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Chinese sex differences in intelligence: Some new evidence

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ABSTRACT

Sex differences on the WISC-R in Chinese children were examined in a sample of 788 aged 12 years. Boys obtained a higher mean full scale IQ than girls of 3.75 IQ points, a higher performance IQ of 4.20 IQ points, and a higher verbal IQ of 2.40 IQ points. Boys obtained significantly higher means on the information, picture arrangement, picture completion, block design, and object assembly subtests, while girls obtained a significantly higher mean on coding. The results were in general similar to the sex differences in the United States standardisation sample of the WISC-R. Boys showed greater variability than girls.

1. Introduction

The question of sex differences in intelligence has been debated from the early years of the twentieth century. The almost unanimous consensus has been that there is no sex difference in "general intelligence" defined as the average of the major cognitive abilities and measured by tests like the Wechslers and the Binets. There are, however, sex differences in a number of specific abilities. The conclusion that there is no sex difference in "general intelligence" was reached in the second decade of the twentieth century by Terman (1916, pp. 69–70) on the basis of his American standardisation sample of the Stanford–Binet test. In recent decades this conclusion was endorsed by many leading authorities. Thus "it is now demonstrated by countless and large samples that on the two main general cognitive abilities – fluid and crystallized intelligence – men and women, boys and girls, show no significant differences" (Cattell, 1971, p. 131); "gender differences in general intelligence are small and virtually non-existent" (Brody, 1992, p. 323); "there is no sex difference in general intelligence worth speaking of" (Mackintosh, 1996, p. 567); and "sex differences have not been found in general intelligence" (Halpern, 2000, p. 218).

The only challenge to this consensus has come from Lynn (1994, 1998, 1999), who has argued that males have larger average brain size than females, that brain size is positively correlated with intelligence at a magnitude of approximately .40 (Vernon, Wickett, Bazana, & Stelmack, 2000), and hence that there is a theoretical expectation that males should have higher average intelligence than females. To examine this theoretical expectation, Lynn (1994) proposed that the Wechsler intelligence tests could be taken as among the best measures of general intelligence on the grounds that they provide measures of the major cognitive abilities of verbal, numerical, perceptual, reasoning, spatial, immediate memory, perceptual speed and general knowledge. He then examined the sex difference in eight standardization samples of the Wechsler intelligence tests for children aged 6–16 and showed that boys obtained a higher mean Full Scale IQ by an advantage of 2.25 IQ points. He also showed that in six standardization samples of adults, men obtained a higher mean Full Scale IQ by an average of 3.08 IQ points. Despite these results, it has continued to be asserted that "females and males score identically on IQ tests" (Halpern, 2012, p. 233) and that "there is no evidence, overall, of sex differences in levels of intelligence" (Sternberg, 2014, p.178). However, Ellis et al. (2008) recently argued in their book that studies have shown that, although small, there are significant sex differences in intelligence over the years throughout the world.

It has also been consistently asserted for approximately a century that while males and females have the same average intelli-

Abbreviations: WISC-R, Wechsler Intelligence Scale for Children-Revised; IQ, intelligence quotient; VR, variance ratios.

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gence, males have greater variability of intelligence than females. An early first statement of this proposition was made by 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 variability was reaffirmed by Thorndike (1910) and by many subsequent authorities including Penrose (1963, p. 186) "the consistent story has been that men and women have nearly identical IQs but that men have a broader distribution. . .the larger variation among men means that there are more men than women at either extreme of the IQ distribution". Others who have asserted this conclusion include Herrnstein and Murray (1994, p. 275), Lehrke (1997, p. 140), Jensen (1998, p. 537), and Ceci and Williams (2007, p. 223): "all sides in the gender wars agree that there is greater variability in male distributions of many abilities." This conclusion has recently been affirmed once again by Deary, Penke, and Johnson (2010): "Males have a slight but consistently wider distribution than females at both ends of the range."

There is a large research literature on sex differences in various cognitive abilities. Kimura (1999, 2002) lists five abilities on which males obtain higher average means than females: spatial orientation, visualization, line orientation, mathematical reasoning, and throwing accuracy; and five abilities on which females obtain higher average means than males: object location memory, perceptual speed, verbal memory, numerical calculation, and manual dexterity.

In this paper we examine sex differences in intelligence in China with a view to determining how far these are consistent with those found in studies in the United States and other western countries on which most of the conclusions have been based.

