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ORIGINAL ARTICLE

Exploring gender factors related to PISA 2003 results in Iceland: a youth interview study

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Abstract Students' mathematical achievement in Iceland, as reported in PISA 2003, showed significant and (by comparison) unusual gender differences in mathematics: Iceland was the only country in which the mathematics gender gap favored girls. When data were broken down and analyzed, the Icelandic gender gap appeared statistically significant only in the rural areas of Iceland, suggesting a question about differences in rural and urban educational communities. In the 2007 qualitative research study reported in this paper, the authors interviewed 19 students from rural and urban Iceland who participated in PISA 2003 in order to investigate these differences and to identify factors that contributed to gender differences in mathematics learning. Students were asked to talk about their mathematical experiences, their thoughts about the PISA results, and their ideas about the reasons behind the PISA 2003 results. The data were transcribed, coded, and analyzed using techniques from analytic induction in order to build themes and to present both male and female student perspectives on the Icelandic anomaly. Strikingly, youth in the interviews focused on social and societal factors concerning education in general rather then on their mathematics education.

Keywords Mathematics · Gender · Gender differences · PISA 2003 · Iceland

1 Introduction: Revisiting the literature on gender and mathematics

In the last 30 years gender differences in mathematics achievement and its relationship to societal expectancies and other variables such as parental involvement, teacher beliefs, teacher- students interactions, autonomous learning behaviors, self-efficacy and persistence theory (Bandura, 1994; Burton, 1986; Chen & Zimmerman, 2007; Fennema, 1990; Fennema, & Peterson, 1985; Fenemma, Peterson, Carpenter, & Lubinski, 1990, Hannula, Maijala, Pehkonen, & Nurmi, 2005; Iben, 1991; Keller, 2001; Ma & Kishor, 1997; Tartre & Fennema, 1995; Tiedemann, 2000), sexual stereotyping as well as differential achievement-relevant attitudes (Forgasz, Leder, & Kloosterman, 2004; Taylor, Pollard, Leder, & Atkins, 1996), and beliefs that mathematics are a male domain (Hyde, Fennema, & Lamon, 1990; Leder, 1986; Leder & Fennema, 1990; Forgasz, et al., 2004; Sriraman & Steinthorsdottir, 2007) are well documented in the research literature.

Exploration of another issue, that of race and class (Atweh & Cooper 1995; (DIME) 2007; Ernest, 2007), also revealed that children of immigrants and minority groups often underachieve in mathematics (Bishop, & Forgasz, 2007; Corbett, Hill, & Rose, 2008; DIME, 2007; Walkerdine, 1989). For example, in the United Kingdom and Australia, several studies provided evidence for the "hidden" link between socio-economic class and students' choices in university studies. Findings from these studies suggested that students in their final years of compulsory schooling were twice as likely to pursue mathematics and

This paper is dedicated to the memory of Leone Burton (1936–2007) who was among the pioneers of gender studies in mathematics education.

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science if they were from the higher rather than lower socio-economic status bands' (Ernest, 2007; Maslen, 1995).

During the Tenth International Congress of Mathematics Education (ICME 10) held in Copenhagen in 2004, fifteen papers on gender and mathematics education were presented in Topics Study Group 26. In two studies from Scandinavia, interesting results were reported about still existing gender differences in Sweden (Brandell, Nystrom, & Sundqvist, 2004; Soro, 2004). In the second of these studies, Soro (2004) reported that Finish teachers held different beliefs about girls and boys in their classrooms and still believed that girls tended to do better on problems requiring routine procedures whereas boys did better when they were given problems that required them to use mathematical reasoning. These findings suggest that, at least in some places, not much has changed for the past several decades in terms of society's dominant conceptions of a gendered ability in mathematics.

