Available online at www.sciencedirect.com
SCIENCE DIRECT®
Personality and Individual Differences 40 (2006) 175–182
PERSONALITY AND INDIVIDUAL DIFFERENCES
www.elsevier.com/locate/paid

Sex differences on the Standard Progressive Matrices and in educational attainment in Kuwait

Ahmed M. Abdel-Khalek [a,*], Richard Lynn [b]

[a] *University of Kuwait, Kuwait*
[b] *University of Ulster, Coleraine BS57 1SA, Northern Ireland, United Kingdom*

Received 14 December 2004; received in revised form 1 June 2005; accepted 1 June 2005
Available online 7 October 2005

Abstract

The Standard Progressive Matrices was standardised on a sample of 6529 8–15-year olds in Kuwait. There was a small sex difference of .08*d* (1.2 IQ points) favouring girls. Educational tests of verbal comprehension, foreign language ability and mathematics were given to a sample of 15-year olds. On these also, girls obtained higher mean scores. These results fail to support the theory that in traditionalist countries females have lower IQs and educational attainments than males.

Keywords: Sex differences; Standard Progressive Matrices; Educational attainments; Kuwait

1. Introduction

The existence of sex differences in various cognitive and educational abilities among school students in the United States and Europe has become reasonably well established. The principal conclusions are (1) on non-verbal reasoning ability assessed by the Progressive Matrices and similar tests, there is a very little difference among children and adolescents up to the age of about 16 years, although at older ages males obtain slightly higher average means than females (Lynn &

* Corresponding author.
E-mail address: lynnr540@aol.com (R. Lynn).

0191-8869/$ - see front matter
doi:10.1016/j.paid.2005.06.020

Irwing, 2004); (2) on the verbal abilities, girls obtain a marginally higher mean of .11*d* among 11–18-year olds (*d* represents the difference between the means of boys and girls divided by the standard deviation) according to the meta-analysis of American studies carried out by Hyde and Linn (1988); (3) on mathematical ability, adolescent boys obtain higher means of .18*d* in the meta-analysis of Hyde, Fennema, and Lamon (1990); (4) on spatial abilities, adolescent boys obtain higher means of .45*d* for mental rotation, .43*d* for spatial perception, and .18*d* for spatial visualization in the meta-analysis carried out by Voyer, Voyer, and Bryden (1995).

While these sex differences have become reasonably well established in the United States and Europe, there is much less evidence on whether they are present elsewhere in the world. The United States and Europe share a common culture and it may be that quite different patterns of sex differences in abilities are present in other cultures. Such a view has been asserted by the British psychologists Hutt and Hughes (2004, p. 828): "the overwhelming importance of cultural influences in shaping sex-typed behaviour is evidenced from cultures where male and female sex roles are characterized quite differently from those in our own culture; the biological dichotomy of the sexes should not be seen as necessarily implying an equally rigid dichotomy of abilities". It has been claimed by Feingold (1988) and Richardson (1997) that sex differences in cognitive abilities in western countries have been decreasing in recent decades and that this should "be ascribed to socio-cultural factors rather than to biological mechanisms" (Richardson, p. 132). A contrary view is that sex differences in cognitive abilities are significantly biologically determined, largely by hormonal influences. This position is taken by Kimura (1999, p. 181) who concludes that "there are substantial sex differences in cognitive functions and we can state with certainty that most of these are strongly influenced by early and/or current hormonal environments" and therefore that they have a genetic basis that has evolved by natural selection. If this is so, the same sex differences should be present in all cultures.

In this paper, we contribute to knowledge of sex differences in abilities by presenting data from Kuwait, a country in the Near East for which few studies of this question have been published. Four abilities were measured. These were verbal comprehension, assessed with a language test in Arabic (the native language), foreign language ability assessed with a test in English, which is learned in school as a foreign language, mathematics, and non-verbal reasoning ability assessed by the Progressive Matrices, which "is recognised as perhaps the best measure of *g*" (Court, 1983, p. 54) and "the Raven tests, compared with many others, have the highest *g* loading" (Jensen, 1998, p. 541).

