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Sex Differences for 10 to 17 Year Olds on the Standard Progressive Matrices in Cyprus

George Spanoudis*
Demetrios Natsopoulos
University of Cyprus, Nicosia, Cyprus

Richard Lynn
University of Ulster, Coleraine, Northern Ireland

*Corresponding author: Department of Psychology and Centre for Applied Neuroscience, University of Cyprus, Kallipoleos 75, P.O. Box 20537, 1678 Nicosia, Cyprus.
Tel: +357-22-892069; Fax: +357-22-895075; email: spanoud@ucy.ac.cy

Sex differences on the Standard Progressive Matrices are reported for 10 to 17 year olds in Cyprus. There were no significant differences among 10 to 16 year olds but among 17 year olds males obtained a mean IQ 4.4 points higher than females.
Key words: Cyprus, Standard Progressive Matrices, sex differences, intelligence

There has been considerable debate over sex differences in cognitive abilities for a long time. This debate was based on three types of evidence: overall scores derived from batteries measuring general intelligence such as the Wechsler scales; data extracted from factorial studies in which scores are derived from a variety of cognitive ability batteries; and the results derived mainly from nonverbal measures like the Raven's Matrices tests (Hunt, 2011). The present paper sought to contribute to the last type of evidence.

Throughout the last century it has been almost invariably asserted that there is no sex difference in general intelligence defined as *g* and as the IQ obtained from tests like the Raven's Progressive Matrices, the Stanford-Binet, the Wechsler scales, the Cattell Culture Fair and numerous others (Miller & Halpern, 2014). In the early twentieth century this conclusion was advanced by Burt and

Moore (1912) and Terman (1916), in the second half of the twentieth century it was reaffirmed by Cattell (1971, p.131), Jensen (1980, p. 360), Hutt (1972, p. 88), Maccoby and Jacklin (1974, p. 65), Eysenck (1981, p. 40), Brody (1992, p. 323), and Herrnstein and Murray (1994, p. 275).

This consensus that there is no sex difference in intelligence was challenged by Lynn (1994), who advanced a developmental theory of sex differences in intelligence that stated that boys and girls mature at different rates both physically and mentally during childhood and adolescence. According to this theory, boys and girls mature at about the same rate up to the age of around 7 years; from the age of 8, girls begin a growth spurt in which there is an acceleration of their physical growth including height, weight, and brain size; the growth rate of girls slows at the age of 14 and 15, while the growth of boys continues. Lynn's (1994) developmental theory proposed that cognitive development parallels physical development. In regard to abstract (nonverbal) reasoning ability, Lynn's original formulation of the theory stated that there is no sex difference up to the age of around 8 years; between the ages of around 9 through 12 years, girls have an advantage of approximately 1 IQ point; there is no sex difference between the ages of around 13 to 15 years, and at the age of 16 years, boys have a small advantage that increases with age reaching an advantage among adults of 4 IQ points. Lynn's thesis was derived from the findings by Ankney (1992) and Rushton (1992) that men have a larger average brain size than women, even when this is controlled for body size. Brain size is positively associated with intelligence at a correlation of .40, as shown in the meta-analysis by Vernon et al. (2000, p 248). A later meta-analysis found a correlation of .24 (Pietschnig, 2015). Consequently, it was argued that it follows that men should have greater average intelligence than women.

Lynn's thesis was criticized by Mackintosh (1996, p. 567), who argued that Raven's Progressive Matrices is among the best measures of intelligence and that on this test "there is no sex difference in general intelligence worth speaking of …large scale studies of Raven's tests have yielded all possible outcomes, male superiority, female superiority and no difference… there appears to be no difference in general intelligence." He reiterated this conclusion in a subsequent paper contending that there is at most only a very small difference consisting of no more than 1–2 IQ points among adults either way (Mackintosh, 1998). Flynn and Rossi-Casé (2011) confirmed Mackintosh's findings and contributed additional evidence suggesting that females matched males on Raven's tests at maturity as well as in childhood. Analyzing large samples from five developed countries they concluded that the observation of a female deficit is biased by the fact that more males than females drop out of school.

