Two Studies of Recent Increases of Intelligence in Taiwan

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Recent increases of IQ in Taiwan are reported for children and adults. The IQ gain in children measured by the WISC-III and the WISC-IV was 2.45 IQ points per decade over the years 1997-2007. The IQ gain in adults measured by the WAIS-III showed a smaller increase of 0.55 IQ points per decade over the years 2001-2011. In both studies the greatest gains were made on the visual-spatial abilities, with smaller gains on reasoning and the smallest gains on verbal abilities.

Key Words: Taiwan; Flynn effect; Wechsler tests.

Numerous studies have shown that intelligence has increased in many countries from at least the 1920s up to the early years of the twenty-first century (Flynn, 2012; Lynn, 2013). In this paper we present recent data for this secular increase of intelligence in Taiwan.

WISC-III and WISC-IV IQ gains in children 1997-2007

IQ gains in children over the years 1997-2007 were examined by the administration of the WISC-III, which was standardized in Taiwan in 1997, and the WISC-IV, which was standardized in Taiwan in 2007, to a sample of 121 children aged 6 to 16 years old (61 male and 60 female). The logic of the study is that if both standardization samples were representative of the national population, and if the current

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sample obtains a higher IQ on the test that was standardized first, the IQ of the population must have increased during the years between the two standardizations. There were 10.5 years between the two standardizations considered here.

The current sample was selected to be representative of the country in terms of IQ and educational level of parents. In regard to the educational level of the parents, 28.1 percent were four year college graduates, 15.7 percent were two year college graduates, 40.5 percent were senior high school graduates, 12.4 percent were junior high school graduates, and 3.3 percent had only elementary school education or below. These percentages correspond approximately to those in the population. In regard to geographical location, 21.5 percent came from Taipei City, 23.1 percent from New Taipei City, 9.1 percent from Tao-Yuan county, 17.4 percent from I-Lan county, and 28.9 percent from Hualien county. Data were collected from both urban and rural areas in Taiwan. To control for practice effects, the tests were given in counterbalanced order. The results are shown in Table 1. This gives the scores obtained on the subtests on the WISC-III and the WISC-IV, the subtest scaled score difference (SD=3), the subtest difference expressed as IQs (SD=15), the IQ change per decade, the IQ change per decade in the United States from 1991-2003 reported by Flynn & Weiss (2007), and the *g*-loadings of the WISC-III subtests given by Kaufman & Lichtenberger (2000).

WAIS IQ gains in adults 2001-2011

The Taiwanese WAIS-III was standardized in the autumn of 2001 on a representative sample (N = 888) aged 16-84 years (Wechsler, 2002). The subtests are combined to give measures of Full Scale IQ (FSIQ), Verbal Comprehension Index (VCI), Perceptual Organization Index (POI), Working Memory Index (WMI) and Processing Speed Index (PSI). The

Table 1. WISC-III and the WISC-IV IQs in Taiwan

Subtest	Raw score, Mean ± SD		Increase scaled score (SD=3)	Increase IQ per decade (SD=15)	United States increase IQ per decade (SD=15)	WISC-III g-loading
	WISC-III	WISC-IV				
Information	*9.83 ± 3.25*	*10.29 ± 3.21*	*-0.46*	*-2.2*	*1.2*	*0.78*
Similarities	*11.00 ± 3.19*	*10.48 ± 3.10*	*0.52*	*2.5*	*2.7*	*0.77*
Vocabulary	*10.31 ± 2.91*	*10.07 ± 3.24*	*0.24*	*1.1*	*0.4*	*0.80*
Comprehension	*9.94 ± 2.89*	*9.84 ± 3.00*	*0.10*	*0.5*	*1.6*	*0.68*
Pict. completion	*11.85 ± 3.09*	*11.12 ± 2.89*	*0.73*	*3.5*	*2.7*	*0.60*
Block design	*11.42 ± 3.23*	*10.51 ± 3.14*	*0.91*	*4.3*	*3.9*	*0.71*
Arithmetic	*10.60 ± 2.81*	*9.98 ± 3.20*	*0.62*	*3.0*	*-0.8*	*0.76*
Coding	*10.72 ± 3.00*	*10.50 ± 3.04*	*0.22*	*1.0*	*2.7*	*0.41*
Digit span	*10.46 ± 3.62*	*9.74 ± 2.93*	*0.72*	*3.4*	*0.4*	*0.47*
Symbol search	*11.87 ± 3.63*	*10.57 ± 3.21*	*1.30*	*6.2*	*4.7*	*0.56*

internal consistency reliabilities of these in the Taiwan standardization sample were .98, .94, .93, .95 and .89, respectively (Wechsler, 2002).