In another study, Becker and Rivera (2004) presented an interesting synthesis of perspectives used to investigate gender and mathematics in different countries (derived from the work of the Gender Working Group at the last several meetings of PME-NA[1] and PME International[2]). They listed four orientations on understanding the linkages between gender and mathematics achievement that has its origin in feminist theory. The first orientation is "Predict" and many studies conducted in the 70 and 80 s concern the positivist perspective of prediction. The second is "Understand", a perspective linked to work in the 80 and 90 s in which attempts were made to make sense of the reality of gender without changing the social environment. In the third orientation "Emancipate", gender is not viewed as an isolated variable but as intertwined with race, class, ethnicity and culture. Finally in the fourth orientation, "Deconstruct", research has linked gender to performance, and gender performance is perceived as subject to social construction, with the goal of the research to deconstruct common beliefs. Even today, not many studies about gender and mathematics fall under the third and fourth perspectives.

Across cultures, the gender story does not differ at higher levels of education, and in fact differences at the tertiary level are amplified (Burton, 2004). The institution of academic mathematics has often been criticized as being both male dominated and constructed to set precedence for transmitting behaviors and teaching and learning practices that tend to alienate women. The sobering facts are that women mathematicians remain by and large a minority in the mathematics profession (Herzig, 2002; Seymour, 1995), in spite of numerous large scale initiatives such as those supported by the National Science Foundation, in the USA, to increase numbers of female students in graduate programs. Related to the general issue, Burton (2004) proposes an epistemological model of "coming to know mathematics" consisting of five interconnecting categories: the person and the social/cultural system, aesthetics, intuition/insight, multiple approaches, and connections. Grounded in an extensive literature base of mathematics, mathematics education, sociology of knowledge and feminist science, this model addressed four challenges to mathematics; "the challenges to objectivity, to homogeneity, to impersonality, and to incoherence" (Burton, 2004, p. 17). Even more fundamentally, Burton argued the need to challenge four dominant views of mathematics: A view of mathematics as an objective homogenous discipline, as an impersonal abstract presentation entity, as a complementing view of an individualistic discipline, that of an egotistical (male) mathematician, and as a non-connected "fragmented" discipline (as many learners experience it).

2 PISA (Programme for International Student Assessment)

Despite the common belief (in many Western countries) that gender differences in mathematical achievement have been eliminated [Strákar í kreppu (Boys in Crisis), 2003], PISA (in addition to the evidence that the presentations at ICME 10 provided) documented statistically significant gender differences in achievement in favor of boys in over half of the participating countries in the years 2000, 2003, and 2006. In fact in the PISA testing of 2000, statistically significant gender difference in achievement in favor of males were found in about half of participating countries (OECD, 2004). In 2003, statistically significant gender differences in achievement favoring males were still apparent in 27 of the 41 participating countries. The only country, in PISA 2003, that had statistically significant gender differences in achievement in favor of girls was Iceland (OECD, 2004). More recently, in 2006 significant gender differences were still measured in 35 of the 57 countries (OECD, 2007). In the following sections a brief overview of the PISA study is provided for the uninitiated reader. This is followed with a closer examination of the Icelandic data.

2.1 Background on PISA

In today's society the prosperity of a country is largely dependent on its human capital and how well individuals advance their knowledge and skill in a rapidly changing world. In 1997 The Organization for Economic Co-

[1] The Psychology of Mathematics Education, North America Chapter.

[2] The Psychology of Mathematics Education, International Group.

operation and Development (OECD) launched the Programme for International Student Assessment (PISA). The intent was that a cross-national comparison pf students' performance in key areas could provide countries with information to judge their strengths and weaknesses and to monitor progress. In effect, PISA sought to measure how well students at age of 15 are prepared to meet the challenges of today's knowledge societies. In PISA 2003, 49 countries participated and in PISA 2006, eight additional countries joined "representing a total of one-third of the world population and almost nine-tenths of the world's gross domestic product (GDP)" (OECD, 2003, p. 20).

Overall, PISA measures, in stages, students' performance in literature, mathematics, and science. The first stage was undertaken in 2000 with literature as the main focus. The second stage of the study was conducted in 2003, with mathematics as the main focus. The third stage occurred in 2006, with science as the primary focus. In 2009 the cycle will start again, with the main focus on reading.

