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Elementary Students' Views on the Gendering of Mathematics

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Abstract: Gender differences in mathematics learning outcomes are still evident in many countries participating in large scale international testing, as well as in national testing in Israel, the context in which the study reported here was conducted. The participants were 281 students from three Israeli elementary schools and were in grades 4 and 6. The students completed a questionnaire with items based on a selection of variables included in explanatory models for gender differences in mathematics. It was found that many students held gendered beliefs related to mathematics learning, particularly when the questions asked related to themselves or to significant others in their lives (parents and teachers); the views of the majority of students were gender neutral. When presented with two photographs – a man, and a woman – and asked who was the one more likely to work with mathematics, it was clear that the students' choices and explanations echoed perceptions of mathematics as a male domain.

Keywords: *Mathematics education, gender stereotyping, elementary students, beliefs.*

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Introduction

In mathematics educational settings, students' attitudes and beliefs are often regarded less seriously than their mathematical thinking processes and outcomes. Yet, when it comes to gender differences in mathematics learning outcomes (achievement and future participation in mathematics), affective factors are found to serve a critical role. In the influential *Handbook of research on mathematics teaching and learning*, McLeod (1992) noted that knowledge in the field of affect and mathematics learning more generally had been much informed and influenced by those researching issues of gender and mathematics. Over time, too, mathematics as a subject, as well as careers dependent on a strong mathematical foundation, have been considered more suitable for males than females, that is, mathematics has been and continues to be considered a *male domain* (e.g., Forgasz, Leder, & Gardner, 1999; Rapp, 2015), despite past (see Leder, Forgasz, & Solar, 1995) and ongoing efforts (e.g., Li & Koch, 2017) to challenge these beliefs. The extent to which people hold gender-stereotyped beliefs about mathematics varies by country, that is, cultural factors are at play. In an international survey of members of the general public, the views of adult respondents from nine countries were compared (Forgasz, Leder, & Tan, 2014). It was found that "among those who held gender-stereotyped views…, mathematics, science, and computing were considered more suitable for males than for females" (Forgasz et al., 2014, p. 369). But in some countries the beliefs were found to be more strongly held (e.g., China), and participants from English-speaking countries were more likely to be gender-neutral. Interestingly, respondents from each country indicated that mathematics was generally considered to be an important study for both girls and boys.

A correlation (positive relationship) between achievement and various affective factors (e.g., enjoyment, interest, perceived usefulness of task, and self-confidence) has frequently been reported over time (e.g., Chen et al., 2018; McLeod, 1992; Thomson, Lokan, Lamb, & Ainley, 2003). Attitudes are more difficult to gauge than mathematical knowledge and understanding. When children are observed in the classroom, teachers can assess their conceptual understandings by listening to what they say, watching what they do and write, and from written tests. The most common way to measure students' attitudes is by using questionnaires, although other techniques are available (see Leder & Forgasz, 2002a). There is understandably less research on the views of very young children and of children in the early elementary years of schooling. In the study reported in this article, we focussed on the attitudes towards mathematics of Israeli grade 4 and grade 6 students. Relevant previous research is discussed first.

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Previous research

A large volume of research on gendered beliefs about mathematics has been reported from the 1970s to the present day. Early on, it was found that gender differences in mathematics achievement favoring males did not surface until the post-elementary years of schooling (e.g., Fennema, 1974). Much of the research subsequently focused on high school students and adults. With more refined research approaches, it was later found that children in the early to mid-elementary years of schooling already held traditional gender-stereotyped beliefs that mathematics was for boys. Forgasz (1992), for example, found that grade 2 girls' self-rating of their mathematics capabilities (confidence levels) were lower than grade 2 boys', even though, on average, their teachers considered the grade 2 boys and girls equally capable mathematically. Girls' attitudes towards mathematics and about themselves as learners of the subject have also been reported to be less functional (likely to lead to future success) than boys' (e.g., Hyde, Fennema, Ryan, Frost, & Hopp, 1990). In a recent study conducted in Israel, Markovits and Forgasz (2017) reported that for students in both grades 4 and 6, the boys expressed higher perceptions of their mathematics achievement levels than did the girls.

