Mathematics – a male domain?

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Introduction[2]

Aim of the study

In the GeMa-project (Gender and Mathematics) student attitudes towards mathematics are investigated. Is mathematics considered to be a male, female, or gender neutral domain by Swedish pupils in compulsory and upper secondary school?

One main motive for the study is the strong gender imbalance in higher mathematics education and in mathematics as a professional field in Sweden. Other science areas and technology show similar patterns of gender imbalance. If mathematics is considered to be a male domain, this might influence girls not to study the subject. If, however, mathematics is perceived as a female domain, girls' interest in mathematics may be positively affected. These hypothesis lie behind the GeMa-project.

The Fennema-Sherman MD-scale and a new development of the instrument

During the 70's and 80's researchers used various theoretical frameworks to explain gender differences in achievement and participation in mathematics education. Some researchers at that time used biological models, but many sought psychologically and socially based explanations for gender differences in academic performance in mathematics. Affective factors also became interesting.

The MD-scale

One instrument that has been widely used is the Fennema-Sherman Mathematics Attitude Scales (MAS), developed by Elizabeth Fennema and Julia Sherman, published in 1976 (Fennema & Sherman, 1976). There are nine scales in all, measuring affects and attitudes towards mathematics using questionnaires. One of the scales measures whether mathematics is viewed as a male domain – i. e. whether mathematics is considered more suitable, important and interesting for boys than for girls – the scale *mathematics as a male domain* (the MD-scale).

In an early study Fennema and Sherman inquired into gender differences using the MAS instrument. Their results showed, in particular, that both girls and boys in school year 9 – 12 considered mathematics to be a male domain, boys to a larger

[1] The full project team also include (in alphabetical order) Sara Larsson, Gilah Leder, Anna Palbom, and Else-Marie Staberg.

[2] A small amount of material in this paper builds on earlier conference reports (Leder & Brandell, 2002; Sundqvist, 2003)

extent than girls (Fennema & Sherman, 1977). During the 70's and 80's the Fennema-Sherman-scale was frequently used, and it still is, particularly in the USA. Janet Shibley Hyde and her colleagues made a meta-analysis containing a number of these studies (Hyde, Fennema, Ryan, Frost, & Hopp, 1990). They considered 70 articles, especially American ones. Among other results they found that boys to a larger extent stereotyped mathematics as a male domain than did girls. Using statistical methods Hyde et al. came to the conclusion that the reported gender differences changed over time (publishing date) and with the age of the students. The gender differences were more evident at the secondary level than for younger children. The differences seemed to decrease during the period studied, but nevertheless are typically still reported in more recent work. Thus the construct "mathematics as a male domain" continues to be seen as a critical variable in helping to explain perceived disadvantage experienced by females in mathematics and related areas.

Hyde and her co-authors discuss if the fact that girls view mathematics as a male domain (although to a lesser extent than boys do) could discourage them from going into mathematics. The authors play down that hypothesis but stress the risks of boys and men stereotyping mathematics as a male domain. Fathers and male teachers may unconsciously transfer their view that girls doing mathematics are less feminine and thus influence the choices of their daughters or female pupils.

A new instrument – a revised scale

In the original MD-scale the only alternatives were mathematics as male or gender neutral. Mathematics as a female domain was not considered to be a possible outcome in the Fennema-Sherman MD-scale. In the 90's, Helen Forgasz, Gilah Leder and Paul Gardner (1999) re-examined the MD-scale. One reason was that the gender-differences concerning mathematics results, earlier in favour of boys, had diminished over the years, and were shown to have disappeared in some studies. Girls even produce better results in some contexts, and are seen to work harder with mathematics. The researchers therefore hypothesized that the scale was no longer adequate, since mathematics could be seen as a female domain as well as a male or neutral domain. They developed a new instrument, *Who and mathematics* (Forgasz et al., 1999; Leder & Forgasz, 2002). The scale allows for three alternatives, mathematics as female, male or gender neutral. The questionnaire used in this new instrument is in itself gender neutral.

Data for an Australian sample are reported in Forgasz (2001). As noted in earlier research, a majority of respondents perceived mathematics as a gender neutral domain. However, among those who did not regard mathematics as a neutral domain, girls rather than boys were thought to be superior at mathematics: for example to be more capable, enjoy it more, and be perceived by their teachers as more likely to succeed. Boys' behaviors were perceived as less functional – for instance, boys were considered as more likely than girls to find mathematics difficult, to be bored by the subjects, and to need more help. These views differ markedly from those reported in earlier work in the field.