In mathematics, students' understanding was categorized according to six proficiency levels (six being the highest level), determined by their scores and the problems they could solve. For example, in 2003 approximately 90% of students were able to solve Level I problems, nearly 50% of them were able to solve level III problems, and around 5% were able to solve level VI problems. Analysis of performances by individual country in PISA 2000, 2003, 2006 are available on OECD website (http://www.oecd.org/pages/0,3417,en_32252351_32236130 _1_1_1_1_1,00.html).

2.2 The case of Iceland

Quite apart from the PISA data, from some studies focusing on gender differences in mathematical achievement it might be assumed that these differences have declined considerably over the last 10 years, resulting in a generally false impression that gender difference favoring male students no longer exist. Whether the lack of research on the issue at hand is a contributing factor to this common popular belief is unclear. In addition, voices claiming that males were being shortchanged in school have become louder and have drawn increasing public attention [Corbett, et al., 2008; Johannesson, 2004; Strákar í kreppu [Boys in Crisis], 2003]. Significantly, PISA 2003 showed interesting results in relation to gender differences in mathematics that contradicted the popular discourse.

According to PISA 2003, as noted above, in just over half of the participating countries, males outperformed females in mathematics. In addition, in mathematics and computer science, gender differences favoring males remained persistently high (OECD, 2003). Further, looking at the graduation rate of females across subject areas in OECD countries, the average number of females in mathematics and computer science is only about 30% of total graduates. Interestingly, in Iceland the proportion of females graduating with a postsecondary degree or higher in mathematics and computer sciences is just around 20%. In comparison, postsecondary graduation of women in humanities, arts, and sciences is around 70% within OECD countries but reaches 80% in Iceland (OECD, 2004).

In Iceland, as noted earlier, in PISA 2003 a significant gender difference in mathematical achievement in favor of girls was reported but, it emerged, only for students in rural Iceland. Further analysis by Olafsson, Halldorsson, & Bjornsson (2006) divided Iceland into nine regions: two comprising the Reykjavik metropolitan area and seven almost entirely rural. The largest difference was found on the south coast of Iceland with a difference of 30 points. The lowest difference outside the Reykjavik area was 12 points, found at the east fjords region. The gender difference in the Reykjavik metropolitan area was not significant (on average, only four points).

Looking at the number of students at the highest and lowest levels, the general results in PISA 2003 show that more males than females reached level VI (7% of males vs. 4% of females). At one end of the spectrum in Iceland, around 4% of all students performed at level VI. The gender differences in number of students performing at level VI continued to differ by region. In Reykjavik and surrounding areas, a greater portion of males reached level VI compared to females. In rural areas, however, more females reached level VI than males (Olafsson, et al., 2006). At the other end of the spectrum, more boys than girls were categorized at Level 0 and Level 1 in all regions, 18 and 11%, respectively. Overall, despite the unusual gender difference in favor of girls found in Iceland, girls in Iceland do not differ from other females in the PISA study when it comes to math anxiety and mathematical confidence, where gender differences favor boys (OECD, 2004; Olafsson, et al., 2006).

One of the more popular explanations for the gender differences in favor of girls is the so-called "jokkmokk"[3] effect—the "phenomenon" of females outperforming males academically in rural areas. At issue is whether in this rural environment, the typical labor market prevents males from seeing value in academic education, while at the same time, such an environment encourages females to do well in school in the hope of achieving status or to prepare them to leave their hometown in search for a "better" life. This effect probably has some bearing in the Icelandic situation but to believe it a cause of the gender difference is naïve. In some rural areas in Iceland, males can be financially successful without a post secondary

[3] Jokkmokk is a town in Northern Sweden.

degree, and most traditional female jobs (e.g., nurse, teacher, bank teller) do require post secondary or college degrees.