Teachers have been found to hold gender-stereotyped expectations of their students' mathematical capabilities. Some years ago, Kulm (1980) reported that teachers (and parents) have critical roles in attitude formation. Fennema, Peterson, Carpenter, and Lubinski (1990) found that teachers had the tendency to overestimate boys' and underestimate girls' mathematical potential. According to Hyde et al. (1990), findings from the Fennema-Sherman (Fennema & Sherman, 1976) *Mathematics as a male domain subscale* revealed that males held stronger gender-stereotyped views than females, and, they surmised that females' male peers might "indicate in a variety of subtle ways that females who achieve in mathematics are somehow less feminine and thus put pressure on females not to achieve in mathematics" (p. 310) and that male teachers might "discourage girls from taking mathematics courses" (p. 310). Lavy and Sand (2015) used Israeli data and reported that elementary teachers' biases favoring boys positively affected boys' achievements and negatively affected girls'. They claimed that "[S]uch gender biases also impact students' enrollment in advanced level math courses in high school—boys positively and girls negatively" (p. 1). Several researchers have explored students' beliefs about their teachers' expectations of their mathematical capabilities. It has been found that girls perceived lower teacher expectations of their mathematical achievements than did boys (Lazarides & Watt, 2015; Wang, 2012); similarly, lower achieving students' perceptions were lower than those of higher achieving students' (Lazarides & Watt, 2015).

In recent times in many western nations (e.g., Australia, Canada, England, France, the Netherlands, U.S.), males still outperform females in mathematics, for example, in the grade 4 results of the 2015 Trends in Mathematics and Science Study [TIMSS] (see Thomson, Wernert, O'Grady, & Rodrigues, 2016). Israel, the setting for the study reported here did not participate in the grade 4 TIMSS in 2015. However, Rapp (2015) examined gender gaps in mathematics from national and international testing over the last decade and found that among the Hebrew-speaking population, boys outperformed girls in mathematics, while among the Arabic-speaking population (as in other Arab nations around the world) girls outperformed boys. Both TIMSS and the Program for International Student Assessment [PISA] gauge students' attitudes towards mathematics as well as measuring achievement levels. Based on 2012 PISA results, it was found that "(T)he gender gap in mathematics performance mirrors the gender gap in students' drive (Organisation for Economic Co-operation and Development (OECD), 2014, p. 1), and that "only 38% of girls, but 53% of boys, plan to pursue a career that involves a lot of mathematics (OECD, 2014, p. 2).

Theoretical perspectives

Early explanations for gender differences in the outcomes of mathematics education (achievement, attitudes, continued studies in higher level mathematics, and careers in STEM-related fields) included a range of psycho-social and socio-cultural variables (e.g., Eccles et al., 1985; Leder, 1990, Reyes & Stanic, 1988). Leder (1992) described the elements common to the various explanatory models:

> …the emphasis on the social environment, the influence of other significant people in that environment [e.g., teachers, parents, and peers], students' reactions to the cultural and more immediate context in which learning takes place, the cultural and personal values placed on that learning and the inclusion of learner-related affective [e.g., confidence, perceived usefulness of mathematics, gender-stereotyping], as well as cognitive, variables. (p. 609 – examples in parentheses have been added)

Over the years, other variables have been identified as contributing to gender differences in mathematics learning outcomes. Some of these variables include: teachers' pedagogical approaches (e.g., Boaler, 1997), children's problem-solving strategies (e.g., Fennema et al., 1998), mathematics anxiety among female elementary teachers (e.g., Beilock, Gunderson, Ramirez, & Levine, 2010), stereotype threat (e.g., Spencer, Steele, & Quinn, 1999), and ability grouping for mathematics learning (e.g., Boaler, Wiliam, & Brown, 2000).

Forgasz (2008) argued that the variables included in the early explanatory models were still relevant considerations for research on gender differences in mathematics learning outcomes. Several of these were included in the study reported in this article: gender-role stereotyping, and the beliefs and expectations of parents, teachers, and peers.

The Study

Aims

The aims of this study were to gauge the extent of Israeli elementary students' gendering of mathematics, and to explore for differences by grade level (4 and 6) and by student gender.