The data derived from the use of the Progressive Matrices in cross-cultural studies are useful for the analysis of sex differences in intelligence and for considering the extent to which they may be culturally determined. It has been found in a meta-analysis of numerous studies in economically developed western nations that boys and girls obtain approximately the same mean scores over the age range between 6 and 15 years. From the age of 16 years onwards, males obtain slightly higher means than females (Lynn & Irwing, 2004). However, evidence on sex differences on the Progressive Matrices in economically developing and culturally more traditional nations is quite sparse. In general, females in economically developing and culturally more traditional countries have less equality and fewer freedoms than males, and in some of these countries they are not expected to achieve so much intellectually. Socialisation theories of sex differences in abilities lead to the expectation that in traditional cultures in which less is expected of girls, their non-verbal reasoning abilities would be less developed. Such a view has been suggested by Mackintosh

Table 1
Sex differences on the Standard Progressive Matrices in economically developing countries

Country	*N*	Age	*d*	Reference
Cuba	1518	12–15	.02	Alonso (1974)
India	370	13	−.07	Sinha (1968)
India	2044	15	.13	Rao (1975)
India	200	10	.28	Lynn and Jindal (1993)
Iran	4561	9–15	.19	Baraheni (1974)
Malaysia	5384	7–12	.06	Chaim (1994)
Mexico	920	7–10	.06	Lynn et al. (2004)
Tanzania—Indians	727	13–15	.16	Klingelhofer (1967)
Tanzania—Africans	1640	14–15	.22	Klingelhofer (1967)

Negative *d*s denote higher mean scores obtained by girls.

(1998, p. 538) who has proposed that among adults men may have obtained higher mean scores than women on the Progressive Matrices in the earlier decades of the 20th century, but this male advantage has disappeared by the closing decades of the century and that "the sex difference in general intelligence among young adults today in the USA, Britain or Israel is trivially small, surely amounting to no more than 1–2 IQ points either way".

There is some supportive evidence for the hypothesis that in economically developing and culturally more traditional countries girls obtain lower IQs than boys on the Progressive Matrices. We have made a search of the literature and found nine studies for which sex differences on the Progressive Matrices among children and adolescents in the age range 6–15 years in economically developing and culturally more traditional countries have been reported. The results of these are summarized in Table 1. Further details of the studies are given in Lynn and Irwing (2004). The sex difference is expressed as *d* scores (the difference between the means of boys and girls divided by the pooled standard deviation). Positive *d*s denote higher means obtained by boys and negative *d*s denote higher means obtained by girls. The explanation for the two entries for Tanzania is that the first study is on ethnic Indians and the second on black Africans. It will be seen that in eight of the studies, boys obtained higher means. The mean of the nine studies is a boys' advantage of .12*d*. This is the equivalent of 1.8 conventional IQ points. The existing evidence does therefore appear to indicate that in economically developing and culturally more traditional countries, boys in the age range of 6–15 years obtain slightly higher IQs than girls on the Progressive Matrices. In order to examine this hypothesis further we present sex differences on the Progressive Matrices for a large sample of 8–15-year olds in Kuwait.

2. Method

The sample for the assessment of non-verbal reasoning ability assessed by the Progressive Matrices consisted of 6529 8–15-year olds. All of them were Kuwaiti citizens and students in the governmental schools in the six districts in Kuwait. In each district, one socially representative elementary, intermediate and secondary school for boys and one for girls were randomly chosen from the list of schools. Children were tested in classes which were randomly selected. The

Standard Progressive Matrices was administered to at least 60 students in each age group of boys and the same for girls in each of the six districts of Kuwait.