With respect to the PISA 2003 results, researchers have suggested another explanation related to school environment and the gendered discourse that takes place among teenagers. Magnusdottir (2005) reported on gender differences in what is accepted discourse among teenagers in Iceland. These findings imply that it is accepted, and even expected, that girls have to work hard to get good grades. For boys, the common belief is that they do not have to study, and that they get good grades whether or not they do. Perhaps, if true, if it is not "cool" for teenage boys to study than it can be expected (assuming that most teenage boys are influenced by the dominant discourse in their peer group) that few teenage boys will strive to achieve high scores. But why then does this cultural expectation explain the lack of gender difference in the Reykjavik metropolitan area?

In the Icelandic context other researchers have suggested that the classroom is a feminine environment and therefore less suited for supporting the achievement of boys, a question raised by both researchers and laymen in addressing the achievement of boys in primary and secondary education [Strákar í kreppu [Boys in Crisis], 2003]. In two studies (Johannesson, 2004; Magnusdottir & Einarsdottir, 2005) compelling arguments are made, based on the historical structure of the academic system, that reject this notion. Even though schools currently have more female teachers and support more of what would be categorized as "feminine" traits, such as caring, cooperation, and shared management, the "masculine" traits still have a stronghold in the foundation of the educational system through teacher-centered pedagogy, the predominance of lectures, and the reliance on individual assessments. One final factor that might offset this argument examines the special education budget: Proportionally more is spent on male students, and male students gain more from special education that is offered in schools.

Perhaps the last question to ask is whether the PISA results were simply a fluke. Olafsson, et al. (2006) looked at the Icelandic National Mathematics Test scores from 1996 to 2006 and found that gender differences in mathematics were in favor of girls during each of the years studied. In some years this difference was statistically significant, in others it was not. Sometimes the differences were found in urban areas; at other times in rural areas. The scores for 2003, however, did mirror the outcome of PISA 2003. The Icelandic National Mathematics Test scores from 2002 to 2006 show that students in the Reykjavik metropolitan area scored higher then students in rural Iceland (Olafsson, Halldorsson, & Bjornsson, 2007).

Augmenting PISA's results for Iceland, a recent report "Ungt fólk 2007" [Yong people 2007] (Rannsoknir og greining, 2008) concerned the general connection of youth's life and school. It was based on a questionnaire about educational goals, after school activities, and health that was given to students who attended gymnasium (late secondary school) in the years 2000, 2004, and 2007. The sample size in 2000 was 71% of all students in gymnasium that year, in 2004 it was 81%, and in 2007 72%. Relevant questions related to the importance of parents' involvement and interest in their children's education showed no differences between urban and rural areas. Most students in the study thought parent involvement was very important and small gender differences were found, that is, males did not think it mattered as much as females. Interestingly no differences were found between urban and rural Iceland when participant were asked if their friends thought it was important to achieve in school; most students thought it was important. Additionally, no differences were found between urban and rural Icelandic students about time spent on homework but some gender differences was detected, with males spending less time on homework than girls. Students in urban and rural Iceland were bored in school to the same extent, but males indicating that they were bored more strongly than females.

In the same report differences between urban and rural Iceland were found in relation to preparation for gymnasium. More students from the Reykjavik metropolitan area than from rural areas believed they were well prepared. Also, males perceived themselves less prepared than females. In addition more students from rural areas than from urban areas thought that gymnasium was difficult, but males thought it was not as difficult as females. More students from urban Iceland than students from rural areas thought they had opportunities for college education. Also more females then males in both urban and rural areas saw themselves as having an opportunity for college education. More females then males in rural Iceland said it was very likely they would go to college; in the Reykjavik metropolitan area there were no differences. Finally students from rural areas were more likely to go into vocational trades after gymnasium than students from urban areas (Kristjánsson, Guðmundsdóttir, Pálsdóttir, Sigfúsdóttir, & Sigfússon, 2008).