The sample

Grade 4 and grade 6 students from three Israeli elementary schools participated in the study. In all, there were 281 students, 143 girls and 138 boys, of whom 134 were in grade 4 (73 females, 61 males) and 147 in grade 6 (70 females, 77 males).

Methods

Survey methods were used in the study. The participating students completed a pen and paper version questionnaire which included closed and open-ended items. Several of the items were drawn from previously used questionnaires developed by other researchers (e.g., Forgasz, 1995; Forgasz, Leder, & Tan, 2014; Leder & Forgasz, 2002). These items had originally been administered English. They were translated into Hebrew, back translated into English to ensure accuracy of translation, and the wording modified slightly to match the reading levels of students in grades 4 and 6. Other items included in the questionnaire were specifically designed for the study. They were written in Hebrew. One of these items (Item 7 – see below) was translated into English for this paper.

The items

In this paper, we focus on the questionnaire items that tapped views about the gendering of mathematics. The seven items included six closed items and one open-ended item.

For items (1-6), students were expected to select one response from the options provided:

1. Who do you think are better at mathematics? Girls/Boys/Same
2. For whom do you think it is more important to learn mathematics? Girls/Boys/Same
3. For whom is mathematics more difficult? Girls/Boys/Same
4. Who do teachers think are better at mathematics? Girls/Boys/Same
5. Who do parents think are better at mathematics? Girls/Boys/Same
6. Who teaches mathematics better, a female teacher or a male teacher? Female/Male/Doesn't matter

For item 7, the students were provided with two photos, one of a man (Picture A), the other of a woman (Picture B). The students were asked to write their response to the following question, and to explain their choice:

7. One of the people in the picture uses mathematics at work. Who do you think it is? Explain why you have picked this person.

The seven items comprise three clusters of beliefs related to the gendering of mathematics:

- Cluster 1 (Items 1-3): Beliefs about the peer group
- Cluster 2 (Items 4-5): Beliefs about significant others (teachers and parents)
- Cluster 3 (Items 6-7): Beliefs about mathematics teachers and people working with mathematics

Analyses

For items 1-6 and the first part of item 7, the data from the students attending the three schools were pooled, and were examined for grade level differences and for differences by student gender. Cross-tabulations with Pearson chi-square analyses were undertaken separately by grade level and by student gender. It should be noted that for each item, missing data were eliminated from analyses. Response rates varied only slightly from 277-281 (full sample size).

For the open-ended responses to the second part of item 7 (the explanation for choice made), each response was assigned to a thematic category. To strengthen reliability, these data were examined twice. To establish reliability of categorisation, responses for which there were discrepancies were later discussed and consensus reached for assignment to the pertinent thematic categories.

Results

The results are presented for the three clusters of items, in turn.

Cluster 1 (Items 1-3): Beliefs about the peer group

The percentage frequency distributions of responses to each of the three items in Cluster 1 by grade level and by gender are shown in Table 1. The results of the chi-square (χ^2) tests are included.

Table 1. Percentage frequency of responses to Cluster 1 items by grade level and gender, with χ^2 test results

Item		All N=281[1]	Gr 4 n=134	Gr 6 n=147	Sig.	Males n=138	Females n=143	Sig.
1 Who do you think are better at mathematics?	Girls	16.6[2]	19.1	14.4		10.2	22.9	χ^2=26.1 p<.001
	Boys	16.6	18.3	15.1	ns	27.0	6.4	
	Same	66.4	61.8	70.5		62.0	70.7	
2 For whom do you think it is more important to learn mathematics?	Girls	15.5	19.7	11.6		17.5	13.5	
	Boys	9.7	11.4	8.2	ns	12.4	7.1	ns
	Same	74.8	68.9	80.1		70.1	79.4	
3 For whom is mathematics more difficult?	Girls	18.2	19.5	17.1		13.3	23.0	
	Boys	14.2	20.3	8.9	χ^2=8.4 p<.05	19.3	9.4	χ^2=8.2 p<.05
	Same	67.5	60.2	74.0		67.4	67.6	

[1] Full sample size. For each item, there were slight variations in response rate (277 to 281)
[2] Percentages are based on response rate for each item

The data in Table 1 reveal that a majority of students believe that there is no difference (the same) between boys and girls with respect to each of the three items: item 1 (66.4%); item 2 (74.8%), and item 3 (67.5%). In other words, approximately two-thirds of the participating grade 4 and grade 6 elementary students did not hold gendered views of mathematics with respect to their peers' mathematical capabilities, for whom mathematics is an important study, and for whom mathematics is challenging. It was interesting to note that for each of the three items, a higher percentage of grade 6 than grade 4 students also indicated that there was no difference.

