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AN INCREASE OF INTELLIGENCE IN SUDAN, 1987–2007

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Summary. Results are reported for mean IQs on the WAIS-R in Sudan in 1987 and 2007. There was a gain of 4·05 Full Scale IQ points over the 20-year period, representing a gain of 2·05 IQ points a decade. The Verbal IQ showed a loss of 1·65 IQ points, while the Performance IQ showed a gain of 7·2 IQ points. These results are broadly consistent with those in economically developed countries in showing that mean IQ on the WAIS-R has increased in Sudan, and the Performance IQ has increased more than the Verbal IQ.

Introduction

It has been reported since the 1940s that there have been secular increases in IQs in the United States (Wheeler, 1942; Smith, 1942; Tuddenham, 1948) and in Scotland (Scottish Council for Research in Education, 1949). From 1950 onwards numerous studies in other economically developed confirmed these results, e.g. in England (Cattell, 1950), Japan (Lynn, 1982; Lynn & Hampson, 1986), and in a number of other countries (Flynn, 1987). The phenomenon of rising IQs has been named the 'Flynn effect'. Nearly all of these IQ increases have been reported in economically developed nations. In addition, there have been three reports of IQ increases in the economically undeveloped nations of Kenya, Brazil and Dominica. In Kenya an IQ increase of 14 IQ points from 1984 to 1998 (10·0 IQ points a decade), based on samples of 7-year-olds measured by the Colored Progressive Matrices, was reported by Daley *et al*. (2003). In Dominica, an IQ increase of 18 IQ points (5·1 IQ points a decade), in cohorts born in 1948 and 1983, measured by the Standard Progressive Matrices, has been reported by Meisenberg *et al.* (2005). In Brazil an IQ increase of 17 IQ points from 1930 to 2002 (2·4 IQ points a decade), based on samples of 7- to 11-year-olds measured by the Draw-a-Man test, was reported by Colom *et al*. (2007).

It is an interesting question whether IQ increases have been as widespread in the economically developing countries as in the developed countries. In this paper a further contribution to this issue is made by presenting data for an IQ increase in Sudan.

Table 1. WAIS-R scores in Sudan in 1987 and 2007

Measure	1987		2007		Gain: *d*
	Mean	SD	Mean	SD	
Full Scale IQ	167·0	77·4	188·0	76·9	0·27
Verbal IQ	104·8	42·1	100·0	44·6	− 0·11
Performance IQ	62·4	40·6	92·1	82·5	0·48
Information	14·0	7·7	16·8	8·3	0·35
Comprehension	21·0	8·0	16·5	8·9	− 0·53
Digit Span	9·5	6·1	9·3	3·7	− 0·04
Arithmetic	8·9	4·2	9·2	4·1	0·07
Similarities	14·9	8·0	13·1	7·7	− 0·23
Vocabulary	37·3	17·2	34·8	17·5	− 0·14
Picture Arrangement	7·3	6·6	9·2	4·3	0·35
Picture Completion	10·3	5·4	12·7	5·9	0·42
Block Design	14·1	11·7	17·1	10·6	0·27
Object Assembly	15·8	8·9	24·1	5·6	1·14
Digit Symbol	15·6	13·2	24·6	13·6	0·67

Method

The American Wechsler Adult Intelligence Scale (WAIS-R, Wechsler, 1981) was standardized in the Sudan in 1987 on a sample of 801 participants by the second author (Sulman, 2008). The sample was selected to be representative of northern Sudan. The southern part of the country was not included in the study because of cultural, ethnic and linguistic differences. Stratified sampling was used to obtain a sample that matched the population documented in the census of 1983. The sample matched the population for geographical regions: Gazira 223 (27·6%), Kordofan 162 (20·9%), Darfur 158 (19·6%), Eastern 106 (13·1), Khartoum 96 (11·9%) and Northern region 56 (6·9%). The sample also matched the population for urban–rural location, sex (418 (52·2%) men and 383 (47·8%) women), level of education and age. The mean age of the sample was 50 years.

The WAIS-R was re-standardized on a comparable stratified sample of the same size in 2007, again with a mean age of 50 years, with the objective of examining whether there were any differences in IQ between 1987 and 2007. There was no change in the test items in the two standardizations.

Results

The raw score means and standard deviations of the Full Scale, Verbal and Performance IQs and of the sub-tests for 1987 and 2007 are shown in Table 1 (note that these numbers are not IQs). These are followed by the differences between the means expressed in standard deviation units (*d*), calculated by dividing the difference in the means by the average of the two SDs.

Discussion

The results show five points of interest. First, there has been an increase in intelligence in Sudan between 1987 and 2007 on the Wechsler Full Scale IQ of 0·27*d*. This is equivalent to 4·05 IQ points over the 20-year period, and therefore represents a gain of 2·05 IQ points a decade. The increase of IQ in Sudan reported in this paper confirms the results obtained in numerous economically developed nations reported by Flynn (1987, 2007) and Lynn & Hampson (1986, 1990a) and for the three economically undeveloped nations of Kenya, Brazil and Dominica. In these three countries the IQ gains were obtained on the Progressive Matrices and the Draw-a-Man tests. The increase of IQ in Sudan has been found on the Wechsler. This indicates the generality of the secular increase in IQs, irrespective of the tests, and suggests that rise of intelligence has been a world-wide phenomenon in the second half of the twentieth century and into the first decade of the twenty-first century.