3 Study design

Participants in the present study were males and females who had taken part in the 2003 PISA testing. At the time of the interviews these individuals were turning 20. Iceland is a very homogeneous country in terms of race and religion as a result of nearly 1,000 years of geographic isolation

(see Bjarnadottir, 2007). Thus all the participants were Caucasian with socioeconomic backgrounds ranging from middle to high middle class. To collect the data for this study, three rural towns and the Reykjavik area were selected for conducting interviews. These interviews were undertaken in spring 2007. They were organized as four groups with 17 individuals (9 females and 8 males; each group had similar number of male and females), and two individual interviews (one female and one male). Two groups were from the northern part of Iceland, one group was from the Reykjavik metropolitan area, one group was from the Reykjanes peninsula, and two individuals from the southwestern part of Iceland. Only three of the participants interviewed were not in school at the time of the interviews. The majority were either in a traditional academic track, planning to apply to the university, or in vocational schools mastering trades such as carpentry, cosmetology, or fashion design. Given lack of funding, group interviews were used. This format allowed for a range of perspectives in a short time—"two-eight-person focus groups would produce as many ideas as 10 individual interviews" (Morgan, 1997, p. 14). Six group interviews were chosen because of the homogeneity of the groups, "with homogeneous groups, the trend in the answers usually become repetitive after three or four groups" (Aubel, 1994, p. 21). Individuals in each group knew each other which allowed them to discuss shared experiences. Two of the group interviews became individual when other members did not show up. In recognition of the limitations of group interview techniques, a special effort was made to ask individuals to express themselves and to make them feel comfortable about their participation. Finally, the interviews were conducted in Icelandic.

All interviews were similarly structured and were transcribed after all had been conducted. Each interview began by asking students introductory questions about the structure of the mathematics classes in eighth to tenth grades. The purpose was to get some idea of what pedagogical practices were common in Grades 8–10. This was followed by specific questions about the PISA 2003 result and their reflection on these results. One question concerned the unique gender differences in Iceland, in contrast to the findings from the general study.

Students were also asked to reflect on distinctions between rural and metropolitan Iceland. Next they were asked about the reasonableness of the "jokkmokk" effect hypothesis, (Olafsson, et al., 2006). Finally they were asked about gender differences and financial independence. At the conclusion they were given time to make final remarks or to add to what they had already said at other times during the interview. In total five broad sets of questions were asked in interviews typically lasting from 1 to 1.5 h.

3.1 Data analysis

The principle of analytic induction (Patton, 2002) was applied to the interview transcripts to uncover dominant themes that described the behavior being studied. According to Patton (2002), "analytic induction, in contrast to grounded theory, begins with an analyst's deduced propositions or theory-derived hypotheses and is a procedure for verifying theories and propositions based on qualitative data" (Taylor & Bogdan, 1984, p. 127). Following the principles of analytic induction, the data were carefully analyzed in order to extract common strands.

Color coding was done manually[4] and data was further organized into in three parts; each part had its own characteristics. Recall that in the first part, in one introductory question, participants reflected on their own experiences of math instruction in grade 8–10. These were coded as being traditional instruction or reform based, using the National Council of Teacher of Mathematics (NCTM) categories about traditional versus reform based instruction as our criteria (NCTM, 2000). As described above, in the second part of the interviews, participants responded to two questions related to the general results of PISA 2003 in Iceland. One questions concerned the general results for Iceland, and another question took up the issue of rural results.

Reasons for Icelandic results according to the interview participants were given a descriptive name (emergent theme) such as "peer pressure" and "family support". The emergent themes where then subdivided into two categories, group consensus or group controversy. Responses that did not fall under any of the already existing codes were coded with different colors.

In the two questions, which comprised the third part of the interview, participants were asked to respond to two hypotheses that had been proposed as possible explanations for the gender differences in Iceland and the reasons why they agreed/disagreed with them. Manual color coding and descriptive themes were again utilized. First, agreement and disagreement for the plausibility of each hypothesis was coded, secondly, the reason for the agreement or disagreement, and finally whether or not there was consensus among the responses. This process was repeated for the other sets of questions. When all interviews had been coded descriptive names were ascribed.

