IOWME NEWSLETTER

VOLUME 23, NUMBER 1, June 2009

A pictures drawn by a young Finnish girl showing "Me in the Land of Mathematics" from Päivi Perkkilä and Eila Aarnos' research summarised in this issue.

Convenor of IOWME: Olof Bjorg Steinthorsdottir
Newsletter Editor: Tamsin Meaney
Copy Editor: Ginny Keen
Technology Co-ordinator: Christine von Renesse
[cvonrenesse@wsc.ma.edu]
http://extra.shu.ac.uk/iowme/
INTERNATIONAL ORGANISATION OF WOMEN AND MATHEMATICS EDUCATION
An affiliate of the International Commission on Mathematical Instruction

Welcome to the first IOWME Newsletter of 2009

Somehow the year has flown and although this newsletter was originally headed to you in February, most of you will not see it until July. Nevertheless, the year has had a sense of change and change for the better, which is surprising given the conditions are very difficult in many places. Perhaps it is the sense that we are at the bottom and the only way from here is up. The financial crisis has touched schools and education and by implication mathematics education in ways that were not even imaginable twelve months ago. Work conditions are changing all over the world as everyone tries to grapple with doing more on less. However, I do not think that I am the only one who is now having discussions about issues that were not even on the radar twelve months ago. Swine flu was also not something anyone had heard of when many of use were at ICME but as I head towards PME in Greece, we have all been warned to take care of our health so that we will not contaminate others.

This newsletter has a number of interesting articles. We hope to continue printing articles from women working in diverse situations. If you would like to write about how women are educated in mathematics or working in mathematics education in your country we would love to hear from you.

One of the discussions that we hope to raise in this newsletter is how we can support women completing post-graduate qualifications. Research in Australia suggests that women PhD students have less opportunities for publishing articles and this is connected to having reduced opportunities to do joint publications with supervisors. In considering how we can rise to the challenges posed this year, it may be worth thinking about ways to increase opportunities for joint research or writing with women who are just beginning their academic and publishing careers.

Tamsin Meaney (IOWME newsletter editor)

tmeaney@csu.edu.au

Contents

Welcome to the first IOWME Newsletter of 2009 2

Contents 3

Differences in the quality of mathematics that female and male students are learning in the Arab countries 4

"ME IN THE LAND OF MATHEMATICS" 6

What are the experiences of women PhD students in mathematics education? 12

New online resources from the Australian Association of Women 17

MES 6 18

Conference Reports 19

Mariá Trigueros Gaisman & Helen Forgasz 19

National Coordinators 22

Differences in the quality of mathematics that female and male students are learning in the Arab countries

Hanan Ayoub Innabi
United Arab Emirates University

The ability to understand and apply mathematical ideas is a prerequisite for full participation in career choice and advancement in modern countries. UNESCO statistics show that in the Middle East and North Africa Regions, female enrolment in scientific disciplines is about one-third that of female participation in other university fields.

There is much evidence to show that in middle and elementary mathematics schools in many Arab countries, female students are equal or even better achievers in the general scores on achievement tests. However, there is some evidence that shows that male students learn mathematics in a better way than the females. The National Comprehensive Studies that were conducted in Oman and Jordan showed that even though there were no significant gender differences in the mean achievement of children at fourth, fifth, and eighth grades, there were significant gender differences favouring male students in problem solving skills.

To clarify this issue, an example taken from Jordan is presented in this article. This example relates to the results from the TIMSS 1999 test. The results of the mathematics analysis by gender that appeared in the *TIMSS 1999: International Mathematics Report* by Mullis, Martin, Gonzalez, O'Connor, Chrostowski, and Smith (2000) showed that female students in Jordan scored higher than males students but the mean difference was not significant. Further analysis of Jordan TIMSS data showed that differences in the general performance in mathematics are hiding many details related to the quality of mathematics that female and male students are learning. A better understanding of these differences was revealed when the analysis went deeper than merely analyzing total achievement scores. This deeper analysis was carried on in 2006 and published in *School Science and Mathematics Journal*, *106* (8), December 2006, by Innabi and Dodeen.

The purpose of the conducted study was to compare the performance of eighth grade male and female students on the mathematical content of

Differentially Functioning Items (DIF). Data were taken from the TIMSS 1999 of Jordan which included responses of 5,299 eighth-grade students. The statistical procedure that was used in this study to identify gender-related DIF items is Mantel-Haenszel (MH) DIF. An item shows DIF if males and females (in the same total achievement level) do not have the same probability of getting it correct. This analysis can highlight some specific gender differences in mathematics achievement that merit closer analysis.