The new instrument has been used in studies in several countries. Data for an American sample are reported in Kloosterman, Tassell, & Ponniah, (2001), for a Singaporean sample in Forgasz, Leder, and Kaur (2001), and for a sample of Greek students in Barkatsas, Forgasz, and Leder (2001). Findings similar to those described for the Australian sample were obtained. The GeMa-study uses a translation of the questionnaire into Swedish and the instrument will be described in some detail in this paper.

Mathematics - participation, achievement and attitudes among Swedish students

Swedish political authorities have repeatedly and clearly established the importance of gender equity in general and higher education (Prop. 1994/95:164) and gender equity is inscribed as a goal in the Education Act. Gender differences in attainment measured by grades exist; they are however in general small or insignificant, and over all girls perform somewhat better in school. On the other hand, participation is strongly related to gender; many of the programmes, especially vocational ones, in non-compulsory upper secondary school show large gender imbalance. At tertiary level women are in majority on the whole. Gender imbalance at this level exists in many areas and often *increases* over time. The general tendency is that the proportion of women increases in all areas except those where women are already in great majority. Among large programmes leading to professional degrees only engineering programmes are still dominated by men.

Participation

In compulsory school, year 1-9, all pupils take the same mathematics course and it is not possible to drop the subject. Hence no gender differences in participation exist at primary and lower secondary level. However at upper secondary and university level gender imbalance in mathematics education increases according to level. In table 1 some data are given that show the imbalance. A short introduction to the educational system is given below in order to explain the structure behind the table.

Almost all pupils (98%) continue to non-compulsory upper secondary school. Since 1994 when a thorough reform was implemented there are seventeen national programmes, all three years of duration. Two of the programmes are specifically directed towards further studies, namely the Natural Science Programme and the Social Science Programme. These two programmes together attract about half of the students. A third programme is a mixture of vocational and preparing for higher studies, the Technology Programme. The rest of the programmes are vocational, but also giving general competence for higher studies. Most programmes are divided into different specializations offered in years two and three. The Natural Science Programme has three options: Mathematics and Computer Science, Environmental Science and Natural Sciences. The specializations of the Technology Programme are decided on the local level.

Within the university structure there are shorter and longer programmes leading to professional degrees. The programmes are designed as a mixture of courses in different subjects, most often several subjects scheduled in parallel. Students may also design their own programme, study only one subject at a time and finish by a general degree with only two or three subjects: Bachelor (requires three years at university) or Master (four years at university). Studies at undergraduate level are always organised in courses, at most one semester long. All courses are classified as mainly belonging to one subject, e.g. mathematics.

Research education is formally of four years duration after a Bachelor, Master or professional degree and leads to a PhD degree. Mathematics is one main area of doctoral studies containing sub areas like e.g. analysis, algebra and applied mathematics.

Participation of women at different levels and the development over time appears in Table 1 (Skolverket, 2003; Statistics Sweden, 2004a, 2004b). In upper secondary level only those directions and programmes that contain the most advanced mathematics are included.

Table 1 *Number of students and proportion of women in mathematics education at different levels and among academic staff in mathematics in 1993 and 2002.*

Level		**Total number of stud/staff**		**Proportion of women**	
		1993/94	**2002/2003**	**1993/94**	**2002/2003**
Upper secondary level (non-compulsory school)	Natural science programme, years 1-3	32425	41026	42%	45%
	Specialization Mathematics and Computer Science, year 2, 3	Not existing	6148	Not existing	20%
	Technology/ engineering programme, years 1-4	18184	Not existing	16 %	Not existing
	New technology programme, years 1-3	Not existing	19138	Not existing	11%
Undergraduate level , university Students taking at least one course in mathematics/ applied math	All levels	32601	42274	26%	31%
	First year level	23820	32584	29%	34%
	Second year level	6168	7259	18%	24%
Graduate level (math and applied math)	PhD-students	283	370	18%	26%
	PhD-exam, three preceding years	70 (91/92 – 93/94)	121 (1999/2000-01/02)	7%	11 %
Professors and researchers at university (math and applied math)		Data not available	476	Data not available	14%

From the table it is evident that women participate in mathematics education almost as much as men at upper secondary level in the natural science program, but to a much lesser extent in both the mathematics direction of the natural science programme and the old and new technology programme. Table 1 also shows that at university the proportion of women decreases with the level of studies.