Statistically significant differences in the response distributions were found for item 1 by gender, and for item 3 by gender and grade level:

- Item 1: gender differences. While the majority of the male and female students believed that boys and girls were equally good at mathematics, a higher percentage of girls than boys believed that girls were better (22.9% compared to 10.2%) and a higher percentage of boys than girls believed that boys were better at mathematics (27% compared to 6.4%).
- Item 3: grade level differences. While the majority of students believed that mathematics was equally difficult for boys and girls, grade 4 students were less convinced of this (60.2%) than were grade 6 students (74.0%).
- Item 3: gender differences. While approximately the same percentages of male and female students believed that mathematics was equally difficult for boys and girls, a higher percentage of boys than girls believed that boys found mathematics more difficult (19.3% compared to 9.4%) and a higher percentage of girls than boys believed that girls found mathematics more difficult (23.0% compared to 13.3%).

While the majority of students believed that boys and girls were equally good at mathematics (Item 1) and that they found it equally difficult (Item 3), there were some students who held gendered beliefs. Among these students, there was same gender support for mathematical achievement (Item 1) and opposite gender support in finding mathematics difficult (Item 3). It could be argued that the views of these minorities of boys were consistent with the belief that mathematics is a male domain, but that the minorities of girls challenge this view or may not yet have been affected by this general societal view (e.g., Forgasz et al., 2014).

While there were no statistically significant differences by grade level or gender on Item 2, it should be noted there was a consistent pattern in the responses. At both grade levels, as well as for both males and females, higher percentages of those who held a gendered view (a minority in each group) indicated that it was more important for girls to study mathematics than for boys to do so, a finding inconsistent with previous research with adult respondents for which the minority in each country who held gendered views considered it more important for boys than girls to study mathematics (Forgasz et al., 2014).

Cluster 2 (Items 4-5): Beliefs about significant others (teachers and parents)

The percentage frequency distributions of responses to each of the two items in Cluster 2 by grade level and by gender are shown in Table 2. The results of the chi-square (χ^2) tests are included.

Table 2. Percentage frequency of responses to Cluster 2 items by grade level and gender, with χ^2 test results

Item		All N=281[1]	Gr 4 n=134	Gr 6 n=147	Sig.	Males n=138	Females n=143	Sig.
4 Who do teachers think are better at mathematics?	Girls	10.5	9.2[2]	11.6		13.3	7.8	χ^2=9.9 p<.01
	Boys	9.4	10.0	8.9	ns	14.1	5.0	
	Same	80.1	80.8	79.5		72.6	87.2	
5 Who do parents think are better at mathematics?	Girls	8.8	8.5	9.1		6.1	11.3	χ^2=10.4 p<.05
	Boys	7.0	9.2	4.9	ns	11.4	2.8	
	Same	83.9	81.5	86.0		82.6	85.1	

[1] Full sample size. For each item, there were slight variations in response rate (277 to 281)
[2] Percentages are based on response rate for each item

As can be seen in Table 2, the vast majority of students (over 80%) believed that both teachers and parents consider boys and girls equally good at mathematics. There was no statistically significant difference by grade level on either item, however significant gender differences were found on both items.

- Item 4: gender differences. A higher percentage of female than male students believed that parents considered boys and girls equally good at mathematics (87.2% compared to 72.6%), and higher percentages of male than female students believed that teachers thought that girls were better at mathematics (13.3% compared to 7.8%) or that boys were better at mathematics (14.1% compared to 5.0%). In summary, the girls' views were more gender-neutral than boys' views.
- Item 5: gender differences. While approximately equal percentages of male and female students indicated that parents considered boys and girls to be equally good at mathematics (M: 82.6% and F: 85.1%), a higher percentage of female than male students believed that parents thought girls were better (11.3% compared to 6.1%) and a higher percentage of male than female students believed that parents thought boys were better.