The results showed that around one-third of items exhibited significant gender-related DIF either against male students or female students. These items were investigated according to several factors. Results showed that most of the DIF items that favoured male students asked for some level of judgment or expectation. For example, items asked what was the best estimate of the sum of two numbers, or asked the respondent to determine the approximate number, or to determine a number in an inequality. Those items favouring female students had the opposite pattern. Female students were favoured in fixed answer items such as "Compute 3/5 + (3/10 * 4/15)".

Results showed also a clear pattern in the *familiarity* of the item relative to typical textbook problems. All the DIF items against female students were *unfamiliar* items. These items included: "Determining the most unreasonable estimate for two 3-digit numbers"; "Locates a point on a number line given its distance from two given points". These problems require some unconventional application of knowledge. Conversely, most of the items that showed DIF against male students were *familiar* items.

In this context, an explanation may be provided related to social factors that influence such achievement. In a conservative culture such as Jordan's, girls are socialized to be compliant and consistent in following rules. Male students, on the other hand, are socialized to be competitive and independent thinkers, to take risks and to test the boundaries of rules.

Viewing mathematics as a tool for thinking and communication and not as formal systems and a collection of procedural knowledge and concepts, leads us to consider the importance of the quality of mathematics that students learn. Effective mastery of mathematics empowers people to deal with the complexity of modern life. This study showed that female students may have more difficulties dealing with the items that look unfamiliar and have fewer strategies to find answers than male students. It is hoped that

this study will turn attention toward the quality of mathematics that both female and male students are learning not just in Jordan but in all of the Arab world. Freeing the full talents of men and women will require removing the barriers to educational equity in mathematics.

A recommendation can be provided to the educational reform that is taking place presently in most Arab countries. Some procedures need to be considered regarding gender-differences in mathematics achievement. Teachers' training programs need to direct the mathematics teachers to be aware of the gender differences in mathematics and to make them aware about their role to reduce gender differences in mathematics performance. Teacher's training needs to provide specific strategies to encourage female students to explore, estimate, form conjectures, and experiment. These skills, as one can conclude, male students have more chances than female students to learn as part of their life outside the classrooms.

To achieve equity in the Arab countries, we need to understand how and why male students outperform female students in quality mathematical learning which involves thinking, communication, and problem solving rather than just memorization and procedural learning.

"ME IN THE LAND OF MATHEMATICS"

CHILDREN'S DRAWINGS AND GENDER ISSUES

Päivi Perkkilä & Eila Aarnos
Finland
University of Jyväskylä
Kokkola University Consortium Chydenius

Paper presented at CERME6 conference Lyon, France 30th January 2009.

In the paper we highlight 6 to 8 years old children's relationship to mathematics by using children's drawings. Children were asked to imagine themselves in math land. We found that there are meaningful connections between gender, children's developmental level, emotions, and mathematical descriptions.

METHODOLOGICAL INTRODUCTION

This paper is based on our multidisciplinary research project "Children

and Mathematics". We have gathered data from 6 to 8-year-old Finnish children (n = 300) using our pictorial test. The pictorial test has two parts: a picture collection presented to children and children's drawings of themselves in the math land. In this paper, we concentrate on the children's drawings.

Drawings give children another language with which to share feelings and ideas. Our goal is to reach the usefulness of multidimensional approaches for understanding children's drawings. The main aims are: to describe the mathematics content and the impressions produced in the girls' and boys' drawings, and to interpret girls' and boys' mathematical and psychological needs from the mathematics learning environment.

The drawings were analysed by an open method of classifying the content, colours and impressions. We found from the data, the following categories:

1. "Me" (person in the picture) with two subcategories: a) activities, and b) social situations,
2. Real life contents with four subcategories: a) nature, b) animals, c) buildings, and d) vehicles,
3. Mathematical contents with five subcategories: a) amounts of numbers, b) quantity of numbers, c) arithmetical problems, d) geometrical forms, and e) mathematical talk,
4. Impressions with five subcategories: a) human expressions, b) colours, c) emotional expressions, d) creativity, and e) maturity.

The background variables were gender and grade.

