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INTELLIGENCE IN TAIWAN: PROGRESSIVE MATRICES MEANS AND SEX DIFFERENCES IN MEANS AND VARIANCES FOR 6- TO 17-YEAR-OLDS

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Summary. Data for Raven's Progressive Matrices are reported for a sample of 6290 6- to 17-year-olds in Taiwan. The Taiwanese obtained a mean IQ of 109.5, in relation to a British mean of 100. There was no difference in mean scores of boys and girls at age 7 years. At age 10 years girls obtained significantly higher scores than boys, and at ages 13 and 16 years boys obtained significantly higher scores than girls. There was no sex difference in variance at age 7 years. At ages 10, 13 and 16 years variance was significantly greater in boys.

Introduction

This paper reports recent data for Raven's Progressive Matrices for Taiwan giving population means and sex differences in means and variance. Mean IQs on the Progressive Matrices have been published previously and are summarized for six samples in Taiwan in Lynn (2006). The IQs obtained by these samples, in relation to a British IQ of 100 and Flynn Effect corrected to equate for the years in which the data were collected, range between 102 and 110, with a median of 105. This summary also gives mean Taiwanese IQs for five studies obtained from other tests. These IQs range between 100 and 110, with a median of 107.

From the early years of the twentieth century it has been consistently asserted that there is no sex difference in average general intelligence but that males have greater variance than females. In the first half of the twentieth century the absence of a sex difference in average intelligence was asserted by Burt & Moore (1912), Terman (1916) and Spearman (1923). In the second half of the century this conclusion was reaffirmed by Cattell (1971, p. 131), Brody (1992, p. 323), Mackintosh (1996, p. 567), Jensen (1998, p. 531), Halpern (2000, p. 218), Bartholomew (2004, p. 91), Anderson (2004, p. 829), Hines (2007, p. 103), Haier (2007), Halpern (2007, p. 123) and Speke (2007, p. 65): 'Men and women have equal cognitive capacity.'

It has also been consistently asserted for approximately a century that while males and females have the same average intelligence, males have greater variance of intelligence than females. An early statement of this proposition was made by Havelock Ellis (1904, p. 425): 'It is undoubtedly true that the greater variational tendency in the male is a psychic as well as a physical fact.' This sex difference in variance has been repeatedly reaffirmed by numerous authorities including Thorndike (1910), Penrose (1963, p. 186), Herrnstein & Murray (1994, p. 275), Lehrke (1997, p. 140), Jensen (1998, p. 537), Ceci & Williams (2007, p. 223) and Deary *et al*. (2010): 'Males have a slight but consistently wider distribution than females at both ends of the range.'

Thus the consensus on sex differences in intelligence for the last century was summed up by Eysenck (1981, p. 42) as follows: 'While men and women average pretty much the same IQ score, men have always shown more variance in intelligence. In other words, there are more males than females with very high IQs and very low IQs.'

Both these assertions have been challenged by Lynn (1994, 1999), who has contended that while there is no sex difference in mean IQ up to the age of 15 years, from the age of 16 years males begin to show greater intelligence than females, reaching an advantage of 3 to 5 IQ points in adults. In subsequent studies Lynn & Irwing (2004) carried out a meta-analysis of sex differences on the Progressive Matrices and confirmed that there was no sex difference up to the age of 15 years, but from the age of 16 years males obtained higher means and in adults men obtain a 5 IQ point higher mean IQ than women. This conclusion was confirmed in a further meta-analysis of sex differences on the Progressive Matrices among college students that found a male advantage of 4.6 IQ points (Irwing & Lynn, 2005).

Lynn's contention that from the age of 16 years males begin to show greater intelligence than females reaching an advantage of 3 to 5 IQ points in adults has been confirmed for a Spanish sample by Colom & Lynn (2004), who report a male advantage at age 18 of 4.3 IQ points on the Differential Aptitude Test. This conclusion has been further confirmed by Meisenberg (2009), who reports a male advantage of 2.8 IQ points among 22- to 23-year-old whites in the United States on the ASVAB (Armed Services Vocational Aptitude Battery). This difference, however, was not present among blacks. In this study intelligence was also measured as *g*, and for this there was no significant sex difference among 15-year-olds among either blacks or whites. Among whites a significant male advantage of 4 IQ points was present among 16-year-olds, and this increased to an advantage of 6.5 points among 22- to 23-year-olds. For blacks a male advantage of 1 IQ point at age 16 increased to an advantage of 2.15 points at age 22–23.

The assertion that males have greater variance of intelligence than females has also been disputed by Lynn and his colleagues. Irwing & Lynn (2005) reported that there was no sex difference in variance in their meta-analysis of 22 studies of sex differences on the Progressive Matrices among university students. Abdel-Khalek & Lynn (2009, p. 112) concluded in their study of thirteen samples in Saudi Arabia: 'the greater variance of males is not a universal phenomenon.' Reservations about the greater variance of males have also been expressed by Harnqvist (1997) and by Reynolds *et al*. (2008), who failed to find greater variance in males.