In the present study, a sample of 135 Taiwanese was tested with the Taiwanese WAIS-III in the spring of 2011. The sample was aged 16-84 years, had no history of significant medical illness or psychiatric problem, and was selected to match the population given in the 2010 census for gender, level of education, and geographical region. Approximately equal numbers of men and women were included in each of the 11 age groups. Because the standardization sample was tested in the autumn of 2001 and the present sample was tested in spring of 2011, there was an interval of 9.75 years between the two data collections.

The results are given in Table 2. This shows, for the standardization sample of 2001 and for the sample tested in 2011, the means and SDs of the subtests and of Full Scale IQ, Verbal IQ, Performance IQ, Verbal Comprehension Index, Perceptual Organization Index, Working Memory Index, and Processing Speed Index. Also shown in the right hand column are the IQ gains for adults in the United States on the WAIS-III to the WAIS-IV from 1995 to 2006 given by Flynn (2012), and the *g*-loadings of the WAIS-III subtests given by Kaufman & Lichtenberger (1999).

Discussion

The two studies found that there have been IQ increases in Taiwan in recent years. In the first study, the IQ increase in children measured by the administration of the WISC-III and the WISC-IV to the same sample was 2.45 Full Scale IQ points per decade over the years 1997-2007. This increase is virtually identical to the gain of 2.3 IQ points per decade in the United States. The magnitudes of subtest IQ gains in Taiwan were similar to those in the United States. In both countries larger gains were made on the non-verbal and visual-spatial abilities of Picture Completion, Block Design and Symbol Search (this

Table 2. Scores on the Taiwanese WAIS-III in 2001 and 2011.

Measure	2001 Mean ±SD	2011 Mean ± SD	Score increase	IQ gain per decade (SD=15)	US 1995-006 IQ gain per decade (SD=15)	WAIS-III g-loading
Vocabulary	9.96 ± 3.17	9.99 ± 2.90	0.03	0.15	*4.55*	*.83*
Similarities	9.99 ± 3.14	10.21 ± 2.68	0.22	1.13	*3.18*	*.80*
Information	10.02 ± 3.11	9.99 ± 2.60	-0.03	-0.15	*2.27*	*.80*
Comprehension	9.98 ±3.08	10.37 ± 2.92	0.39	2.00	*1.82*	*.78*
Pict. Completion	9.97 ± 3.07	9.94 ± 2.87	-0.03	-0.15	*4.09*	*.68*
Block Design	9.98 ± 3.08	9.87 ± 2.83	-0.11	-0.56	*1.36*	*.75*
Matrix Reasoning	10.02 ± 3.06	10.13 ± 2.75	0.11	0.56	*2.73*	*.75*
Picture Arrangem.	9.94 ± 3.12	10.21 ± 3.09	0.27	1.38	*4.09*	*.69*
Object Assembly	10.02 ± 3.02	10.12 ± 2.95	0.10	0.51	-	*.65*

Arithmetic	10.00 ± 3.03	9.79 ± 2.57	-0.21	-1.08	*0.00*	.77
Digit Span	10.05 ± 2.99	10.29 ± 2.99	0.24	1.23	1.36	.60
Letter Number Sequencing	10.01 ± 3.00	9.87 ± 3.10	-0.14	-0.72	-	.68
Digit-Symbol Coding	9.98 ± 3.06	10.49 ± 2.91	0.51	2.62	0.91	.62
Symbol Search	9.96 ± 3.07	10.90 ± 3.00	0.94	4.82	-	.72
FSIQ	100.00 ± 15.00	100.54 ± 13.26	0.54	0.55	3.06	-
VIQ	100.00 ± 15.00	100.48 ± 13.33	0.48	0.49	-	-
PIQ	100.00 ± 15.01	100.70 ± 13.71	0.70	0.72	-	-
VCI	100.02 ± 15.01	100.37 ± 12.74	0.35	0.36	-	-
POI	100.00 ± 14.99	99.91 ± 13.87	-0.09	-0.09	-	-
WMI	100.00 ± 15.01	99.02 ± 14.54	-0.98	-1.01	-	-
PSI	100.00 ± 15.00	103.93 ± 14.44	3.93	4.03	-	-