The pattern of same gender support was evident in the response pattern for Item 5 (as for Item 1). While it is to be expected that children with gendered beliefs would think their parents would believe in them, it is interesting to speculate why this pattern occurred. Was the same gender support indicative of children in which they were only children or only had same gender siblings, did the boys who thought parents believed girls were better at mathematics (6.1%) have very mathematically capable sisters, and did girls who thought their parents believed boys were better (2.8%) have very mathematically capable brothers?

Cluster 3 (Items 6-7): Beliefs about mathematics teachers and people working with mathematics

The percentage frequency distributions of responses to item 6 (from Cluster 3) by grade level and by gender are shown in Table 3. The results of the chi-square (χ^2) tests are included. No statistically significant differences were found by grade level or by student gender.

Table 3. Percentage frequency of responses to Item 6 by grade level and gender, with χ^2 test results

Item	Response options	All N=281	Gr 4 n=134	Gr 6 n=147	Sig.	Boys n=138	Girls n=143	Sig.
6 Who teaches mathematics better, a female teacher or a male teacher?	Female teacher	14.7	13.5	15.9		10.4	18.9	
	Male teacher	11.2	15.0	7.6	ns	14.1	8.4	ns
	Doesn't matter	74.1	71.4	76.6		75.6	72.7	

The data in Table 3 reveal that the majority of all students (74.1%), of boys (75.6%) and of girls (72.7%), as well as those in Gr 4 (71.4%) and Gr 6 (76.6%) believed that the gender of the teacher did not matter when it came to good mathematics teaching (item 6); this is a very positive finding. It was noted, however, that there was a trend for same gender support, that is, there was for a slightly higher percentage of girls (18.9%) than boys (10.4%) who believed that women were better mathematics teachers, while a slightly higher percentage of boys (14.1%) than girls (8.4%) believed that men were better mathematics teachers.

The percentage frequencies of responses that students provided for their choice of the man or the woman as the person who worked with mathematics in their job are shown in Table 4.

Table 4. *Percentage frequencies of responses to "Picture" item.*

Item		Responses	All N=281	Gr 4 N=134	Gr 6 N=147	Boys N=138	Girls N=143
7	One of the people in the picture uses mathematics at work. Who do you think it is?	No answer	5	7	4	4	7
		Woman	33	34	31	28	37
		Man	57	55	58	62	52
		Both or can't know[1]	5	4	7	6	4

[1] This option was not provided in the questionnaire. Because several students wrote comments reflecting this view, we have added it to the table.

As can be seen in Table 4, when it came to whether the students believed it was the man (Picture 1) or the woman (Picture 2) who used mathematics in their job (item 7), the majority of all students (57%), most students in grade 4 (55%) and in grade 6 (58%), as well as a majority of the boys (62%) and of the girls (52%) chose the man; about one third of all students selected the woman (33%). This pattern of responses suggests that for most of the students, men were considered more likely than women to have jobs involving mathematics, a finding consistent with views on the gender stereotyping of mathematics as a male domain. Interestingly, although there were only two clear answers to the item – Picture A, the man; or Picture B, the women – 5% of the students wrote that a man or a woman might work with mathematics, or that it is impossible to know which one of the two worked with mathematics.

The students were also asked to explain their responses. The written explanations provided by the 209 students who chose the man or the woman as the person who worked with mathematics were analysed.

Below we describe the six main categories of response that emerged from the data and provide examples:

1. Teachers. Students suggested that one or other of the pictures was of a mathematics teacher.
   She teaches mathematics. She looks like a teacher
   He looks like an excellent teacher
2. Personal aspects/characteristics such as cleverness, smartness, seriousness that the students associated with working with mathematics
   He looks smarter
   She looks a talented and interesting person
3. External aspects/characteristics such as appearance, clothes, face
   He is dressed more formal and looks more like a geek
   The person in Picture A (the man) seems to be of higher status than the person in picture B (the woman). In my opinion the woman deals with mathematics
4. Perceptions of belonging to other occupations
   He looks like a professor and she like a model
   The man in the picture is too respectable. He looks like a lawyer
5. Gender-stereotyped explanations
   Because boys are more likely to deal with mathematics
   Girls are better
6. Guess, hunch
   I don't know. I guessed
   Just a hunch

The distributions of the explanations for the choice of the man or the woman as the person who works with mathematics for the various groupings of students are shown in Table 5.