In response to this criticism, Lynn presented further data on sex differences on the Progressive Matrices that confirmed his thesis of a male advantage from the age of 16 years into adulthood (Colom & Lynn, 2004; Lynn, 1998; Lynn, Allik & Must, 2000; Lynn, Allik & Irwing, 2004; Lynn et al., 2004). He also published a meta-analysis of sex differences on the Progressive Matrices among general population samples that confirmed his thesis of a male advantage from the age of 16 years reaching 5 IQ points among adults (Lynn & Irwing, 2004), and a further meta-analysis of sex differences on the Progressive Matrices among college student samples that concluded that males have an advantage of 4.6 IQ points (Irwing & Lynn, 2005).

Following these meta-analyses, the thesis that males have a higher Progressive Matrices IQ from the age of 16 years has been supported by several further studies. A male advantage of 4 IQ points has been reported for 77 year olds in Scotland (Deary et al., 2004), of 5.7 IQ points among 26 year olds in Spain (Diaz et al., 2010), of 6.4 IQ points among 17 year olds in England (Mackintosh & Bennett, 2005), of 5.5 IQ points in a sample of 23-37 year olds in Libya (Al-Shahomee, 2012), and of 3.6 IQ points among 23 year olds in the United States (Stephenson & Halpern, 2013). There have been two studies that have not supported the thesis of a higher Progressive Matrices IQ among men. The first is a study by Savage McGlynn (2012) of 16-year-olds in Britain in which females obtained a higher mean of 2.1 IQ points on the Standard Progressive Matrices Plus. This result on a fairly small sample of 263 is not strongly damaging to Lynn's thesis that the male advantage only begins to appear at age 16. The second is a study by Flynn and Rossi-Casé (2011) of 17 to 30 year olds. This is the only substantial exception to Lynn's thesis.

Despite the extensive documentation that men have a higher average intelligence than women as assessed by the Progressive Matrices, several scholars have continued to assert that there is no sex difference on the Progressive Matrices (Jensen, 1998). For instance, Anderson (2004, p. 829): "it is an important finding of intelligence testing that there is no difference between the sexes in average intellectual ability; this is true whether general ability is defined as an IQ score calculated from an omnibus test of intellectual abilities such as the various Wechsler tests, or whether it is defined as a score on a single test of general intelligence, such as Raven's Matrices"; and Dolan et al. (2006, p. 194) write that "sex differences are absent on Raven Progressive Matrices."

Method

The Standard Progressive Matrices was administered in the academic year 2006 to a sample of 3803 (males 1987; females 1816) school students aged 10

years 2 months to 18 years. The participants were recruited from a pool of about 8623 primary and high school students from 24 schools, 14 primary and 10 high schools. Twenty of these schools are situated in the capital city of Nicosia and four in the city of Limassol, Cyprus. The male and female participants attended the same schools. All students were Greek-Cypriots and they were broadly representative of the general population.

Results

Table 1 shows the numbers of males and females for each age group from 10 to 17.5 years, their mean scores and standard deviations, the differences between males and females expressed as *d*s (standard deviation units), and the values of t as tests of the statistical significance of the differences between the scores of the males and females. We tested a one-tailed directional hypothesis, predicting that males outperform females. The p value for the 17.5 years age group remains significant at p<.05 after a Bonferroni correction.

Table 1. *Standard Progressive Matrices data for males and females in Cyprus. Negative signs denote higher scores by females.*

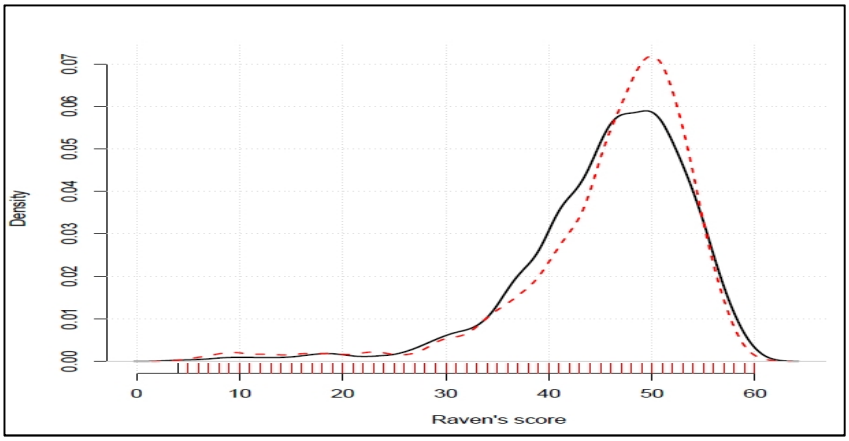
Age	N	Males Mean±SD	N	Females Mean±SD	*d*	t
10.5	75	39.48 ± 9.06	73	40.25 ± 9.56	-0.083	-0.50
11.5	117	42.86 ± 8.35	90	43.88 ± 9.59	-0.115	-0.81
12.5	365	43.39 ± 8.11	291	43.59 ± 8.89	-0.024	-0.29
13.5	430	44.76 ± 7.19	350	45.23 ± 7.66	-0.064	-0.88
14.5	306	46.56 ± 7.70	337	47.31 ± 7.56	-0.098	-1.24
15.5	362	47.19 ±6 .93	426	47.10 ± 8.36	0.012	0.16
16.5	148	47.93 ± 8.22	132	47.94 ± 8.58	-0.001	-0.01
17.5	184	50.95 ± 6.21	117	48.71 ± 7.66	0.330	2.78**