Development is not unambiguously positive. At secondary level programmes/ directions with emphasis on mathematics have been introduced during the 90's where men are in great majority. At tertiary level the development is positive but rather slow. Men are still in great majority among PhD students, new PhD:s and academic staff.

Performance

In compulsory school grades and national standardised tests showed gender differences with boys in favour until the 90's. Westin (1999) showed that girls have reduced the lead of the boys. During the last few years girls and boys show similar results, both in national tests and in grades, with girls having slightly better grades.

At upper secondary level the picture is currently somewhat complex. There are five main courses in mathematics called Mathematics A – E, building on each other. Students in all programmes take mathematics A as a compulsory course. In addition to that the programmes have none, one, two, three or four of the courses B – E as compulsory. The proportion of boys and girls vary in courses B – E, in accordance with the proportion of the sexes in various programmes. Men have slightly better grades in Mathematics A and B, while women have better results at Mathematics D and E. Mathematics C shows a pattern where slightly more boys have the highest and the lowest (not pass) grade (data not published, communicated by staff at Statistics Sweden). These data concern students leaving upper secondary level in 2001, with a complete certificate from one of the programmes.

Attitudes

Over 4000 students in the last year (year 9) of compulsory school in Sweden participated in the PISA study together with students from about 25 other countries (Skolverket, 2001). In comparison with pupils in most other countries, Swedish pupils show less interest in mathematics. As in most countries boys in Sweden show greater interest than girls. Girls in Norway, Austria and Sweden show least interest of all groups.

Mathematics academic self-esteem varies a lot among countries. In all countries boys value themselves higher than girls according to the PISA-study. Swedish boys show a slightly more than average level of academic self-esteem, while Swedish girls and pupils in a few other countries (girls in Norway, Portugal, Korea and Czech, girls and boys in Hungary and Korea) are the groups that show the lowest self-esteem.

A study based on the new instrument in Sweden

In the GeMa-project questionnaires and interviews are used. Two studies were done, one in year nine of compulsory school, where data were gathered in 2001 and 2002, the other in year two of upper secondary school, with data from year 2003. The students are not the same.

In this paper we focus on results from the analysis of the *Who and Mathematics* part of the questionnaire.

The interviews were conducted partly to help clarify the interpretation of single questions. While the results from the questionnaires can be used on their own the interviews should be seen as a complement to the questionnaires. For the results of the other parts of the questionnaire and the interviews, the GeMa- reports are recommended[1] (Brandell, Nyström, Staberg, & Sundqvist, 2003).

The questionnaire
As mentioned in the introduction, the GeMa-project is built on the re-examined MD - scale. There are four different parts in the questionnaire. First of all there is a part with background questions. Then there is part 1: questions about *others and mathematics* and part 2: questions about *the individual and mathematics*. The questionnaire ends with a part where students can comment on their answers to the other questions. The *others and mathematics* part is a translation of the new scale from the *Who and Mathematics* instrument (Leder & Forgasz, 2002). For upper secondary level a couple of questions in the questionnaire were slightly altered, in accordance with the situation at upper secondary level.

The *Who and mathematics part* contains 30 questions for the year 9 sample, and 28 questions for the year 11 sample, where the students are supposed to take a stand if statements are more likely to be true for girls, boys, or if there is no difference. The response alternatives are:

- BD – boys definitely more likely than girls
- BP – boys probably more likely than girls
- ND – no difference between boys and girls
- GP – girls probably more likely than boys
- GD – girls definitely more likely than boys

The statements concern students' relations to mathematics e.g.:

- Mathematics is their favourite subject
- Like challenging mathematics problems
- Need more help in mathematics

Samples
Statistics Sweden's (Statistiska centralbyrån, SCB) list of schools have been used in order to get samples that are possible to make generalisations and draw conclusions from. The samples were gathered with consideration to municipality and school level. The three municipalities used in the study where Luleå/Umeå, Stockholm, and Lund/Malmö, all of them university cities but from different parts of Sweden.

A list of all the compulsory schools was compiled for each municipality. The schools should have more than 40 students listed in year nine in the school year 2000/2001. Every school was classified depending on the combined educational level of the parents of the students. This resulted in nine groups (depending on municipality and parents educational level) from which a sample of schools was randomly selected, in total 17 schools. The headmasters of the selected schools were asked to pick out two classes or teaching groups in year nine and 34 classes were thus selected and participated. This method gave us some background information on group level and a geographical spread.