Interpreting and understanding children's drawings

The children tell us in pictorial language how they feel about themselves and the determining influences in their lives. They are also telling us how they need other people. An attempt to interpret a child's art within a single theoretical framework can only result in frustrating oversimplification. More productive than a single-minded approach is an eclectic one that draws upon disciplines that have contributed significantly to our understanding of the infinite variety of human behaviour. In this paper such an eclectic approach draws upon mathematics learning and teaching, educational and developmental psychology.

Children's drawings are thought to reflect their inner world. Although children may use drawing to explore, to problem solve, or simply to give visual

form to ideas and observations, the overall consensus is that art expressions are uniquely personal statements that have elements of both conscious and unconscious meaning in them and can be representative of many different aspects of the children who create them.

According to Malchiodi, themes of children's drawings may also be gender-related. General themes appear in boys´ and girls´ drawings, Malchiodi observed that, "the spontaneous production of boys reveal an intense concern with war fare, acts of violence and destruction, machinery, and sports contents, where as girls depict more tranquil scenes of romance, family life, landscapes, and children at play". Girls use fairy tale images such as kings and queens and animals such as horses as the subjects of their drawings. Whether this tendency to portray specific subjects by boys and girls is developmental or the result of parental or societal influences or both remains as an unsolved question.

RESULTS

Children were asked to draw themselves in the land of mathematics. They drew themselves in rich forms and provided mathematical content and informal content (e.g. nature and buildings). Most children were standing alone in math land. Most girls were smiling and some of the boys seemed to be involved in action. Girls and boys equally expressed numbers and arithmetic problems. Besides the children themselves, wild nature was the main content of the pictures.

In figure 1, the children show their number sense which is an essential part of the early mathematics curriculum. Still there is a worry that this kind of number practicing is not enough in children's early mathematics learning.

Figure 1: First-grader boy's and first-grader girl's drawings demonstrating huge number productions

Figure 2: Second-grader boy's and second-grader girl's drawings demonstrating creative use of numbers

The children who drew the pictures in Figure 2 also show their number sense but in a more creative way than the children in figure 1. However, we have to accept that it is difficult to conclude any differences only by the pictures. In regard to this challenge, we compared these differences to children's other responses in our pictorial test and investigated parallel results.

Table 1: Emotional impressions (=41.8***) 2χ

	Girls (%)	**Boys (%)**
Sad	4.5	19.3
Neutral	42.6	60.0
Joyful	52.9	20.7

Statistically significant gender effect can be seen in girls' and boys' emotions (Table 1). Most girls express in their drawings joyful attachment to mathematics whereas it was hard to see the same clear emotional expressions in most boys' drawings, and so boys' drawings were interpreted to have neutral attachment for mathematics. We wonder if these results have a basis in either the differences in girls' and boys' development or early gender stereotypes.

The meaning of mathematics for these children seems to be: being alone, silent, producing numbers and arithmetical problems. The contexts for mathematical learning is for most children in this research outside school buildings, mostly in nature.

Typically, in boys' drawings there were a few more buildings and vehicles whereas girls produced a few more animals and nature. The buildings in the drawings were towers, cottages, castles, home houses etc..

Figure 3: First-grader boy's and first-grader girl's drawings demonstrating no numeric content

In the drawings in figure 3, children seem to practise early mathematical skills e.g. classifying, grouping, and making series. In general, these skills develop in early years.

Interpretation

Different kinds of needs can be interpreted from the children's drawings "Me in the math land". Children have both mathematical and psychological needs. Concerning the math learning, we could find three different groups of children: traditional school mathematicians (Fig. 1); wild and creative mathematicians (Fig. 2); and beginning mathematicians (Fig. 3). We suggest that these groups need different mathematics teaching. In order to identify the main gender effects, three main scales were used based on the categories presented earlier: emotions, developmental level; and math productions.

We found a strong cumulative circle between children's developmental level, mathematics productions, and emotions. Aunola et al. (2004) have shown that children's mathematical skills develop in a cumulative manner from the preschool to the first years of school, even to the extent that the initial mathematical skills in beginning of preschool were positively associated with their later growth rate: the growth of mathematical skills was faster among those who entered preschool with already higher mathematical skills. Aunola et al. (2004) also showed that, by the end of grade 2, children have problems

both in attachment for mathematics and in mathematics learning.

