Sex Differences in Measurement

Adrianne Brockdorff

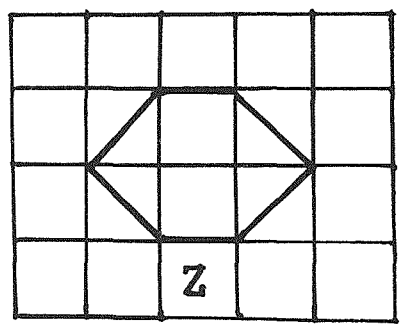
In a recent study, an attempt was made to assess secondary school children's understanding of the concepts of measurement, in one and two dimensions. Since the concepts studied involve spatial ability, an area in which males supposedly outperform females, the results were also analysed to study any differences in the understanding of the concepts between the sexes.

The study was carried out by means of a test paper on a particular section of the secondary school population — Junior Lyceum students during March-May, 1985. Therefore, although the results might shed light on possible differences in other sections of the secondary school population, no such generalizations are possible.

The test paper was adapted from the Chelsea Diagnostic Mathematics Test on Measurement[1] and consisted of 18 questions, with a total of 37 separate items. The first six questions dealt with length whilst the rest dealt with the topics of area and perimeter. Comparing the test paper with the secondary school syllabus one finds that most of the topics dealt with in the test would have been studied by Form 1, if not by Year 6. The only difficulty, therefore, with answering the test paper was that the questions were not presented in the usual orthodox fashion which school children are acquainted with. Rather, the questions were worded in such a way that they examine the actual concepts and not the students' training at answering questions mechanically.

Below is an example of an item from the test.

This 6-sided figure Z is drawn on *centimetre square* paper (that is the squares have sides of 1 cm).



Draw a line under the correct answer:

The distance all round the edge of Z is:

6 cm more than 6 cm less than 6 cm you cannot tell

The total sample of students studied involved 473 children, that is 12.7% of the whole Junior Lyceum population at the time. 232 girls were randomly chosen from the Blata l-Bajda Junior Lyceum school while 241 boys were chosen from the Tal-Handaq Junior Lyceum. Since the study also aimed to investigate differences along secondary school years, children were chosen so as to make up approximately 50 students from each form in each of the two schools.

Of the 37 items studied, it was found that when comparing all the females with all the males, there were nine items in which males scored significantly better and three wherein females scored significantly better (therefore there were 25 items resulting in no difference, a clear indication of the overlap that exists between the sexes). The items in which the girls scored better involved non-standard units of length, and those in which the boys performed better involved comparing lengths of straight lines and curves, comparing area and perimeters of shapes and finding the area of triangles. However it was interesting to note that the differences between the sexes is more pronounced in the earlier years of secondary school. In fact as the table below shows, in the sample studied, girls in Form 5 performed significantly better than boys.

Table 1 Means tested for statistical significance in results between sexes

Form 1	SSD (B)
Form 2	SSD (B)
Form 3	SSD (B)
Form 4	No SSD
Form 5	SSD (G)

SSD (B) — boys' results are statistically significantly better than those of girls

SSD (G) — girls' results are statistically significantly better than those of boys.

Interestingly enough, of the nine items whose facility level was less than 50%, there was only one item which resulted in significant difference between the sexes. That is, in most of the more difficult items in the test, no statistically significant difference was found to be present between the sexes over all the ages in the sample.

Another interesting difference which emerged between the sexes was obtained when comparing their rate of learning in the topic concerned. The differences in means obtained by boys and girls at different levels were tested for statistical significance. The results are shown in the tables below.

Table 2 Boys' means tested for statistically significant difference along the years.