With the permission of Dr. J. C. Raven, an Arabic version of the Standard Progressive Matrices (SPM) sets A, B, C, D and E was adapted. The only difference between the English and Arabic versions is that in the Arabic test booklet the main matrix and the six or eight alternatives have been transposed from left to right in the same page. Thus, in the Arabic booklet the problems are in the sequence from right to left, following usage in the Arabic language.

The SPM was administered to students by a group of competent and trained testers. The testers in the boys' schools were males, while they were females in the girls' schools. In every class, testing was carried out by a tester and an assistant. Testing was carried out in the whole classes of 25–30 students. Verbal instructions were given to the students on how to do the test. The testing was carried out in the year 2002. The raw data of the completed answer sheets were scored by the computer.

For the study of sex differences in verbal and mathematical abilities, a sample of 780 boys and 890 girls were tested in representative secondary schools. The mean age was 15.86 (SD = 0.85). Verbal comprehension was assessed with a language test in Arabic (the native language); foreign language ability was assessed with a test in English, which is learned in secondary schools as a foreign language, and mathematics included arithmetic, algebra and geometry. The educational data reported here are based on a study published in Arabic by Abdel-Khalek et al. (1997).

3. Results

The results for the Progressive Matrices are given in Table 2. This shows the numbers of boys and girls in each age group, their mean scores and standard deviations on the test, the values of *t*-tests for statistical significance of the differences, and the magnitude of the sex differences

Table 2
Sex differences on the Standard Progressive Matrices in Kuwait

Age	Boys			Girls			*t*	*d*
	N	*M*	SD	*N*	*M*	SD		
8	395	21.94	9.73	416	23.33	10.12	1.98*	−.14
9	369	25.39	11.01	419	28.26	10.60	3.72***	−.27
10	441	29.66	10.50	366	31.87	10.20	3.01**	−.21
11	424	35.22	9.82	409	36.27	9.13	1.60	−.11
12	408	37.21	9.58	419	37.80	8.75	0.94	−.06
13	467	40.84	8.54	423	40.32	8.47	0.92	.06
14	402	43.03	7.46	413	44.12	7.57	2.06**	−.14
15	372	44.32	8.28	386	44.23	7.47	0.17	.01
Total	3278	34.81	12.11	3251	35.75	11.49	3.24***	−.08

Negative *d*s denote higher mean scores obtained by girls.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 3
Means and standard deviations of boys and girls on the scholastic tests

	Boys ($N = 780$)		Girls ($N = 890$)		t	d
	M	SD	M	SD		
Arabic language	1.07	1.08	1.82	1.35	12.66***	.60
English language	0.94	1.17	1.38	1.39	7.03***	.34
Mathematics	0.83	1.16	1.11	1.36	4.47***	.22

*** $p < .0001$.

expressed as *d*s (negative *d*s indicate that girls obtain higher means than boys). The bottom row gives the data for the total sample.

The results for the scholastic tests of verbal comprehension of Arabic, English and mathematics are given in Table 3. This shows the mean scores and standard deviations of boys and girls on the tests, the values of *t*-tests for statistical significance of the differences, and the magnitude of the sex differences expressed as *d*s. Girls obtain higher means than boys on all three tests.

4. Discussion

The results provide five principal points of interest. First, for non-verbal intelligence measured by the Progressive Matrices, the girls obtained significantly higher means than boys among the 8-, 9-, 10- and 14-year olds. There are no statistically significant differences among the 11-, 12-, 13- and 15-year olds. The girls' advantage in the total sample given in the last row of Table 2 is statistically significant although it is very small at .08*d*, equivalent to 1.2 IQ points. In the meta-analysis of sex differences on the Progressive Matrices by Lynn and Irwing (2004), there was no significant sex difference for the age range 8–15. In the economically developing countries shown in Table 1, boys obtained slightly higher means (.12*d*) on the Progressive Matrices than girls. The result from Kuwait is inconsistent with this general trend. We have no suggestions to explain the fractionally higher mean obtained by girls in Kuwait. Possibly it is due to a sampling bias. However, although the higher mean obtained by the girls in Kuwait is highly statistically significant because of the large sample of 6529, in practical terms the sex difference on the Progressive Matrices in Kuwait is negligible. In any event, the result shows that girls are not disadvantaged in Kuwait in respect of non-verbal reasoning ability.