For upper secondary level, schools with both the Natural Science (NS) and Social Science (SS) programmes were chosen. The list of possible schools in each of the three regions (Stockholm, Luleå/Umeå and Lund/Malmö) is much shorter, and the socio-economic background not possible to define on school level. Schools were

[1] The upper secondary school report is under preparation and will be available shortly at http://www.maths.lth.se/GeMa/

randomly chosen in each municipality. The headmaster was asked to pick out two classes from each of the two programmes, year two (that is school year 11). In all 24 classes participated.

One member from the GeMa-group, different persons depending on district, visited and distributed the questionnaires at the selected schools. The students were informed that they participated in a national study concerning gender and that similar studies are conducted in other countries. To avoid influencing the results the aim of the study was not expressed. Totally 747 questionnaires were handed in from year nine pupils and 550 for upper secondary level, year two.

Results from the Swedish study

The results presented here are from part 1 of the questionnaires*: Who and mathematics*. Most of the items in this part were identical for the two samples. For almost all items the most common answer is the alternative No difference. This is true also for various subgroups. However interesting patterns occur when we take into account the minorities who answer in any of the two directions.

In order to make the presentation of results compact, we show mean values for different groups of students. Mean values are calculated after assigning numbers to the five alternative answers in the questionnaire. In part 1 this means that the answer “Girls more than boys, definitely” is assigned the number 1, the answer “Girls more than boys, probably” the number 2, etcetera. A mean value of 3 means that the distribution of answers is more or less symmetric around the answer “No difference”, i.e. there are roughly as many students who answer in the “Girls more than boys”-direction as there are students who answer in the “Boys more than girls”-direction. The mean values do not signal the dispersion of answers, there can be small or large number of students answering in both directions. Statistical inference is used in order to investigate if the mean values deviation from 3 is likely to represent an answering pattern in either direction for the whole population. Significance is signalled on two levels, ** means that the deviation from 3 is significant with $p < 0.01$, and * means that the deviation from 3 is significant with $p < 0.05$.

Common patterns for the two samples

A common pattern for students in all subgroups of the two populations, is that men, more than women, need mathematics for their adult life and in order to get good jobs. Men as well as women in the two samples think that men more than women like challenging mathematics problems and find mathematics easy.

Table 1 Mean values for various groups according to sex, school year and programme.

	Female students				Male students		
	Year 11		Year 9		Year 11		Year 9
	NS	SS			NS	SS	
10 Need mathematics to maximise future employment opportunities	3.16**	3.16**	3.10**		3.52**	3.27**	3.33**
11 Like challenging mathematics problems	3,26**	3,38**	3,25**		3,74**	3,34**	3,28**
14 Think mathematics will be important in their adult life	3.15*	3.22**	3.07		3.34**	3.14	3.14**
17 Find mathematics easy	3.20**	3.25**	3.12**		3.51**	3.11	3.09

Comment: A mean value greater than 3 indicates that on group level students find that the statement is more likely to be true for boys, a mean value less than 3 indicates that it is more often true for girls.

On average, students of both populations and sexes express the opinion that mathematics teachers give at least as much attention to girls as to boys. Male students even find that girls more often are encouraged by their mathematics teachers.

Table 3

	Female students				Male students		
	Year 11		Year 9		Year 11		Year 9
	NS	SS			NS	SS	
3 Are asked more questions by the mathematics teacher	3.16*	2.94	3.02		3.02	3.07	2.90
12 Are encouraged to do well by the mathematics teacher	3.02	3.02	2.91*		2.88**	2.82*	2.70**
13 Mathematics teachers think they will do well	3.07	3.07	2.97		3.07	2.89	2.83**
24 Mathematics teachers spend more time with them	3.02	3.07	2.97		2.71**	2.71**	2.62**

There are patterns common for women in both populations. As a group, women express that it is more typical for women, compared to men, to

- Worry if they don't do well in mathematics
- Think that it is important to understand mathematics
- Think that mathematics is boring
- Have to work hard in order to do well in mathematics
- Want to do well in mathematics

Male students on the other hand, express varied opinions on these items.

Table 4

	Female students				Male students		
	Year 11		Year 9		Year 11		Year 9
	NS	SS			NS	SS	
21 Worry if they do not do well in mathematics	2.41**	2.64**	2.42**		2.98	2.92	2.88*
2 Think it is important to understand the work in mathematics	2.60**	2.63**	2.59**		3.20**	2.97	3.07
25 Consider mathematics to be boring	2.80**	2.66**	2.87**		2.76**	3.17	3.28**
5 Have to work hard in mathematics to do well	2.77**	2.86**	2.91**		2.85**	3.07	3.16**
7 Care about doing well in mathematics	2.81**	2.81**	2.76**		3.14*	3.01	3.06

Different patterns for the two populations

Among the upper secondary students in this study, the students on average express that boys more than girls like mathematics, and have mathematics as their favourite subject. The answers from students in year 9 signal that these students do not think that there is any difference between boys and girls in this respect. Furthermore do the year 11 students in this sample express that women, more than men, find mathematics hard, are not good in mathematics, and need more help. The younger students show divided opinions on these items.