Concerning the need for different learning environments, children's math lands were mostly in nature. They spontaneously combined the informal and formal mathematics. Boys seemed to need more lively actions and constructions in their learning environments. Girls' expectations towards mathematics learning environments were more positive than boys'. Teachers and other educators should recognize how powerful out-of-school learning experiences could be in mathematics learning. Mathematical experiences are essential parts in children's world from a very early stage of life. The child's focus on numerosity produces practice in recognizing and utilizing numerosity in the meaningful everyday context of the child.

The Finnish curriculum (2004, 17) is giving more attention to the following aspects: special needs of girls and boys; equal opportunities for children to learn and to start school; strengthening children's positive self-concept and their ability to learn skills; having children learn to understand the significance of a peer group in learning; and having children learn to join learning and to face new learning challenges with courage and creativity.

The gender variations found in children's drawings are important to think about. We suggest that early math learning environments should be child centred and gender sensitive.

Please, read more:

Perkkilä, P. & Aarnos, E. (2007a). *Children's Mathematical and Emotional Expressions Inspired by Pictures*. University of Jyväskylä. Kokkola University Consortium Chydenius. https://jyx.jyu.fi/dspace/handle/123456789/18034

Perkkilä, P. & Aarnos, E. (2007b). *Children's Talk about Mathematics and Mathematical Talk*. University of Jyväskylä. Kokkola University Consortium Chydenius. https://jyx.jyu.fi/dspace/handle/123456789/18035

Please, contact us:

paivi.perkkila@chydenius.fi
eila.aarnos@chydenius.fi

What are the experiences of women PhD students in mathematics education?

IOWME began its life as a support network for women working in mathematics education. In considering what the organisation should focus on in the next few years, it is perhaps time to reflect on how it could become a support network again. To do this, we need to have a clearer understanding of the experiences of women at different stages in their careers. We begin this process, in this newsletter, by looking at the experiences of three women who are in the process of completing their doctoral studies.

Research into the experience of completing a PhD shows that there are differences according to the students' gender. In summarising research into PhD students' experiences, Dever (2008) stated that "[i]solation, lack of confidence, uneven access to resources, lack of funding (including part-time scholarships), lack of access to networks and mentoring have all been cited as factors affecting women's capacity to complete higher degrees once enrolled" (p. 8). More women than men do their doctoral studies part-time and this contributes to their restricted access to research networks. Family commitments also fall more to female academics including those completing PhDs and this has an impact on their ability to attend conferences and present papers, also restricting their opportunities for networking (Baker, 2008).

References

Baker, M. (2008). *The family life of academics: Gendered priorities and institutional constraints*. Paper presented at the Annual Conference of the Australian Institute of Family Studies, Melbourne, 9-11 July, 2008.

Dever, M. (2008). *Gender differences in early post-PhD employment in Australian Universities: The influence of the PhD experience on women's academic careers*. Brisbane: The University of Queensland Social Research Centre.

Case Studies from PhD Students

The three PhD students came from different countries and from different periods of their lives. Unlike many women who complete PhDs, all

three women are studying full-time and have received scholarships from different organisations. Each was asked the same set of question via email, but had the opportunity to respond to the questions in any way they wished. The stories suggest diversity in experiences but in no way can be considered representative of women doing post-graduate research in mathematics education. However, there are some similarities in these experiences and these resonate with what the research studies mentioned earlier suggest is the general experience for women PhD students.

When do women take up PhD studies in mathematics education?

For all three women, choosing to do a PhD was closely related to possibilities for their future, by providing them with increased job opportunities. For the two older women, the research that they undertook was closely related to their previous experiences and could be seen as a continuation of a personal body of work. Research may provide a different avenue for rethinking about this work but they bring to it their understandings from earlier experiences.

Annabelle, from Australia, started her PhD just after completing her undergraduate education. At twenty-three, when offered the opportunity to apply for a scholarship and with the support of respected supervisors, she felt that the opportunity was too good to refuse. Completing a PhD would provide Annabelle with opportunities to have a career in academic research.

Ngaire began her PhD in New Zealand a decade after completing a Masters in Mathematics Education. She worked in an aluminium smelter, before working as secondary mathematics teacher. After several years as a teacher, she considered her career options and felt that she would like to work in teacher education and realised that if she wanted to do this she would need to upgrade her qualifications.