Second, on the three educational tests of Arabic, English and Mathematics, girls obtained significantly higher means than boys. The magnitude of the girls' advantage on these tests in Kuwait is compared with those obtained by adolescents of approximately the same age in five economically developed western societies in Table 4. The sex differences in Kuwait are broadly similar to those in the western countries. With regard to verbal comprehension, girls obtain higher means in all countries, but the advantage of girls in Kuwait (.60*d*) is greater than in any of the western countries. With regard to foreign language ability (English for the Kuwait sample), girls again obtain higher means in all countries and the advantage of girls in Kuwait (.34*d*) is intermediate between the greater advantage of girls in Ireland (.60*d*) and the slightly lower advantage of girls in Australia (.25*d*) and Sweden (.25*d*). With regard to mathematics, girls obtain a higher mean in

Table 4
Sex differences in adolescents in verbal comprehension, foreign language and mathematical abilities in six countries

Country	Age	*N*	Verbal comp	Foreign language	Mathematics	Reference
Kuwait	15	1670	−.60	−.34	−.22	Present study
Australia	18	1468	−.37	−.25	.15	MacCann (1995)
Canada	13	3346	−.05	–	−.29	Randhawa (1991)
Ireland	13	599	−.25	−.64	−.21	Lynn and Wilson (1993)
Sweden	12/13	2250	−.03	−.27	.49	Ljung (1965)
USA	11/18	–	−.11	–	.18	Hyde et al. (1990); Hyde and Linn (1988)

Negative *d*s denote higher mean scores obtained by girls.

Kuwait (.22*d*) of about the same magnitude as in Canada (.29*d*) and Ireland (.21*d*), but in Australia, Sweden and the United States boys obtain higher means than girls ($d = .15$, .33 and .18, respectively). Sex differences in mathematics depend on the nature of the problems. Girls normally do better on arithmetical computation, while boys normally do better at problems (Hyde et al., 1990), so the sex differences depend on the mix of these two kinds of problem.

Third, a referee has contended that the results show the effects of cultural differences between the countries. He writes "the Kuwaiti data do exhibit distinctive patterns of female superiority relative to other developing countries on the Progressive Matrices and to developed countries on Verbal Comprehension. These results require a cultural explanation". We disagree. It is true that in Kuwait the girls obtain a higher mean on the Progressive Matrices than in the nine economically developing countries shown in Table 1, but we do not think this difference requires a cultural explanation. We think that these small sex differences between countries and samples are more likely due to sampling errors. The sex difference in Kuwait is −.08*d* in favour of girls, while the mean difference in the nine economically developing countries is 0.12*d* in favour of boys, a difference of 0.20*d*. Note, however, that the range of differences in the nine economically developing countries is from −0.07*d* to 0.28*d*, and the difference of −0.08*d* in Kuwait is indistinguishable from this range. Furthermore, the three studies from India given in Table 1 give sex differences of −0.07*d*, 0.13*d* and 0.28*d*, a range of .35*d*. Are we to conclude that these differences in India require a cultural explanation? We think it is more probable they are sampling errors.