Table 5. Percentage distributions of explanations for choice of the man or the woman as the person who works with mathematics

	All students		All girls		All boys		Gr 6		Gr 4	
	W[1]	M	W	M	W	M	W	M	W	M
Explanation	**n=77**	**n=132**	**n=45**	**n=60**	**n=32**	**n=72**	**n=41**	**n=71**	**n=36**	**n=61**
A teacher	27	14	31	15	22	14	32	10	22	20
Smart, clever, serious	23	39	24	45	22	33	22	37	25	41
External appearance: clothes, face	21	28	20	23	22	33	20	29	22	28
Different occupation	11	11	7	10	15	12	7	15	14	5
Gender stereotyped explanation	14	5	13	5	5	3	17	6	11	3
Guess, hunch	4	3	5	2	4	4	2	3	6	3

[1] W = "Woman" refers to the selection of Picture 2 as the person who works with mathematics; M = "Man" refers to Picture 1.

Students' explanations implicitly emphasize gender issues. A higher percentage of students identified being a teacher as the explanation for choosing the woman as the person working with mathematics (27%) than for choosing the man (14%). On the other hand, cleverness and smartness was more likely to be the explanation for selecting the man (39%) than for selecting the woman (23%). In other words, the students were more likely to think that a woman who works with mathematics is doing so because she teaches mathematics, while a man works with mathematics because he is smart/clever. The same explanatory pattern can also be seen among boys, among girls, as well as among the grade 4 and grade 6 students. A partial explanation for the prevalence of the selection of women as teachers may be due to the students' experiences that elementary level teachers are more likely to be female. That being smart or clever was more likely to be associated with men than with women who work with mathematics echoes the widely held gender-stereotyped belief that mathematics is a male domain.

Interestingly, among all the groups of students, gender stereotyped explanations were found to be more prevalent among the explanations provided for selecting the woman as the one working with mathematics, while external appearance was a more likely explanation for selecting the man.

Most of the students who mentioned a different occupation did so in order to eliminate one of the pictures. For example, a grade 6 boy who selected the man as the person working with mathematics wrote: "The girl looks like a model". Similarly, a grade 6 girl who selected the woman wrote "The man…seems more like a politician".

Only a few students indicated that they had guessed whether the man or the woman was the one working with mathematics. We are left to ponder whether providing a third option, "can't tell", rather than forcing a choice of the man or the woman, would have been fruitful in identifying students who did not hold gendered beliefs.

Discussion

With respect to the gender stereotyping of mathematics, the findings from this study of Israeli grade 4 and grade 6 students exhibit some very positive aspects and a few concerning trends. The majority of children did not hold gender stereotyped views about girls or boys being better at mathematics, or finding mathematics difficult, or whether it was more important for girls or boys to study mathematics (Items 1-3). The majority of students also believed that teachers or parents considered girls and boys equally good at mathematics (Items 4-5), and that men and women were equally good mathematics teachers (Item 6). Concerns with the findings related to Items 1-6 lie with the minorities of students who hold gender-stereotyped views. Among them, the boys tended to exhibit stronger views consistent with the view that mathematics is a male domain.

On only one of the Items 1-6 was there a significant grade level difference. For Item 3, a higher percentage of students at grade 6 than grade 4 thought that girls and boys found mathematics equally difficult, similar percentages of students at both grade levels said girls found mathematics more difficult, but a lower percentage of students in grade 6 than in grade 4 indicated that boys found mathematics more difficult. However, the trends in the response patterns were similar for Items 1 and 2, although not statistically significant. The more egalitarian perspectives on girls' and boys' mathematical capabilities reflected in the response patterns for Items 1-3 are promising, but will these views persist into high school and into adulthood? As was noted in the literature review, early researchers had indicated that gender differences in views about mathematical capabilities did not emerge until high school, and, in their study of the views of the general public in nine countries, Forgasz, Leder, and Tan (2014) reported that in "each of the nine countries, more respondents indicated that "boys" were better at mathematics than responded that "girls" were" (p. 381), demonstrating a strong international trend that adults consider males to be more apt mathematically than females.