In Sweden, Lena's PhD research is about assessment practices in mathematics education and this is directly related to the job that she had before, during and after her study. She had originally been a primary school teacher but more recently had worked for a research group involved in developing open questions for national assessments that were designed to help teachers. She continues to work 20 percent of her time for this organisation whilst completing her PhD over an extended period of time. When she finishes her PhD, she will return to working full-time, bringing with her a desire to broaden the research basis for this organisation.

What is it like to do a PhD?

Unsurprisingly, all three women found challenges in doing a PhD. The loneliness of doing an individual study was something that was seen as the least enjoyable part of doing a PhD. There were also joys. The challenges were slightly different between the women and this had much to do with where each of them were in their life stories. Many of the comments were about working with people – the loss of contact with students, the gaining of contact with research orientated people resulting in different sets of conversations. For all women, having contact with people was a main focus.

One of the challenges that Lena has had to manage was when the work load from her employment increased to more than 20 percent and this bit into her PhD writing time. She had to make it clear to her employer that this extra time was compensated for at a later time. One of the things that had changed in Lena's life was there was now a blurring of the week-end and the week-days. With a sense that there was so much to investigate and write about, she actually is unsure that unencumbered week-ends will ever be a full-time possibility again. However, she was spending more time at home in order to complete the thesis, which would not be something that she could do once the thesis was completed and she returned to work full-time. Working at home provided a flexibility that she loved. However, writing a thesis was a lonely business as she tried to hold a whole thesis in her head.

Doing a PhD had its compensations for these struggles. Lena enjoys reading, going to interesting conferences, writing and learning. Interacting with teachers and students who were part of her research was really meaningful. She enjoys a lot of deep interesting discussions with colleagues on different "levels". Lena hopes that her thesis will have important content. The moments when she feels confident about that are moments really full of joy!

Annabelle also has entered an enjoyable period of doing her research. It was a relief to have jumped the many hurdles of the first year – completing the research proposal, presenting the endorsement of candidature seminar, obtaining ethics approval. Her data collection is in full swing, and she is fully engaged in the process of writing the drafts of several chapters. Indeed, she is enjoying the research so much that she would like to continue in a similar role once her PhD is completed.

For Ngaire, the biggest challenge is finding a balance between working on her thesis and her family. Consequently, she only had minimal contact with other PhD students. She has found all the PhD students, both male and female, that she has come in contact with, to be wonderfully supportive and human. She has learnt, like other women, that doing a PhD is essentially a lonely role.

Coming from the classroom, she missed contact and the reality of working with students and the teamwork from working with other teachers. On the other hand, she has enjoyed a break from teaching to think more about the complexities of the mathematics classroom. She now has evidence to support some of her gut feelings from the classroom about textbooks and peer interactions. She has also enjoyed getting to know her supervisors. They have both acted as role models and provided their own career paths as examples to be learned from.

How does being a women impact on doing a PhD?

Each post graduate student perceived the impact of being a woman differently. However, managing work and family responsibilities at the same time as completing a PhD were something that all women had had to grapple with. Again relationships with others are common in their stories.

Ngaire began her PhD the week her son turned one so family has always been important and had a big impact on her study. Recently she moved to Oman with her family because of her husband's work. This has resulted in a huge change in culture, library and internet contact. She is at the stage of writing up her thesis. To fit her work into her life, she is constantly working to 'grab' more hours. Currently she gets up at the call to prayer at 5.30 am and does an hour, gets the children to school and child care, does three more hours in the morning and then maybe a bit more in the evening. Burning the candle at both ends is difficult. When she finishes her PhD, she has the daunting prospect of piecing together potential new roles with the needs of her still small children, the need to start earning money again, and her husband's career.

At Lena's institution, all the PhD students were women so it was a little difficult for her to know what might be different for a male PhD student. However, she did feel that when issues came up she dealt with them in a "male" way by insisting on her own rights being achieved rather than considering the needs of others first, which she considered to be a more

"female" approach. With her career already sorted, she does not have the same uncertainties faced by Ngaire over her next career step.

The research centre in which Annabelle works has mostly women, like Lena's institution. The other PhD scholar, with whom Annabelle shares an office, is also a young woman. Their similarities enable them to support and understand each other, and contributes to a sociable working environment. For her, the thing which complicates a PhD student's journey the most – particularly a *female* student's – is children. Annabelle does not yet have children of her own. However, she has the utmost respect for her fellow PhD student who has just given birth to her third child and has subsequently taken leave from her candidature for 12 months. This raises an important question for her as a young married woman for whom the prospect of starting a family looms in the near future: What is more important – the PhD or children? Need the two be mutually exclusive?