Table 5

	Female students				Male students		
	Year 11		Year 9		Year 11		Year 9
	NS	SS			NS	SS	
1 Mathematics is their favourite subject	3.24**	3.31**	3.09*		3.58**	3.32**	2.95
6 Enjoy mathematics	3.12*	3.39**	3.05		3.53**	3.17*	2.95
26 Find mathematics difficult	2.80**	2.68**	2.78**		2.70**	3.00	3.11*
22 Are not good in mathematics	2.92*	2.90*	3.01		2.85**	2.94	3.07
19 Need more help in mathematics	2.89	2.80**	2.92*		2.81**	2.97	3.16**

Discussion

Students in all subgroups have apparently adopted a perspective of gender equity and demonstrate this by answering “No difference” in high proportions on several items. However, their answers at the same time express a clear perception of existing gender differences.

It is fairly common – among both sexes - to regard mathematics as a male domain in some respects. All subgroups tend to find that men are more likely than women to like challenging mathematics problems, find mathematics easy and need mathematics in their future life.

Women on the other hand are associated by many, especially by the female students, with negative aspects of mathematics, such as more often finding mathematics boring and difficult. On the other hand they are supposed to work hard and to worry about not getting on well.

Interestingly enough female students find that women more often find it important to understand mathematics.

In earlier class room studies teachers have been shown to encourage boys more than girls and giving more attention to boys. In this study however, students do not find that teachers more often encourage male students in mathematics. Some groups even express that teachers encourage girls more often. This may indicate that teachers have changed their attitude, or else that students’ expectations are biased, and they expect teachers to let boys dominate the scene.

Older students seem to have developed more clear views on gender differences. This may depend on the age, but also on the different samples. For upper secondary level only students in non-vocational programmes were chosen, but in year nine the whole population participated. It may be that students choosing programmes leading to higher studies stereotype mathematics more than students aiming at a vocational education.

Male students in year two of the Natural Science programme express more marked attitudes in many cases than the other groups. It may for some reason be of greater importance for these male students who are specialising in mathematics themselves, to relate mathematics positively with their own sex.

It is important to note that the results are complex. The tendencies described are not unambiguous. In the comments and during interviews it was made clear by some students that they were negative to the whole idea of asking about gender differences.

Comparison between Australia and Sweden

The actual questionnaire has, been used in a study with similar size in Australia and among students of the same age or somewhat younger than the Swedish students in compulsory school study (Forgasz, 2001). We have access to data from that study and have consequently been able to make comparisons between the responses from Australia and Sweden. The Swedish data is from the sample from year nine. Table 6 shows the mean values for both sexes in the two samples.

Table 6

	Australia		Sweden	
	Males	Females	Males	Females
1 Mathematics is their favorite subject	2.84	2.91	2.95	3.09
2 Think it is important to understand the work in mathematics	2.88	2.53	3.07	2.59
3 Are asked more questions by the mathematics teacher	3.23	3.08	2.90	3.02
4 Give up when they find a mathematics problem is too difficult	3.61	3.41	3.19	3.02
5 Have to work hard in mathematics to do well	3.21	2.92	3.16	2.91
6 Enjoy mathematics	2.73	2.82	2.95	3.05
7 Care about doing well in mathematics	2.70	2.40	3.06	2.76
8 Think they did not work hard enough if do not do well in math	2.97	2.60	2.98	2.77
9 Parents would be disappointed if they do not do well in math	3.05	2.84	3.12	2.87
10 Need math to maximize future employment opportunities	3.19	2.95	3.33	3.10
11 Like challenging mathematics problems	2.99	3.02	3.28	3.25
12 Are encouraged to do well by the mathematics teacher	3.00	2.98	2.70	2.91
13 Mathematics teachers thinks they will do well	2.72	2.76	2.83	2.97
14 Think mathematics will be important in their adult life	3.01	2.76	3.14	3.07
15 Expect to do well in mathematics	2.86	2.71	3.00	3.13
16 Distract other students from their mathematics work	3.85	3.85	3.57	3.80
17 Get the wrong answers in mathematics	3.32	3.19	3.06	3.03
18 Find mathematics easy	2.84	2.88	3.09	3.12
19 Parents think it is important for them to study mathematics	3.06	2.91	3.07	2.93
20 Need more help in mathematics	3.49	3.16	3.16	2.92
21 Tease boys if they are good at mathematics	3.32	3.35	3.32	3.38
22 Worry if they do not do well in mathematics	2.72	2.43	2.88	2.42
23 Are not good at mathematics	3.21	3.06	3.07	3.01
24 Like using computers to work on mathematics problems	3.37	3.34	3.48	3.60
25 Mathematics teachers spend more time with them	2.95	3.04	2.62	2.97
26 Consider mathematics to be boring	3.73	3.25	3.28	2.87
27 Find mathematics difficult	3.38	3.13	3.11	2.78
28 Get on with their work in class	2.43	2.58	2.73	2.52
29 Think mathematics is interesting	2.88	2.96	3.03	3.10
30 Tease girls if they are good at mathematics	3.23	3.49	3.06	3.22