2. Method

A Chinese sample of 788 children in the sixth grade aged 11–13years with a mean age of 12.5 was tested with the Chinese version of the Wechsler Intelligence Scale for Children-Revised (WISC-R) in 2011–13. The sample was obtained from the Jintan Child Cohort Study. The Wechsler (1974) original sample in this study comprised 1656 Chinese children (55.5% boys, 44.5% girls) consisting of 24.3% of all children in this age range in the Jintan region, which is located in Jiangsu, China. This sample includes children from city, town, and village populations; in addition, the demographics of Jiangsu are similar to those found on the national level, making this sample likely to be fairly representative in terms of sex ratio, urban versus rural population ratio, ethnic majority, and others. The Jintan Child Cohort Study is an on-going prospective longitudinal study with the aim of exploring early health risk factors in the development of child cognition and behavior. Details of this study have been described in a previous publication (Liu, McCauley, Zhao, Zhang, & Pinto-Martin, 2010). The cohort took their first IQ test (the WPPSI) at age 6 years and the sex differences have been given by Liu and Lynn (2011, 2013) and Liu, Yang, Li, Chen, and Lynn (2012).

The Chinese version of the Wechsler Intelligence Scale for Children-Revised (WISC-R) with which the children were tested was standardized in China in 1985 and has shown good reliability in Chinese children (Yue & Gao, 1987). The WISC-R consists of six verbal subtests, namely Information, Comprehension, Arithmetic, Vocabulary Similarities and Digit Span, that are summed to give the Verbal IQ, and of six non-verbal subtests, namely Picture Arrangement, Picture Completion, Object Assembly, Block Design, Coding and Mazes tests, that are summed to give the Performance IQ. The Verbal IQ and Performance IQs are combined to give a Full-Scale IQ.

The WISC-R IQs of the 2011–13 Chinese sample were collected between spring 2011 and summer 2013 when the participants were in sixth grade or had just graduated from sixth grade. Participants were invited to the laboratory, where research assistants, who participated in an intensive training course, administered the Chinese WISC-R. Ten of the subtests were used, Digit Span and Mazes being omitted. The research assistants were supervised by a Ph.D. trained clinical psychologist who specializes on cognitive brain assessment at Nanjing Brain Hospital. The same training procedure as described in detail in Liu and Lynn (2013) was followed. The IQ test was administered over the course of one hour in a quiet room in Jintan Hospital. Each test was scored by two individuals to minimize scorer bias. This procedure for data collection was approved by the research ethics committee of Jintan Hospital and the University of Pennsylvania. Written consent was obtained from parents and written assent from children was collected prior to initiation of the study.

3. Results

Table 1 gives the mean scaled scores and standard deviations for boys and girls on the subtests, and the verbal, performance and full scale IQs on the Chinese WISC-R of the 2011–2013 Jintan sample. Also given are the differences between the means of the boys and girls expressed as *ds* (the difference between the means divided by the pooled standard deviation, with minus signs showing that girls obtained higher means than boys), the *t* values using independent sample *t*-tests for the statistical significance of the differences between the means of the boys and girls, and the variance ratios (VR) as a measure of the sex differences in variability calculated as the standard deviation of the males divided by the standard deviation of the females. Thus, a VR greater than 1.0 indicates that males had greater variance than females. Table 2 gives sex differences on the WISC-R in China and in the standardization sample ($N = 2200$) in the USA given by Jensen and Reynolds (1983).

4. Discussion

The results provide six points of interest. First, it is shown in Table 1 that in the present Chinese sample boys obtained a significantly higher Full Scale IQ than girls by 0.25*d*, the equivalent of 3.75 IQ points. This figure is higher than the average boys' advantage of 2.25 IQ points on the Wechsler Full Scale IQ in eight standardization samples of the Wechsler tests for children noted in the introduction. In the present Chinese sample boys obtained a significantly higher Performance IQ than girls by 0.28*d*, the equivalent of 4.2 IQ points, and a significantly higher Verbal IQ than girls by 0.16*d*, the equivalent of 2.40 IQ points. These results provide additional evidence that modest but significant sex differences exist in intelligence, thus refuting continued assertions that no differences exist (e.g., Halpern, 2012, p. 233; Sternberg, 2014, p. 178)

Second, there are six statistically significant sex differences on the subtests of the WISC-R in the present Chinese sample shown in Table 1. Boys obtained significantly higher means than girls on Information, Picture Arrangement, Picture Completion, Block Design and Object Assembly, and girls obtained a significantly higher mean than boys on Coding.