Finally, in a multiple face analysis the themes were compared to theoretical constructs in the existing literature with the explicit purpose of verifying whether existing gender models were applicable to this qualitative data, as well as to extract themes that characterized the students'

[4] Krueger (1998, p. 57) refers to this type of analysis as the "long table" approach.

views. Corbin and Strauss (1998) stated that using comparisons brings out properties, which in turn can be used to examine the incident or object in the data. The specific incidents, objects, or actions that we use when making theoretical comparisons can be derived from the literature and experience. It is not that we use experience or literature as data, but rather that we use the properties and dimensions derived from the comparative incidents to examine the data in front of us (p. 80).

4 Results and discussion

All the students interviewed described their mathematics classes in 8th through tenth grades as traditional. The teacher explained an example on the board and students were then to solve assigned problems. If they did not finish the assigned problems in class, they were supposed to finish them at home. The textbook that they all used was a traditional mathematics textbook. The Icelandic educational system is centralized and, due to the size of the country, the variation of textbooks is small (two series at that time). In 2003, the most commonly used textbooks in eighth to tenth grades could be categorized as traditional and it is likely that most students experienced similar mathematics lessons in tenth grade.

4.1 Reflection on the general PISA results and gender differences in Rural Iceland

What was striking across the interviews was the broad emphasis that the participants placed on general social and societal factors related to their mathematics learning rather than on narrower issues of curriculum and pedagogy. Focusing on gender differences and relating once again to the PISA results, five specific themes emerged from the interviews about why girls did better than boys. Students suggested factors related to (1) parental influence and upbringing, (2) peer pressure and the gendered discourse among teenagers, (3) professional ambition, (4) general human development, and (5) role models. In what follows, illustrations are also provided from occasional interviewee comments.

4.2 Parental influences and upbringing

Most of the participants agreed on the importance of parental involvement and caring. This view is reflected in the previously mentioned report "Ungt fólk 2007" [Yong people 2007] (Rannsoknir og greining, 2008). They particularly emphasized the importance of parents showing interest in school work and in keeping track on whether school work was completed. A few males thought it was important for parents to put pressure on them to do their school work by, e.g., cutting allowances if they did not do well. The females in the groups instead emphasized that parents should simply show interest in their children's school work.

Children's upbringing and gender differences in upbringing were frequently mentioned. Participants all agreed that girls were more likely to be taught to behave appropriately and do what they were supposed to do. "Boys are supposed to be a handful—they are just supposed to be like that, 'boys will be boys'" was one girl's explanation. It is clear that interviewees thought that upbringing was gendered from birth. On the one hand, their perception was that because of the differences in upbringing, girls were more able to adapt to the demands of the mathematics classroom and do what was expected of them. Boys, on the other hand, were more likely to have been "thrown out" because of their behavior and as a consequence they also were more likely to miss what was covered in the math classes.

When asked how the situation in Iceland might explain the gender differences interviewees offered interesting interpretations. Their perception of parents' involvement was that parents paid more attention to girls. Parents were more likely to keep track of their daughters, particularly whether they did homework and if they were doing well in school. Their sons, however, seemed to have more freedom to do what they pleased, including simply "hanging out" with friends and going to soccer practice. One girl expressed this as follows:

> Girls pay more attention to their studying because it is important for them to do well in school to get somewhere, particularly for our generation. Parents are maybe more likely to push their girls to study because they know it is very important for the girls.

A common consensus was that if women wanted to take advantage of the possibilities that society has to offer, education for girls became very important. From a historical perspective, white males have a certain status already in Icelandic society and, therefore, might fear less the "danger" of loosing education-related opportunities that came their way.

4.3 Peer pressure and the gendered discourse among teenagers

Data from this interview study supports Magnusdottir's (2005) findings with respect to the influences of the school environment and the gendered discourse that takes place among teenagers in Iceland. All participants brought up the notion that boys were under more pressure than girls to be "cool." When asked what it meant to be "cool," one

response was" not to study". This idea was presented in multiple contexts and phrases: "Girls are expected to study hard to get good grades so they can" and "if boys study hard there is something wrong with them" were common explanations both from male and female participants. One of the male participants emphasized the teenage culture and its influence on behavior at this age. His explanation was that.