Discussion

The similarities between Swedish and Australian pupils mainly concern school work. This is not surprising since studies for many years have shown roughly the same pattern for the behaviour of girls and boys in several countries. There is also a similarity concerning the beliefs of the students regarding the parents of other students. This indicate that in Australia and Sweden parents regard learning mathematics equally important for girls and boys. As expected there is also a similarity concerning computer use; computers are coupled with boys.

The differences are more interesting. In several aspects the group of Australian students regard mathematics as a female rather than a male domain, while the Swedish ones are of opposite opinion, especially the girls.

This pattern is visible by many of the items in table 6, and we give a few examples: Swedish students – girls and boys – believe that boys more often than girls like challenging mathematical problems while Australian students are more gender neutral. Boys more often than girls find mathematics easy, according to Swedish students, while Australian students find the opposite is true. Australian students answer that boys more than girls get the wrong answers in mathematics and are not good at mathematics, while Swedish students' answers are gender neutral. (Table 6, items 11, 18, 23, and 17.)

One reason for these differences may be that the Australian equity policy has been more energetic the Swedish one. We have no possibility to decide whether that is true. The school systems vary between the countries and in Australia there are also differences between the federal states. As an example of the Australian policy we can name the document *The National Policy for the Education of Girls* from 1987 that concerned all state schools, but was accepted also of non state schools (Yates 1993, p 14 ff). Even before the arrival of this document there were different initiatives in the federal states. According to Yates (p 24) the field 'broadening options' got the most attention from the federal state governments. The goal has been to increase girls participation in mathematical, scientific and technological subjects. The Swedish campaigns have been more directed to science and technology. Mathematics has not received the same attention here.

Swedish boys differ from other groups in a couple of respects. They do not as the other groups believe that girls more often find it important to understand mathematics and they find that teachers encourage girls and give more time to girls. Can it be that Swedish boys more than the Australian boys guard mathematics as a male domain? If girls were more eager to understand this could indicate that they are more interested and involved in mathematics. Do boys express that they find teachers to favour girls at their cost? These are hypothetical questions, that we are not able to answer here.

Australian girls differ in the respect that they do not think that boys need mathematics more than they themselves do in order to get a good job. Maybe Australian girls have been influenced by the Australian campaigns aiming for girls to get a profession? This issue may have been important later in Australia than in Sweden? It is, however, not enough to look upon school and school politics regarding this question. School policy must be related to other structures. Not only gender but class and ethnicity must be discussed according to Madeleine Arnot, Miriam David and Gaby Weiner in *Closing the Gender Gap* (1999), an analysis of this issue in England and Wales. In their conclusions they claim (p 150ff) that economic and social changes as well as feminism have influenced girls. The norm for girls during the 90's became 'getting on and getting out'. The circumstances in Australia and Sweden have differed and there is no simple explanation for the different results concerning future jobs.

Conclusions

In the GeMa-project we have shown that mathematics is gender stereotyped in some aspects by Swedish students in both year nine in compulsory school and in year two in upper secondary school, Natural Science and Social Science programmes. Mathematics is most often perceived as gender neutral, but some students express other views, both in a female and a male direction. There are gender differences and differences between the two age groups. In general older students stereotype mathematics more as a male domain, which is in accordance with studies from other countries.

In comparison with Australia, Swedish students are more inclined to perceive mathematics as a male domain, while Australian students in some cases relate mathematics positively and strongly with women.

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