With regard to Verbal Comprehension, the referee writes "females outperform males on Verbal Comprehension in five economically developed countries: *N* weighted effect size = −.12*d*. A null hypothesis stating that the Kuwaiti difference is equal to the Western difference may be rejected: $d = -.60$ for Kuwait—a non-trivial difference that is .48 SD larger ... this difference requires a cultural explanation". We disagree. In all the five economically developed countries given in Table 4, girls obtain higher means than boys on verbal comprehension. The range of the girls' advantage is from −0.05*d* in Australia to −0.37*d* in Canada, a difference of 0.32*d*, while the difference between Canada and Kuwait is 0.23*d*. Do we need to seek a cultural difference between Australia and Canada to explain the difference of 0.32*d*? We think it is more probable that all these differences are due to sampling errors or to differences in the content of the tests. In the meta-analysis of American studies of sex differences in verbal abilities, Hyde and Linn (1988) found an overall 0.11*d* advantage for adolescent girls, but the range of the studies from which this average was

derived is from a 0.33*d* advantage for boys to a 0.57*d* advantage for girls. This is a much larger range of differences (90*d*) than that between counties (.55*d*) given in Table 4. Thus, the range of differences among studies within the United States is substantially greater than the range between counties. One of the main reasons for this large range in the magnitude and even the direction of the sex differences lies in the content of the tests. Hyde and Linn (1988) found in their meta-analysis of the sex differences in verbal abilities that on verbal anagrams girls had an advantage of 0.22*d*, while on verbal analogies boys had an advantage of 0.16*d*. The point is that the figures for sex differences in verbal abilities from different countries given in Table 4 are not wholly reliable but are likely to depend on the precise nature of the verbal abilities tested as well as on sampling errors. The important thing is to look at the general trend, which in Kuwait and the five economically developed countries is not adolescent girls obtain higher means on verbal ability than adolescent boys.

Fourth, we believe that, taking the results as a whole, they fail to confirm the cultural determination theory of sex differences in cognitive abilities outlined Section 1. The strong form of this theory affirms "the overwhelming importance of cultural influences in shaping sex-typed behaviour is evidenced from cultures where male and female sex roles are characterized quite differently from those in our own culture" (Hutt & Hughes, 2004, p. 828). If this theory is correct, the sex differences in non-verbal IQ measured by the SPM and in verbal ability, foreign language ability and mathematics might be expected to be quite different in Kuwait from those in western countries. Although Kuwait has a high per capita income generated by its large production of oil, it differs culturally from western nations in being a rather traditional Muslim country in which boys and girls are segregated in schools and at university. Despite this, the sex differences in cognitive abilities in Kuwait are similar to those in the five western countries given in Table 4.

Fifth, the means obtained by the Kuwait sample on the Progressive Matrices are somewhat lower than those of British children in the 1979 British standardization sample given by Raven (1981). The average of the mean scores of each year of the Kuwait sample compared with those of the British standardization sample show that the mean of the Kuwait sample is equivalent to the 26th percentile of the British standardization sample. This is typical of samples from countries in the Near East including Iran, Iraq, Lebanon and Qatar, results for which are summarized in Lynn and Vanhanen (2002). One reason for this may be that the sample was drawn from government schools and did not include private schools, which are mainly American and British. It seems likely that the inclusion of these would have increased the average IQs of the sample. In addition, average IQs in economically developing countries have been increasing during most of the 20th century at a rate of approximately 2–3 IQ points a decade (Flynn, 1984, 1987; Lynn & Hampson, 1986) as a result of various environmental improvements, although there is no general agreement on the exact nature of these. Thus, the average IQ in Kuwait today is approximately the same as that in Britain and the United States a generation ago and can be expected to rise in future decades.

Acknowledgement

The present study was supported by Kuwait University under Grant No. OP01/02. The authors gratefully acknowledge the assistance of the research administration.

References

Abdel-Khalek, A. M., Khalifa, A. M., Al-Khedr, O. H., El-Naser, H. A., Al-Moussawy, H., Al-Anzi, F. O. et al. (1997). Evaluation of the scholastic achievement and adjustment in the credit hours and two-semester regimes in the secondary schools in Kuwait. Kuwait Ministry of Education [in Arabic].

Alonso, O. S. (1974). Raven, *g* factor, age and school level. *Havana Hospital Psiquiatrico Revista, 14*, 60–77.

Baraheni, M. N. (1974). Raven's Progressive Matrices as applied to Iranian children. *Educational and Psychological Measurement, 34*, 983–988.