> "the expectation and norms of the society at this age is that boys are tough and girls well behaved, I think it has an impact. In my school it was not cool to do math or study."

The phrase "boys are supposed to be smart and not study" was brought up by all groups. The male participants all agreed with this notion and had multiple examples to offer. The overall results were that boys tended not to admit that they did actually study, or as one boy articulated, "if you had to study for the exam you were not very smart. It was cooler to get the ten without studying." These comments reflect to some extent the common belief and biases that males are biologically superior in intellect to women. Significantly the girls in this study particularly had the view that smart boys were smarter then smart girls, when the term "smart" referred to being good in mathematics.

Some of these students noted that competition was higher among the girls at that age. "It was rather lame if you did not achieve the nine [meaning 90% at any exam]", stated one girl about her female peer group. This is an interesting twist on the common belief that males are more competitive than females and could be related to ideas about the recent importance of education for women. When female interviewees talked about competition, the word held no negative connotation. In general, they thought competition was a good thing and noted that it provided a healthy goal for them.

4.4 Sports and school work

Gender differences also emerged relative to time spent on study and sport. Most male and female participants practiced some sport when they were in tenth grade. During conversations about males' experience of peer pressure, it became evident that for them pressure was based both in school work and in sports. Males agreed that sport was more important than school work at that age. Phrases like "for boys it is more important to go to a soccer practice then to study" or "for boys it is more important to be good in sport than to get good grades" were not uncommon. Females did not experience the same pressure to be good in sports in exchange for being good in schoolwork. They agreed in general that "it was important to be in sport but also to study and we all did both." Again the belief that females have to study to be good in school was accepted, and girls did not feel any negative pressure if they decided to spend more or less time on school work than sports.

When asked how this explains why gender differences in mathematics showed up only in the rural areas, participants suggested that this may be related to school size and the number of different "cliques". Their perception was that in Reykjavik and the surrounding area, males had more "cliques" to choose from. In Reykjavik, they might be more likely to find different groups such as the "sport clique', "the do-well-in-school clique", and "the party clique", but in a small town there might be only one group. One girl noted that.

> In a school in Reykjavik if there are two boys that, like, read all day long then there might be the third one that would join them and then they are a group and they can, like, support each other. But there might be, like, this one boy in a small town that does well in school, but he does not have any chance to, like, redeem himself because there is no one to support him because there is no one else like him.

Similar reflections came from one male participant:

> In smaller schools, the peer groups are more important, like, may be in a large school each person is for themselves, or you can change groups. In small schools, there is maybe only one group, but in large schools there are more groups to be part of.

4.5 Ambition, maturity, and future goals

In general male participants agreed that their female counterparts were more ambitious and goal-oriented. They believed that the "boys are more busy being cool" than thinking about how they might achieve any future goals they might have during the teenage years. In the interviews, it was clear that both male and female participants thought that girls were more independent and mature than boys at that age.

4.6 Role models

Both female and male participants talked about the importance of role models and their influence on views of different professions. The girls talked about the shortage of women in math-related fields such as physics and mathematics and noted that this might have an impact on girls' choices and might also support the common belief that males were more suited to learn mathematics. One girl's comment was, "of course it is important for young girls to see that women can do the same thing as men, and as well

as men." Another girl discussed the importance of seeing women with different careers:

> Now women are more in public places and in administration positions than before. Also when I looked at the brochures from the University, there were a lot of photos of women—there are not only old men that teach at the University, there are lots of young and beautiful women.

The males in the study agreed with the importance of role models. They also expressed pleasure in seeing more women at the university and other public places, noting "I think it is great, that is the way it is supposed to be". In others parts of the interview male participant similarly supported the advancement of their female peers.