With respect to Items 5 and 6 (Table 2) for which students were asked to consider the views of significant others – teachers and parents – about girls' and boys' mathematics capabilities, the vast majority of students (around 80% or higher on both items) believed that teachers and parents would consider girls' and boys' capabilities equally. Forgasz, Leder, and Tan (2014) reported a similar pattern of responses to the same two items from members of the general public in Israel; however, the percentage of adults indicating equal mathematical capabilities for girls and boys was much lower (≈ 35%) than among the elementary students reported here. Interestingly too, the responses of the female students in the present study generally reflected this view more strongly than the male students and the gender differences were statistically significant. This finding is consistent with previous research indicating that females are generally more egalitarian than men, particularly in less egalitarian countries (e.g., McDaniel, 2008).

The findings from Item 7 were concerning. The "man" was more likely to be selected as the person working with mathematics by girls and boys, and by students at both grade levels. Also the explanations for the choice of the man or woman were indicative of gendered perceptions of men's and women's careers related to mathematics. Certainly their experiences of more women than men as primary teachers (who also teach them mathematics) might partially explain why a higher percentage of those whose explanation was that the person was a teacher chose the woman than chose the man as the person working with mathematics. But what influenced the higher proportion of students whose explanation was that the person was smart/clever, and associating this characteristic with the man over the woman, warrants further investigation. Somehow they have picked up the message that those working with mathematics are clever/smart and more likely to be men than women. It is notable that this finding is consistent with those of Forgasz,

Leder, and Tan (2014) who reported that in all nine participating countries (including Israel), more respondents indicated that men, compared to women, were more suited to being scientists and to working in the computer industry.

It is noteworthy that the elementary students appeared to be less gender-stereotyped about issues associated with mathematics capabilities when the questions were asked about themselves or about people they know (teachers/parents), but that they demonstrated more gendered views about people in society. Perhaps it is that their views reflect what they see around them in the society in which they live as well as in media representations, where men predominate in many spheres of life, including science-related careers. It should be noted, however, that for Item 7 the opportunity to demonstrate gender neutral views was not provided, that is, the response "it could be either the man or the woman" was not an option from which they could select. Alternatively, it could also be that when the response option of "same" (no difference) is there, students may be aware that it is expected (*politically correct*) to say that there is no difference between boys and girls.

Final Words

Little was known about the gendered views about mathematics of Israeli, Hebrew-speaking, elementary aged students. Yet the findings reported here echo those from earlier research with older students and adults around the world. Efforts to change the patterns of gendered beliefs evident among the elementary-school aged children that were identified in this study, and another that we have reported (Markovits & Forgasz, 2017), are clearly needed. Teachers alone cannot be expected to bring about the change. Some teachers (and other educational leaders) may hold similar views, as may other significant people in children's lives – their parents, extended families, and friends; as well as those in their social and cultural environments in which the students live. As well, the educational system and its organizational structures, as well as the school attended and classroom experiences of students may also be contributing factors.

Israel is a country with dual educational systems (Hebrew speaking, and Arabic speaking). As noted in the literature review, there are differences in the mathematics achievement of students from the two ethnic backgrounds, and Forgasz and Mittelberg (2008) have reported differences in the gendered patterns of beliefs about mathematics among grade 9 students from the two Israeli education sectors. Research on Arabic speaking elementary students in Israel is needed.

The findings from the study reported in this paper challenge claims that we have attained gender equity in mathematics. Around the world, women are under-represented in science, technology, engineering and mathematics (STEM) careers (OECD, 2017), yet the links between education, gender equality, and a country's sustainability and economic well-being are well established (e.g., OECD, 2018). With some elementary students already holding traditional gender-stereotyped views associated with the learning of mathematics, much needs to be done to counter this trend.

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