finally, there are a number of potential implications that emerge from these findings, specifically in relation to teaching practices in the mathematics classroom. The findings suggest that the subjective experience of doing mathematics, even among those who have a positive relationship with it, can differ in important ways between individuals. Consequently, teachers who acknowledge this variability might actively explore students’ individuals ideas about mathematics as well as understand how these ideas are influenced by peer relations. Students’ approaches to participation in the classroom are influenced by how peer relations are intertwined with MIs. Cultivating greater awareness regarding this relationship may help teachers to distribute opportunities of participation more strategically in public discourse and also to scaffold collaboration between students during private group work (see also Bishop, 2012). We argue that attention to the peer group structure as it presents itself in the classroom might be significant to the formation of positive identities for girls in mathematics and should be the focus of future research in this field. The complexity revealed by this study of one classroom in a supposedly socially homogeneous school suggests that accounts of MI that ignore peer clustering might miss a crucial reference point, and methodologies should be developed accordingly.

The nested model of identity based on a case study approach used in this paper enhances the methodology of some previous studies such as Choudry et al. (2016) and Gholson and Martin (2014) in several respects, in particular in the acknowledgement of the significance of the cultural models that mediate the peer clusters and how these might afford distinct MIs. Thus, conforming to what is expected of a “normal” (gendered) identity associated with a Normal peer cluster might mediate a normal, gendered MI; similarly, being “weird” might mediate an alternative MI. Acceptance of a diversity of peer clusters’
ways of being and engaging in mathematics classrooms might support a variety of less obviously normal, less stereotypically gendered, and perhaps more positive MIs for girls. Future studies and thoughtful policy and practice might be wise take these considerations into account.
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