test requires children to scan visually two groups of shapes and identify whether any shapes are common to the two groups). Smaller gains were made on the verbal abilities of Information, Vocabulary and Comprehension. The only loss was made on Information in Taiwan, while a slight loss was observed on Arithmetic in the United States. The correlation between the magnitudes of the IQ gains on the subtests in the two countries is .47. The p value (2-tailed) is only .167, which is not statistically significant but suggests that IQ gains in children have similar patterns in the two countries. The greatest discrepancy is the large gain on the working memory related subtests such as Arithmetic and Digit Span in Taiwan and the close to zero gain on these subtests in the United States. The correlations between the g-loadings and the magnitude of the Flynn effect gains is -.310 (p=.384) in Taiwan and -.295 (p=.409) in the United States, indicating that the gains should not be attributed to increasing g (general intelligence) but to more specialized abilities. This has also been observed in other countries, reviewed by Te Nijenhuis (in press). This pattern is expected because g is the most heritable aspect of intelligence, and Flynn effects are attributable to improving environments, not improving genes. Genes are probably deteriorating in most countries (Lynn, 2011; Woodley, 2012).

In the second study, the IQ increase in adults measured by the scores obtained by the standardization sample of the WAIS-III in 2001 and by a new representative sample in 2011 showed a smaller increase of 0.55 Full Scale IQ points a decade. This is smaller than the gain for adults in the United States from 1995 to 2006, where the gain on the Full Scale IQ on the WAIS-III to the WAIS-IV was 3.06 per decade calculated by Flynn (2012). The correlation between the magnitudes of the IQ gains on the subtests in the two countries is .02. The magnitude of IQ gains (and losses) on different ability domains seems to be different for the adult

populations in the two countries. The correlation between the *g*-loadings of the subtests and the magnitude of Flynn effect gains is -.225 (p=.440) in Taiwan, but is positive at -.241 (p=.476) in the United States. Should this be +.241? However, neither of these two correlations is statistically significant.

The results of the present study confirm the many previous studies showing an overall IQ gain in recent years. Larger gains were observed on the non-verbal and visual-spatial abilities measured by the Processing Speed Index and the Performance IQ, while smaller gains were made on the verbal abilities measured by the Verbal IQ and the Verbal Comprehension Index. In Taiwan, children's working memory increased while the opposite trend was observed in the adult population in the past decade.

The Taiwanese pattern of continuing IQ gains in children but minimal gains (or even losses) in adolescents and adults during recent years has been observed in other countries as well. In Britain, scores on the non-verbal Raven test continued to increase among children between 1980 and 2008, but small losses were found at age 14-15 (Flynn, 2009). Similar observations have been made for trends in scholastic achievement. Summarizing trends in 4th grade mathematics achievement from 1995 to 2011, mainly in economically developed countries, the organizers of the Trends in International Mathematics and Science Study (TIMSS) note: "Of the 17 countries and three benchmarking participants with data spanning this period, twelve countries and one benchmarking participant had increases in average achievement, three countries and one benchmarking participant had decreases, and two countries and one benchmarking participant had no difference." In 8th grade, however, they report: "Of the 25 countries and eight benchmarking participants with comparable data spanning the 1995 or 1999 to 2011 period, nine countries and four benchmarking participants had increased achievement,

eleven countries and two benchmarking participants had decreased achievement, and five countries and two benchmarking participants showed no difference." (Mullis et al, 2012, p. 55) Results of intelligence tests and scholastic achievement tests are closely related at the country level (Meisenberg & Lynn, 2011). Results like these show that rising intelligence of children does not always translate into rising intelligence of teenagers or adults. It can be the result of faster childhood cognitive development.

Limitations of the two studies reported here are the small sample sizes, possible measurement errors, and the short time span of a decade covered.

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