Second, in the United States the gain on the WAIS during the second half of the twentieth century was about 3·0 IQ points a decade (Flynn, 2007). It may be surprising that the rate of IQ increase has been lower in Sudan (at 2·05 IQ points a decade) than in the United States. This is probably because economic development has not been great in Sudan during the last half century. IQ increases are associated with increases in living standards that have had a variety of beneficial effects such as improved nutrition, education and exposure to media. There has been some increase in standards of living in Sudan during the last half-century as indexed by life expectancy, which increased from 41 years in 1956 to 54 in 2006. However, increases in *per capita* income have been quite small. From 1950 to 1990 the *per capita* income in US$ increased by only approximately 11% (from 1014 to 1123), as compared with increases of approximately 200% in the United States, the United Kingdom and other economically developed nations (Maddison, 1995). In 2002 the GNI (Gross national Income at Purchasing Power Parity) was only $1740 compared with $36,120 in the United States and $26,580 in the United Kingdom (World Bank, 2004).

Third, there is a difference in Sudan in the secular change between the Verbal IQ, which shows a loss of 0·11*d*, the equivalent of 1·65 IQ points, and the Performance IQ gain of 0·48*d*, the equivalent of 7·2 IQ points. The greater increase of the Performance IQ than of the Verbal IQ has also been found in the United States (Flynn, 2007), and many studies have reported that increases in non-verbal abilities have been greater than in verbal abilities (e.g. Lynn, 1990a). The present results are broadly consistent with those in economically developed countries in that (1) mean IQ on the WAIS has increased in Sudan, and (2) the Performance IQ has increased more than the Verbal IQ. However, a decline of WAIS-R Verbal IQ is a curious feature of the results that has not been reported hitherto. In regard to the sub-tests, there was a decline in four of the six verbal tests (comprehension, digit span, similarities and vocabulary), and there was no increase in arithmetic. It is notable that there has been quite a large loss on the similarities sub-test of 0·23*d*, the equivalent of 3·45 IQ points over the 20-year period and therefore 1·7 IQ points a decade. This is a surprising result because the similarities sub-test has shown quite large increases in the United States (Flynn, 2007).

Fourth, the results of the five performance sub-tests are consistent in so far as they all show an increase but the gain has been much larger for object assembly (1·14*d*) than for the other sub-tests. It is notable that this gain has been so much greater than the gain on block design (0·27*d*), because object assembly and block design are both measures of visual–spatial ability. We are not able to offer an explanation for this difference.

Fifth, while the results reported here confirm that increases in IQs have taken place not only in the economically developed nations but also in an economically developing nation, there is no consensus regarding the causes of these increases. A referee has asked 'Could this be greater exposure to the mass media?' but we think the smaller gains on the verbal abilities (and in Sudan the losses) argues against this theory, since mass media would surely be expected to improve verbal abilities more than non-verbal abilities. Two of the most frequently advanced theories are improvements in nutrition (Lynn, 1990b, 1998) and in education (Flynn, 2007). The education theory encounters the problem that the increases have been smallest in the abilities that are taught in schools, e.g. vocabulary, comprehension and arithmetic, and in Sudan the first two of these have actually shown a decline. This is a problem that education theorists have yet to explain.

References

Cattell, R. B. (1950) The fate of national intelligence: tests of a thirteen year prediction. *Eugenics Review* **42**, 136–148.

Colom, R., Flores-Mendoza, C. E. & Abad, F. J. (2007) Generational changes on the Draw-a-Man test: a comparison of Brazilian urban and rural children tested in 1930, 2002 and 2004. *Journal of Biosocial Science* **39**, 79–89.

Daley, T. C., Whaley, S. E., Sigman, M. D., Espinosa, M. P. & Neuman, C. (2003) IQ on the rise: the Flynn effect in rural Kenyan children. *Psychological Science* **14**, 215–219.

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

Flynn, J. R. (2007) *What is Intelligence? Beyond the Flynn Effect*. Cambridge University Press, Cambridge.

Lynn, R. (1982) IQ in Japan and the United States shows a growing disparity. *Nature* **297**, 222–223.

Lynn, R. (1998) In support of the nutrition theory. In Neisser, U. (ed.) *The Rising Curve: Long Term Gains in IQ and Related Matters*. American Psychological Association, Washington DC.

Lynn, R. (1990a) Differential rates of secular increase of five major primary abilities. *Social Biology* **38**, 137–141.

Lynn, R. (1990b) The role of nutrition in secular increases of intelligence. *Personality and Individual Differences* **11**, 273–285.

Lynn, R. & Hampson, S. L. (1986) The rise of national intelligence: evidence from Britain, Japan and the USA. *Personality and Individual Differences* **7**, 23–32.

Maddison, A. (1995) *Monitoring the World Economy 1820–1992*. Development Center of the Organisation for Economic Cooperation & Development, Paris.

Meisenberg, G., Lawless, E., Lambert, E. & Newton, A. (2005) The Flynn effect in the Caribbean: generational change in test performance in Dominica. *Mankind Quarterly* **46**, 29–70.

Scottish Council for Research in Education (1949) *The Trend of Scottish Intelligence*. University of London Press, London.

Smith, S. (1942) Language and non-verbal test performance of racial groups in Honolulu before and after a fourteen year interval. *Journal of General Psychology* **26**, 51–93.

Sulman, A. (2008) Flynn effect in Sudan 1987–2007. Masters thesis, University of Khartoum.

Tuddenham, R. D. (1948) Soldier intelligence in World Wars I and II. *American Psychologist* **3**, 54–56.

Wechsler, D. (1981) *Manual for the Wechsler Adult Intelligence Scale – Revised.* Psychological Corporation, New York.

Wheeler, L. R. (1942) A comparative study of the intelligence of East Tennessee mountain children. *Journal of Educational Psychology* **33**, 321–334.

World Bank (2004) *World Development Report*. Oxford University Press, New York.