Table 1. Descriptive statistics for the Progressive Matrices in Taiwan

	M	F	M	F	M	F	M	F
Test	CPM-P	CPM-P	SPM-P	SPM-P	SPM+	SPM+	SPM+	SPM+
n	794	712	991	915	948	845	604	481
Age: range	6–8	6–8	9–11	9–11	12–14	12–14	15–17	15–17
Age: mean	7.75	7.73	10.49	10.48	13.73	13.73	16.19	16.07
Mean score	28.61	28.48	43.11	43.84	39.41	38.81	42.64	41.74
SD	5.13	5.37	7.58	6.79	5.89	5.38	5.95	5.37
Brit PC	50	50	73	78	84	80	84	80
Brit IQ	100	100	109	111	115	113	115	113
Cohen's *d*	0.03	—	−0.10	—	0.10	—	0.16	—
Student's *t*	0.58		−2.18*		2.11*		2.61*	
VR	0.91	—	1.25	—	1.20	—	1.23	—

*Statistically significant at $p<0.05$.

Methods

The Raven Progressive Matrices tests (Raven, 1981) were administered during the years 2005–2006 to a sample of 3337 males and 2953 females aged 6 to 17 years drawn from socially representative schools throughout the country. The sample was drawn by cluster sampling involving two steps. First, counties were selected that were representative of the country in respect of region, *per capita* income measured by average annual income and number of computers per household, educational level, measured as percentages of residences with higher education, and population density as a measure of urban and rural locations. In the second step, schools within counties were randomly selected.

The sample was divided into four age groups. The 6- to 8-year-olds were given the Coloured Progressive Matrices Parallel (CPM-P) (an alternative to the Coloured Progressive Matrices-Classic). The 9- to 11-year-olds were given the Standard Progressive Matrices Parallel (SPM-P) (an alternative to the Standard Progressive Matrices-Classic). The 12- to 14-year-olds and the 15- to 17-year-olds were given the Standard Progressive Matrices Plus (SPM+). These tests are described by Raven (2008a, 2008b). The tests were administered without time limits.

Results

The results are given in Table 1. This gives for each of the four age groups the version of the Progressive Matrices that was administered, the numbers, the age ranges, the mean ages, the mean scores, the standard deviations, the British percentile equivalents of the Taiwanese means, the British IQ equivalents of the Taiwanese percentiles, Cohen's *d* as a measure of the sex differences (to express these as IQ differences, they need to be multiplied by 15), the values of Student's *t*-test for the statistical significance of the sex differences, and the variance ratios (VR). The variance ratios (VR) are calculated as the male variance squared divided by the female variance

squared; thus VRs greater than 1.0 show greater male variance, while VRs less than 1.0 show greater female variance. The statistical significance of the variance ratios was tested by analysis of variance. The VR for the 6- to 8-year-old age group is not statistically significant but VRs for the other three age groups are statistically significant at the 0.05 level.

The British percentiles and IQ equivalents of the Taiwanese samples were calculated as follows. For the 6-to 8-year-olds tested with the Coloured Progressive Matrices, the Taiwanese means are calculated for the 2007 British Standardization (Raven, 2008a). For the 9- to 11-year-olds tested with the Standard Progressive Matrices, the Taiwanese means are calculated for the 1979 British Standardization (Raven, 1981). No Flynn Effect correction is needed because the IQ of British 10-year-olds did not change over the years 1979–2008 (Lynn, 2009). For the 12- to 14-year-olds and the 15- to 17-year-olds tested with the Standard Progressive Matrices Plus, the Taiwanese means are calculated for the 2008 British Standardization (Raven, 2008b).

Discussion

The results raise three points of interest. First, the Taiwanese IQ in relation to a British mean of 100 and calculated as the average of the eight samples is 109.5. This is at the upper end of the range between 102 and 110 summarized for six previous Taiwan studies of the Progressive Matrices noted in the Introduction and can be taken as confirming previous studies showing that the mean IQ in Taiwan is significantly higher than that in Britain. However, the Taiwanese 6- to 8-year-olds obtain the same IQ as the British. This result is consistent with the study reported 40 years ago by Hsu (1971), whose sample also aged 6–8 years (n=1865) obtained a British IQ of 102. It appears that the Taiwanese IQ advantage increases as children grow older. This is confirmed by the present results in which the Taiwanese 9- to 11-year-olds obtained a British IQ of 110, and the Taiwanese 12- to 14- and 15- to 17-year-olds obtained a British IQ of 113.

Second, the sex differences in the mean IQs go from a non-statistically significant and negligible 0.45 IQ point advantage for boys at age 7, to a statistically significant 1.50 IQ point advantage for girls at age 10 years, followed by a significant 1.5 IQ point advantage for boys at age 13 years, and a statistically significant 2.40 IQ point advantage for boys at age 16 years. These results are broadly consistent with those of the meta-analysis of sex differences on the Progressive Matrices by Lynn & Irwing (2004), which showed no difference in pre-pubertal children, followed by a small advantage of 1.30 IQ point for girls at ages 10 through 12 years, attributed to the earlier growth spurt in girls, succeeded by a small but increasing advantage for boys from the age of 14 reaching a 2.70 IQ points advantage for boys among 16- to 17-year- olds, closely similar to the 2.40 IQ point advantage for boys at age 16 years in the present data. It should be noted that in the years of the study there were slightly fewer 16- to 17-year-old boys than girls in school (88.7% compared with 91.2%) and this may have slightly increased the boys' advantage. None of the 57 data sets reviewed in the Lynn & Irwing (2004) meta-analysis of sex differences on the

Progressive Matrices was from Taiwan, so the present results confirm those of the meta-analysis for a new country.

Third, the contention that has so frequently been made during the last century that males have greater variance of intelligence than females is not consistently supported in the present results. Boys do have greater variance than girls in the three older age groups but there was no difference in variance among the 6- to 8-year-olds. This confirms the point made in the Introduction that the supposed greater male variance of intelligence is not a universal phenomenon.

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