Differences in results which were statistically significant	Differences in results which were not statistically significant
Form 1 — Form 2	Form 2 — Form 3
Form 1 — Form 3	Form 3 — Form 4
Form 1 — Form 4	Form 4 — Form 5
Form 1 — Form 5	Form 2 — Form 4
Form 2 — Form 5	Form 3 — Form 5

Table 3 Girls' means tested for statistically significant difference along the years

Differences in results which were statistically significant	Differences in results which were not statistically significant
Form 1 — Form 2	Form 2 — Form 3
Form 3 — Form 4	
Form 4 — Form 5	
Form 1 — Form 3	
Form 1 — Form 4	
Form 1 — Form 5	
Form 2 — Form 4	
Form 2 — Form 5	
Form 3 — Form 5	

As shown, in the results for boys, it was found that half the differences in results were statistically significant and half the differences were not. In fact, where results of two successive years were compared, except for the differences in results between Form 1 and Form 2, the difference was not significant. There were two ways of explaining this — it could either imply that boys' maturity in this topic of measurement progresses at a slow pace such that from one year to another no significant difference is recorded; or else that the maximum level of understanding of the topic for the age group studied was reached by Form 2 and therefore very little improvement was likely to occur in subsequent years.

With regards to the results achieved by girls we find a very different situation. In this case, it is only the difference in results between Form 2 and Form 3 which are not statistically significant. Comparing the results of all other classes we find that the differences in results are statistically significant. Once again this can be explained in two ways. Either the rate of learning of girls in this particular topic is greater than that of boys such that the difference between one form and the next is statistically significant, or that girls do not achieve full understanding of the concepts early in their secondary school years but as they grow older their understanding of the topics of measurement increases. It could also be that these two processes are acting together.

How do the results of the test paper tie up with research carried out in Malta? A somewhat strange phenomenon seems to be occurring in our country. Through various research work it has been found that girls perform better than boys in mathematics at both primary and secondary level.[3]

Local researchers suggest that a reason for such a result, female superiority in maths, could be due to the effect of private schools. Both in the

preparatory classes and at secondary level the percentage of boys attending private schools is greater than that of girls. This could therefore explain the results obtained since private schools usually enrole the brighter pupils and therefore in government schools the brighter boys' population is reduced.

Another possible reason suggested, is that females are predominatly better than males at languages, and since maths tests are carried out in English, girls would be at an advantage. It could also be that females, possibly due to their upbringing, are more meticulous and conscientious in their work. This would therefore give them an advantage over males in their academic work.

How then can the results of this test paper be explained? Results, which show male superiority in the test from Forms 1 to 3 and female superiority in Form 5, in the topic of measurement, a topic in which males are thought to score better. Earlier on in this article, it was suggested that the reason could be due to a difference between the sexes in the rate of learning of the concepts involved. It has therefore been assumed up to now in this report that the difference in results was due to sex differences. Another possible explanation could be a changing sample, due to the changing role of the Junior Lyceum schools in our country. When these schools were first set up, in 1981/82 private schools were still preferred to these schools. However, over the past four-five years, due to parents' preoccupation about the future of private schools as well as due to the good results obtained by Junior Lyceum students, these schools have risen in popularity, therefore more students are enrolling in such schools.

This could therefore explain why among students in Form 5, which involve students who entered Junior Lyceum when these were just starting out, the females are superior to males in their performance in the topic of measurement. The students who have enrolled in the past four-five years, both males and females, probably are nor more representative of the brighter range of students in the entire population of secondary school children. Naturally, this other view of explaining the results, in terms of a changing sample, can only be examined in later studies when hopefully the students enrolled will then be more balanced in terms of female/male intellectual potential.

It might then be found, as is being found abroad[4], that when all extraneous factors are carefully controlled, fewer significant differences in mathematics achievement between females and males exist.

1. A. Brockdorff: Children's Understanding of Measurement Form 1 — Form 5; dissertation presented in 1986.
2. K.M. Hart (ed.) *Children's understanding of Mathematics 11-16* (London, John Murray, 1981).
3. M.G. Borg, *An analysis of a Mathematics Test* 1981
   J.M. Falzon, A. Sammut, *Secondary Schools Annual Examination 1975* (A report) Malta Education Department 1976.
   R. Zammit, J. Galea, *An Analysis of Two Mathematics Test Papers* 1979.
4. E. Fennema 'Success in Mathematics' in *Sex Differentiation and Schooling* M. Marland ed. (London, Heinemann Educational, 1983).