***p*<.005 (one-tailed).

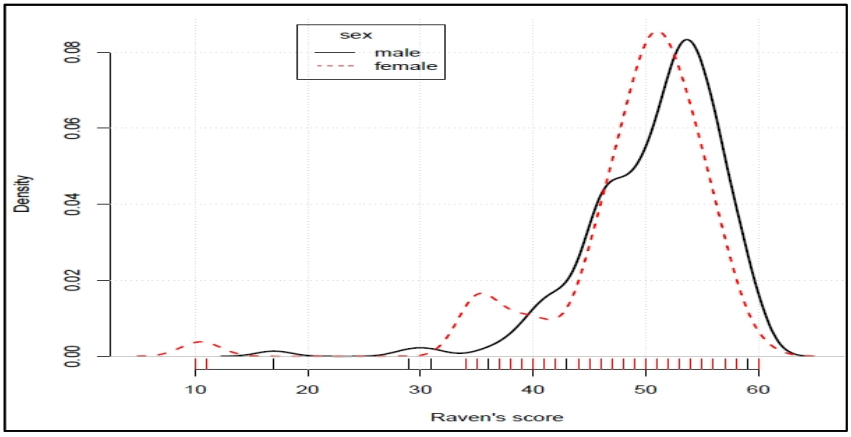
Discussion

The results are broadly consistent with Lynn's (1994) thesis that between the ages of around 9 through 12 years, girls have a slight intelligence advantage of approximately 1 IQ point attributable to their growth spurt, replaced by no sex difference between the ages of 13 to 15 years, and then by a male advantage that begins to appear at the age of 16 years and increases to reach approximately 5 IQ points among adults. Thus, in the present data the 10 to 13 year old girls obtained an average advantage of .07*d*, equivalent to 1.1 IQ points. From age 14 to 16 years girls obtained an average advantage of .03*d*, equivalent to 0.4 IQ

points. However, among the 17.5 year olds there was a statistically significant male advantage of 0.33*d*, equivalent to 4.95 IQ points (t = 2.78, p<.005, one-tailed) and approaching the 5 IQ point advantage among adults on the Progressive Matrices and on abstract reasoning estimated by Lynn (1999) and reported in the meta-analysis of sex differences on the Progressive Matrices by Lynn and Irwing (2004).



A. Whole sample across sex



B. The age group of 17.5 year-olds across sex

Figure 1. *Distribution of the scores for the Raven's SPM test in all age groups (A) and in the age group of 17.5 year-olds (B).*

One possible source of bias in the revealed sex difference would be sex-specific attrition for the oldest children in our study. Given that the Cyprus Statistical Service did not collect attrition rate data across the sexes, we employed a two-sample Kolmogorov-Smirnov test to evaluate this alternative hypothesis for the higher male scores at age 17.5 years. The analysis showed that the two sexes did not differ significantly from one another in terms of size-frequency distributions, D=0.173, p>.01. Figure 1 shows graphically the distributions of the two sexes for the complete sample and for the subsample of 17.5 year olds. It is evident that the male advantage in the 17.5 years group cannot be attributed to the absence of lower-scoring males, but to higher male scores in the average and above average range.

These results provide a further disconfirmation of the contentions that "most standardized measures of general intelligence show negligible sex differences" (Hines, 2004, p. 11), "males are not superior to females in reasoning ability" (Mackintosh, 2011, p. 366), and "females and males score identically on IQ tests" (Halpern, 2012, p. 233). The findings of this research complement those of earlier studies conducted in developed countries. However, the small to medium effect size does not allow a strong conclusion about sex differences. It rather adds to an increasing body of evidence showing that subtle sex differences in intelligence do exist.

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