Ngaire responds that the PhD and children are not mutually exclusive. In fact, for her having children has given her the space both to think about career paths and the freedom to pursue the PhD. If she had not taken time off from teaching to have children she may not have taken the time to consider what she wanted to do. Her husband as the primary earner may not have had the same luxury to take up study to do a PhD.

Could IOWME have a role as a support network?

All three women belong to a range of research networks and it was unclear how IOWME could add to these established networks. Each woman made suggestions on what they saw were possibilities. For example, Lena stated that, although she had not experienced differences when it comes to gender, she feels that a web-page with support and discussion is a very good idea. Ngaire sees IOWME as being able to provide contact with role models. At the beginning of her academic career, she would like to see how others have organised their careers. Annabelle has also not faced any real issues in her PhD study but sees certain issues as being more female oriented and so networks such as IOWME become valuable. She suspects that other PhD students may not be so lucky as she has been with her study. She would like to see links between students facilitated, and that a group such as IOWME could go a long way towards achieving this.

So what do we learn from these stories?

The stories have both similarities and differences. All the women had begun their PhD studies because they saw it as opening doors into academic careers that were not available in any other ways. For the two older women, the study was a continuation of earlier interests which made use of their experiences in a new way. In all three stories, contacts with people were important. The loss of some relationships was tempered by the joys of forging new relationships. Most of the differences derived from where each woman was in their career. Annabelle was at the beginning of her working life and was trying to imagine how family commitments would fit into these. She wanted to continue doing research work once her PhD was completed. Ngaire's family commitments were having a significant impact on her study but would also be something that she would have to consider when looking for a university position. For Lena, the PhD was much more integrated into her academic career as she would continue with her present employer once the PhD was finished. However, working on the PhD had made her aware that pre-study, free week-ends were unlikely to be so common even after she had completed her PhD.

If IOWME is to contribute to the support network for women doing PhDs in mathematics education, then it seems that it should concentrate on building and maintaining relationships. Some of this could be about developing relationships between PhD students but also building relationships between post-graduate students and women who were more established in their careers. We would welcome any suggestions about how this could be achieved given the world-wide nature of IOWME. A range of options of how to do this could be discussed at the IOWME meeting at the next ICME in Korea in 2012.

Please forward any suggestions to: Tamsin Meaney at tmeaney@csu.edu.au

New online resources from the Australian Association of Women

The following information comes from the Australian Association of Women but may be of interest to others.

Gender and Education Guidelines

Many excellent gender and education resources have been developed, and the

arguments and directions for change have been well articulated. One of the greatest obstacles for all of us is time. This resource provides an accessible outline of issues and approaches linked to selected key readings and professional learning and teaching resources. It also gives an e-life to sections of the excellent training module *Piecing it together – understanding the social construction of gender* (Education Queensland 1996) and provides a scaffold for findings from the AWE Leading Social Change project research.

LINKS

http://www.awe.asn.au/links.php
Hundreds of lesson plans to help you put gender back on the agenda, as well as readings and resources for professional learning.

Online FORUM

http://www.awe.asn.au/cgi-bin/yabb2/YaBB.pl
Find out about current issues and events and participate in discussions.

MES 6

The 6th International Mathematics Education and Society Conference (MES 6) will be held in Berlin (Germany) from 20th to 25th March 2010. Please find the First Announcement of MES 6 at the conference website:
http://www.ewi-psy.fu-berlin.de/mes6

We kindly want to remind you that paper proposals should be send to mes6@zedat.fu-berlin.de before September 15, 2009. We are looking forward to receive your contribution. For information about possible formats please approach the conference website.

On behalf of the Organising Committee,
Kind Regards,
Eva Jablonka -- Candia Morgan -- Uwe Gellert

mail to: mes6@zedat.fu-berlin.de

Conference Reports

ICME Topic Discussion Group #32: Gender and Mathematics Education

Mariá Trigueros Gaisman & Helen Forgasz

Sessions of the working group during ICME- 2008 in Monterrey, México were lively and dynamic. The papers presented covered a wide range of interesting research questions and encouraged participants to reflect on the complexities of phenomena related to gender and mathematics education. TSG 32 began with the very stimulating opening words of Gilah Leder. She provided participants with an overview of research on gender issues in relation to mathematics education, and provoked thinking about what has been accomplished and the continuing problems confronting the community of researchers in this area that need to be addressed.