4.7 Proposed hypothesis: the jokkmokk effect and an individual's financial independence

4.7.1 The "jokkmokk" effect

Most participants agreed with the general hypothesis of the "jokkmokk" effect. They thought that young people want to leave their small towns in search of adventure and/or opportunities. They did agree, and talked about how girls were more likely to move because they were more "organized" and more likely to work toward the goal of leaving. They thought that boys talked about wanting to leave but did not work toward the goal. One girl explained this idea clearly when she said that "it is not that the boys don't want to leave—they just are too careless at this age that they don't think about it as something they have to plan ahead to go." Another supportive argument for the "jokkmokk" effect came from a girl in Reykjavik; "boys are more homebound, girls want to stand on their own feet, and they want to show that they can do it". In general the groups agreed that boys would probably not put much effort into their studying and this would affect mathematics achievement. The rural male participants added that it was not necessarily that guys did not care about school but rather valued their home community and its vocational values more.

4.7.2 Financial independence

Participants were in agreement that importance of gaining financial independence was a more likely explanatory factor for rural girls' achievement rather than the "jokkmokk" effect. However, they did agree that there were more chances in rural areas for an uneducated male to become financially independent than for an uneducated woman. All the males in the study agreed that "there are many more jobs for males in rural areas; it is probably not the dream of many girls to work in the fish factory or in the grocery store."

In discussions about what made sense, the "jokkmokk" effect or the search for financial independence, it became clear that participants linked the "jokkmokk" effect to the need for financial independence. Two male participants indicated that they could understand why more females might leave their hometown and understood that it might be connected to the possibilities of gaining financial independence: Their comments were "I think some guys go out on sea and earn a lot, and then there is no need to go anywhere" and "role models for guys in the rural area that quit school are more positive than for girls. The role models that the girls have are women working in the fish factory or in the store earning minimum salary."

One female participant agreed that females wanted to leave their communities but not because they did not want to return. Her view was that even if women wanted to and had a possibility to gain financial independence, they needed education. If women had any career goals beyond working in the fish factory or in the grocery store in their hometown, they needed postsecondary education.

5 Concluding remarks

The results of this interview study were entirely unanticipated. The striking conclusion is that for youth participants, mathematics achievement appears to be implicit in their lives, even when questions explicitly were focused on mathematics education. Before a concluding comment about this finding, a return to PISA for Iceland requires attention.

Interestingly, PISA 2003 results, those that attracted world-wide attention, appear not robust. PISA 2006 revealed that girls' average scores were higher than males but not significantly so (OECD, 2007). Also, according to Olafsson et al. (2007), the Icelandic National Mathematics Test in 10th grade has consistently revealed since 1996 that, on the average, girls are better in mathematics than boys, with higher average scores but significance is mixed across years. Moreover, in analysis of this test, there was no constant pattern in the size of the gender differences in urban versus rural Iceland. It varied instead between years; that is, in some years, general differences were larger in rural areas and in other years they were larger in the Reykjavik area. What was constant was that, when boys and girls were taken together, students' scores in the Reykjavik area were always higher then in rural Iceland. The point, linked to the interview study reported here, is perhaps that a combination of factors other than gender alone, or rural residence specifically, led to the 2003 results.

In summarizing the interview results, qualifications are necessary and relevant. First, there is no suggestion that causal relationships exist between the social and societal factors about which interviewees talked, to educational attainment in general, nor to mathematics achievement. Indeed, both boys and girls brought up connections that seemed pertinent to them. Secondly, a focus on "the social context" meant that, seemingly for them, the mathematics teaching and learning that occurred was at best indirectly connected to central matters of their lives.

Findings from this small interview study revealed a set of issues that were important—and important to education in general more so for interviewees than what they did with mathematics. These issues included parent involvement, peer pressure, the relationship of academics to sports, future plans, and even how youth talked about themselves as students. What is significant is that these factors add a context to the central outcomes of PISA for Iceland. A larger study in this nation, and indeed a large inquiry of youth views across PISA countries, might qualify and make more complex the general outcomes. While mathematics educators and researchers might well want students to focus attention on their learning, one final implication is that 'boys and girls will be boys and girls'.

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