Chaim, H. H. (1994). Is the Raven Progressive Matrices valid for Malaysians? Unpublished.

Court, J. H. (1983). Sex differences in performance on Raven's Progressive Matrices: a review. *Alberta Journal of Educational Research, 29*, 54–74.

Feingold, A. (1988). Cognitive gender differences are disappearing. *American Psychologist, 43*, 95–103.

Flynn, J. R. (1984). The mean IQ of Americans: massive gains 1932 to 1978. *Psychological Bulletin, 95*, 29–51.

Flynn, J. R. (1987). Massive IQ gains in 14 nations: what IQ tests really measure. *Psychological Bulletin, 101*, 171–191.

Hutt, C., & Hughes, M. (2004). Sex differences in childhood. In R. L. Gregory (Ed.), *The Oxford Companion to the Mind*. Oxford, UK: Oxford University Press.

Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: a meta-analysis. *Psychological Bulletin, 107*, 139–153.

Hyde, J. S., & Linn, M. C. (1988). Gender differences in verbal ability: a meta-analysis. *Psychological Bulletin, 104*, 53–69.

Jensen, A. R. (1998). *The g factor*. Westport, CT: Praeger.

Kimura, D. (1999). *Sex and cognition*. Cambridge, MA: MIT Press.

Klingelhofer, E. L. (1967). Performance of Tanzanian secondary school pupils on the Raven Standard Progressive Matrices test. *Journal of Social Psychology, 72*, 205–215.

Ljung, B. (1965). *The adolescent spurt in mental growth*. Stockholm: Alqvist and Wiksell.

Lynn, R., Backhoff, E., & Contreras, L. (2004). Sex differences on the Progressive Matrices among 7 to 10 year olds: some normative data for Mexico. *Personality and Individual Differences, 36*, 779–789.

Lynn, R., & Hampson, S. L. (1986). The rise of national intelligence: evidence from Britain, Japan and the USA. *Personality and Individual Differences, 7*, 23–332.

Lynn, R., & Irwing, P. (2004). Sex differences on the progressive matrices: a meta-analysis. *Intelligence, 32*, 481–498.

Lynn, R., & Jindal, S. (1993). Positive correlations between brain size and intelligence: further evidence from India. *Mankind Quarterly, 34*, 109–115.

Lynn, R., & Vanhanen, T. (2002). *IQ and the wealth of nations*. Westport, CT: Praeger.

Lynn, R., & Wilson, R. G. (1993). Sex differences in cognitive abilities among Irish primary and secondary school children. *Irish Journal of Psychology, 14*, 293–300.

MacCann, R. (1995). Sex differences at the NSW Higher School Certificate after adjustment for the effects of differential selection. *Australian Journal of Education, 39*, 163–188.

Mackintosh, N. J. (1998). Reply to Lynn. *Journal of Biosocial Science, 30*, 533–539.

Randhawa, B. S. (1991). Gender differences in academic achievement: a closer look at mathematics. *Alberta Journal of Educational Research, 37*, 241–257.

Rao, Y. R. (1975). Distribution of Progressive Matrices scores among pupils of XI standard. *Indian Journal of Applied Psychology, 12*, 76–82.

Raven, J. (1981). *Irish and British Standardisations of the Standard Progressive Matrices*. Oxford: Oxford Psychologists Press.

Richardson, J. T. E. (1997). Conclusions. In P. J. Caplan, M. Crawford, J. S. Hyde, & J. T. E. Richardson (Eds.), *Gender differences in cognition*. New York: Oxford University Press.

Sinha, U. (1968). The use of Raven's Progressive Matrices in India. *Indian Educational Review, 3*, 75–88.

Voyer, D., Voyer, S., & Bryden, M. P. (1995). Magnitude of sex differences in spatial ability: a meta-analysis and consideration of critical variables. *Psychological Bulletin, 117*, 250–270.