Presenters at TSG32 represented a diverse range countries: Australia, Botswana, Canada, Iceland, Iran, Malawi, Mexico, New Zealand, UK and USA; the group attending and participating in the sessions was even more diverse. The papers presented had been classified into four different topics that were presented at different sessions: gender and technology; gender, affect, and classroom issues; gender and socio -cultural factors; and gender and achievement.

Gender and the use of technology

Discussions related to this first topic focused on differences in student attitudes towards the usefulness of computers (Kaino), and on teachers' practices when teaching and assessing students' learning in classrooms where technology was used (Rodriguez & Ursini; Trigueros & Lozano). It was reported that gender differences were found in Botswana in the way students perceived the usefulness of computers, with boys thinking they were more useful. The findings, it was suggested, were related to the way subjects using computers are taught in high school. Gender differences were found in teachers' classroom practices in Mexico. Within the project "Enciclomedia", there were emotional dimensions to female teachers' experiences with using computer programs and their success was related to support from other female teachers'; male teachers related the use of computers to their usefulness and seldom shared information or asked for support from other teachers. In another Mexican study, gender differences were found in teachers' assessment practices. One female teacher's

conceptions of learning mathematics and the use of technology incorporated a variety of elements including students' attitudes, understanding, creativity, independence and autonomy. However, the male teacher had a pragmatic view focused on students' abilities to understand mathematical concepts and procedures, and on the possibility of students using technology in the future.

Gender, affect and classroom issues

During this session, an intervention in Malawi which resulted in a positive change of attitudes of girls towards mathematics (Chamdimba) was reported. One reason for this outcome might be the fact that teachers' participation in the project promoted their responsiveness to gender issues. In another study from Mexico (Ramirez & Ursini), three female teachers' interactions with their students when the women taught mathematics were investigated. The results were consistent with what other researchers have found: teachers consider mathematics to be a male domain, and they think girls need to expend more effort than boys to learn the discipline. These differences in interaction patterns may have an impact on the future behaviors of girls and boys. Another study with under-prepared college students in the USA (Knowles) focused on understanding participants' "mathematical selves", in particular, those who showed under-preparation and low mathematics self esteem. Big gender differences in attitude were found, and helping them required the development of gender-sensitive practices. In a study with gifted students in an Iran university (Pourkazemi), it was shown that among the gifted mathematics group there was a dominance of males, while among groups in other disciplines there were more females than males.

Gender and socio-cultural factors

In the session devoted to papers on this topic, a range of issues were addressed. In one study (Pálsdóttir), the beliefs of four Icelandic girls about mathematics and of themselves as learners of mathematics from 2003 to 2008 were investigated. It was found that girls: view mathematics as a process; emphasise understanding and solving the problems at hand; are self confident, and are well organized and study hard. In another study from Iceland (Steinthorsdottir & Sriraman), an explanation was sought for PISA results that showed significant gender differences in favour of girls, in particular in rural areas. The study was qualitative and involved 19 students from rural and urban areas who were interviewed. Strikingly, none of these students was interested in studying programs related to mathematics, and all

perceived males as mathematically superior to females, particularly at the gymnasium (upper secondary school). How women doing mathematics are represented in popular culture was another topic presented at the session (Mendick). It was reported that even though the media usually use men when representing people doing mathematics, the number of women represented is growing. However, it was found that there was still a strong association between mathematics and masculinity, whiteness, the middle- class, and heterosexuality in the representations. Certain stereotypes were detected among the male and the female mathematicians represented. In all cases, mathematics was portrayed as accessible to only a few and problematic to everyone else. The experiences of women in Canada who persevered with mathematics at the undergraduate degree level were explored in another study (Hall). It was found that participants had personality traits that helped them persevere; they had a great love of and skill for their subject areas; and the y were supported informally in their academic endeavours by their peers.