Third, on several of the subtests, the sex differences in the present Chinese sample were consistent with those in the American standardization sample shown in Table 2. The advantage of boys in the present Chinese sample on Information is virtually identical to that in the United States with statistically significant *d*s of .44 and .37, respectively. These results confirm those of several studies of the Wechsler information tests among adults and of other studies finding that among adults men have significantly higher means than women on information and general knowledge (Lynn & Irwing, 2002; Lynn, Irwing, & Cammock, 2002).

Table 1
Mean scaled scores, standard deviations, and variance ratios for boys and girls on the Chinese WISC-R.

Subscales	Boys		Girls				
	N = 426		*N* = 362				
	Mean	SD	Mean	SD	d	t	VR
Information	9.98	2.99	8.73	2.47	0.44	6.43***	1.22
Comprehension	9.05	2.34	9.06	2.36	0	-0.06	0.99
Similarities	10.01	2.22	10	2.23	0.01	0.09	1
Arithmetic	13.42	3.15	13.11	3.12	0.1	1.41	1.01
Vocabulary	9.25	1.93	9.31	1.94	−0.03	−0.45	0.99
Picture arrangement	9.65	2.3	8.85	2.17	0.19	5.06***	1.06
Picture completion	8.58	2.43	8.14	2.25	0.19	2.69**	1.08
Block design	12.74	2.31	12.29	2.49	0.19	2.62**	0.93
Object assembly	11.42	2.51	10.45	2.45	0.38	5.44***	1.02
Coding	11.85	2.53	12.85	2.16	−0.41	−6.08***	1.17
Verbal IQ	51.77	9.14	50.33	8.65	0.16	2.29*	1.06
Performance IQ	54.78	7.69	52.73	6.7	0.28	3.96***	1.15
Full scale IQ	106.62	13.95	103.11	13.43	0.25	3.64***	1.04

d = the difference between the 2 means divided by the average SD.
t = the value of *t* as a test of the significance between the two means.
VR = the SD of girls divided by the SD of boys.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 2
Sex differences on the WISC-R in China and the USA expressed as *d*s (minus signs denote higher means of girls).

Tests	China	USA
Information	0.44***	0.37***
Comprehension	0.00	0.09
Similarities	0.01	0.07
Arithmetic	0.10	0.06
Vocabulary	−0.03	0.14**
Picture arrangement	0.19***	0.11*
Picture completion	0.19**	0.15**
Block design	0.19**	0.15**
Object assembly	0.38***	0.18**
Coding	−0.41***	−0.53***
Verbal IQ	0.16*	0.19**
Performance IQ	0.28***	0.01
Full scale IQ	0.25***	0.12*

* $p < .05$.
** $p < .01$.
*** $p < .001$.

The advantage of boys in the present Chinese sample on Picture Arrangement is consistent with that in the American standardization sample with statistically significant *d*s of .19 and .11, respectively. The advantage of boys on Object Assembly in the present Chinese sample is also consistent with that in the United States with statistically significant *d*s of .38 and .18, respectively. Boys obtained higher scores on Picture Completion in the present Chinese sample (.19) and in the U.S. (.15) and on Block Design with *d*s of .19 and .15, respectively. The higher means obtained by boys in both China and the United States on Picture Arrangement, Object Assembly, Picture Completion and Block Design are explicable because these are all measures of visual–spatial abilities on which males typically obtain higher means than females (Linn & Peterson, 1985; Voyer, Voyer, & Bryden, 1995). The statistically significant advantage of girls on Coding in the present Chinese sample is consistent with the higher mean obtained by girls in the United States with *d*s of .41 and .53, respectively.

Fourth, on Comprehension and Similarities the sex differences in the present Chinese sample, where both boys and girls score similarly at .00 and −.01, is consistent with those in the American standardization sample with *d*s of .01 and .07.

Fifth, there is some inconsistency in the sex difference in Vocabulary, where there was no significant difference between boys and girls in the Chinese sample ($d = -.03$) but boys obtained a significantly mean in the American sample ($d = .14$).

Sixth, the frequent assertion that males have greater variability of intelligence than females is generally confirmed in the present Chinese sample. Boys had greater variability than girls on the Verbal, Performance and Full Scale IQs and in six of the ten subtests. However, girls had greater variability than boys in Comprehension, Vocabulary and Block Design, and there was no difference in the variability of boys and girls on Similarities.

Future studies might consider controlling for sociodemographic variables to further validate this finding.

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