Gender and achievement

In this final session, gender differences in mathematics achievement were the focus. Data were presented showing that even though gender differences in mathematics achievement in Australia have not been significant for many years, differences in achievement favouring males may be re-emerging (Vale), with a pattern of lower interest and declining participation in mathematics among girls being evident. The findings on these trends were attributed to effects in the Australian political context where some apparently anti-feminist policies were said to have been implemented and strategies focusing on teachers' pre-service preparation were suggested. In another Australian study, the focus was on the continued monitoring of large-scale mathematics assessments for gender differences, in particular among the highest mathematics achievers (Forgasz). Results for 2007 showed a clear pattern of male dominance among the highest achievers in all of the mathematics subjects examined, as well as evidence that single-sex environments, related to socio-economic factors, benefit both females and males with respect to high mathematics achievement. A clear difference was also found in favour of students attending metropolitan schools. In another study examining gender differences in mathematics achievement based on results in recent regional and international student assessments, results showed that girls were catching up with boys (Ma). Interestingly, female

breakthroughs in mathematics achievement came from developing countries. Gender stereotypes, in the developed world, typically emphasize academic ability while in the developing word they emphasize social role; these different emphases were able to be related to the results. In another presentation, factors contributing to gender differences in high school students' mathematical performance in the United States were discussed (Paek). Results confirmed the outcomes from previous research, but the study added insight by analyzing why this might happen. When unlimited time to solve a problems were allowed, females were more successful than males and attempted more problems; on timed paper-and-pencil assessment, however, females performed worse than the males on the same items. Males also tended to skip steps more often than females, but females self-regulated their work better than males. These results, it was argued, could be used to design strategies to help female students perform better in timed tests.

Discussions throughout the sessions were lively and friendly. There were some ideas shared on the importance of incorporating new methodological approaches and new foci into research on gender and mathematics education.

Papers presented at TSG32 can be found and downloaded from: http://tsg.icme11.org/tsg/show/33

National Coordinators

Australia	Leigh Wood	leigh.wood@mq.edu.au
Austria	Helga Jungwirth	hejun@t-online.de
Botswana	Topayame D. Mogotsi	tmogotsi@bocodol.ac.bw
Brasil	Gelsa Knijnik	gelsak@unisinos.br
Cameroon	Babila-Njingum Ghogomu Emilia	yayor_babila@yahoo.co.uk
Canada	Tasoula Berggren	tasoula_berggren@sfu.ca
Cyprus	Rita Panaoura	edrita@ucy.ac.cy
Czech Republic	Barbora Batikova	babatikova@yahoo.com
Finland	Riitta Soro	riitta.soro@loimaa.fi
Germany	Laura Martignon	martignon@ph-ludwigsburg.de
Greece	Maria Chionidou-Moskofoglou	mchionidou@rhodes.aegean.gr

Hungary	Susan Berényi	bermatsz@freemail.c3.hu
Iceland	Gudbjord Palsdottir	gudbjord@khi.is
India	Surja Kumari	surja_45@yahoo.com
Israel	Miriam Amit	amit@mail.bgu.ac.il
Italy	Litizia Jengo	enrico.stefanini@next.it
Japan	Hanako Senuma	hanako@nier.go.jp
Jordan	Liliana Atanassova Al- Zboun	lilian_zboun@yahoo.com
Malaysia	Munirah Ghazali	munirah_ghazali@yahoo.com
The Netherlands	Jenneke Krüger	j.kruger@slo.nl
New Zealand	Margaret Walshaw	M.A.Walshaw@massey.ac.nz
Northern Ireland	Sally McClean	si.mclean@ulster.ac.uk
Norway	Bjorg Kristin Selvik	bks@hib.no
Pakistan	Nusrat Fatima Rizvi	nusrat.fatimarizvi@aku.edu
Papua New Guinea	Neela Sukthankar	sukthankar@yahoo.com
Russia	Emanuila G. Gelfman	gelfman@mpi.tomsk.ru
Spain	Maria Jesus Luelmo	mluelmo@roble.pntic.mec.es
South Africa	Renuka Vithal	vithalr@ukzn.ac.za
Sweden	Barbro Grevholm	barbro.grevholm@mna.hkr.se
Switzerland	Nicoletta Sala	nsala@arch.unisi.ch
Trinidad & Tobago	Margaret Bernard	mbernard@fsa.uwi.tt
UAE	Hanan Ayoub Innabi	hinnabi@uaeu.ac.ae
USA	Olly Steinthorsdottir	steintho@email.unc.edu
Zimbabwe	Chipo Tsvigu	ctsvigu@yahoo.com