The higher educational achievement of Chinese pupils, inside and outside of Asia: the higher transparency of Chinese numbers or a higher value of learning within Chinese culture?

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Abstract
The most recent PISA data once more reveal that Chinese secondary school pupils both in- and outside of Asia excel in mathematics, reading, and science. Our analysis suggests that a key to understanding the high Chinese performances might be both the transparency of Chinese numbers and the relatively high value the Chinese attach to education. Based on achievement data of 43.961 pupils, our results show that whereas Chinese pupils' reading skills might profit from the higher number of hours spent on learning and the increased memory by learning characters, their mathematic skills profit from speaking the Chinese language at home.

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Introduction

The educational achievements of Chinese secondary school pupils, not only in China but also in non-Asian societies, are high. These higher educational scores of Chinese pupils (not only on science and math, but also on reading) inside and outside of Asia are clearly visible in the PISA data and cannot be solely explained by pupils' socio-economic background, the country of destination or the migration history (anonymised reference; anonymised reference; see also figures 1 & 2). Whereas most single-country explanations of the Chinese pupils' higher scores either focus on their selective immigrant background or on authoritarian Chinese education, we will indirectly test two other cross-national explanations: 1. the higher transparency of Chinese numbers; 2. the higher value of learning within Chinese culture.

By analyzing Chinese pupils inside and outside of Asia we can also see whether the Chinese higher scores are caused by the Chinese educational system, which values high levels of memorization but less self exploration by pupils (Hoossain, 1991). Therefore some observers (Hanushek, 2002) consider the high educational scores of pupils in Chinese societies as an artifact of this memorization and not as a consequence of 'real' learning.

Another explanation of the high educational scores of Chinese pupils in non-Asian societies is the strong family ties between Chinese immigrants. Although this seems to be a plausible explanation, the strong family ties explanation is less convincing. After all, the highest educational scores of pupils can be rather observed in the more individualistic European countries (Finland) than in the more family-oriented societies (Italy) (OECD, 2007).

We draw on the neuropsychological studies of Dehaene (2005, 2008). Our assumption is that the Chinese written numbers have a higher transparency and thus less constrains for learning arithmetic than the Arabic numerals. Chinese is simplicity itself; its number syntax perfectly mirrors the base-ten form of Arabic numerals, but with a minimum of terms. Moreover, the Chinese number words are so brief (on average, they take less than a quarter of a second to verbalize, compared to a third of a second for English) that the average Chinese speaker has a memory span of nine digits, versus seven digits for English speakers (Hoosain, 1991). This explanation results in three hypotheses: 1. Chinese-speaking natives and immigrants in Asian countries have higher math scores than non-Chinese-speaking natives and immigrants in Asian countries 2. Chinese-speaking Chinese immigrants in non-Asian countries have higher math scores than non-Chinese-speaking Chinese immigrants in non-Asian countries. 3. Second generation Chinese-speaking pupils in non-Asian countries have lower math scores than first generation Chinese-speaking pupils in non-Asian countries.

The high value of learning within Chinese culture dates back to the use of classical education as an avenue for the selection of administrators and civil servants in the successive Chinese empires, from the first Chinese emperor Yeng Zheng (who died 210 BC) until the start of the 20th century. This tradition of a high value of learning is more time-honored in Chinese society (at least 22 centuries) than in other societies (at maximum 2 centuries), and is enshrined in Confucianism. Max Weber (1951: 107-

113) summarizes this importance of education very well in the opening of his chapter on the literati: "For twelve centuries social rank in China has been determined by qualification for office than by wealth. This qualification, in turn, had been determined by education, and especially by examinations. China has made literary education the yardstick of social prestige in the most exclusive fashion, far more exclusively than did Europe during the period of the humanists. (…) In China, the literati go back, at least in the main, to the descendants, probably the younger sons, of feudal families who had acquired a literary education, especially the knowledge of writing, and whose social position rested upon this knowledge of writing and of literature. A plebeian could also acquire a knowledge of writing, although considering the Chinese system of writing, it was difficult. But if the plebeian succeeded, he shared the prestige of any other scholar. Even in the feudal period, the stratum of literati was not hereditary or exclusive." Max Weber (1951: 115) also describes the importance of the examination system: "All categories of Chinese civil servants were recruited from certified claimants to office prebends, and their qualification for office and rank depended upon the number of examinations they had successfully passed. These examinations consisted of three major degrees, which were considerable augmented by intermediary, repetitive, and preliminary examinations as well as by numerous special conditions. For the first degree alone there were ten types of examinations. (…) In spite of the ancestor cult, how many ancestors one had was not decisive for social rank. The very reverse held: it depended upon one's official rank whether one was allowed to have an ancestral temple." Max Weber (1951: 121) describes the content of the examinations as follows: "The examinations of China tested whether or not the candidate's mind was thoroughly steeped in literature and whether or not he possessed the ways of thought suitable for a cultured man and resulting from cultivation in literature. (…) All grades were intended as tests in penmanship, style, mastery of the classical writings. (…) It was a highly exclusive and bookish literary education."

A consequence of this high value of education is that Chinese pupils will spent more hours to learn math or reading and value good notes at school more than non-Chinese pupils. This high value is reflected by the existence of shadow education in Asian societies: the use of private lessons next to regular education as a means of increasing educational achievement (Baker, Akiba, le Trendre & Weiseman, 2001). This argument results in three hypotheses: 1. Hours spent on learning math or reading and the importance of good notes at school are higher for Chinese immigrants in all non-Asian countries compared to natives in non-Asian countries, irrespective of whether they speak Chinese at home. 2. Hours spent on learning math or reading and the importance of good school notes are not higher for Chinese-speaking natives in Asian countries than for Chinese-speaking immigrants in non-Asian societies. 3. Hours spent on learning math or reading and the estimated importance of good school grades explain a significant part of the higher math and reading scores of Chinese natives and immigrants in Asian and non-Asian countries.

Data and Variables

The OECD instigated the PISA-project in order to measure how well young adults are prepared to meet the challenges of today's knowledge-based societies when they reach the end of obligatory education (OECD, 2007). To do so, the OECD tri-annually conducts large scale tests among 15-year-olds living in its member states and partner states in order to assess pupils' mathematical, reading, and scientific literacy in a standardized way. In 2006, PISA respondents were asked for the second time to report their country of birth and the birth countries of both of their parents. However, since the OECD has allowed participating countries to vary the level of specificity of which respondents answer the questions regarding their origin countries, pupils' origin countries can only be determined in a limited number of participating countries. Pupils in Scotland could for example select China, India or Middle-Eastern, African, Caribbean and several European countries as their possible countries of birth. Next to Scotland, only pupils in Australia, Austria, Hong Kong, Macau, New Zealand, Portugal, and Taiwan were provided with the explicit question whether they or their parents had been born in a Chinese country (being Mainland China, Taiwan, Macau or Hong-Kong). Our analytic dataset allows distinguishing between two groups from these eight countries: 1. immigrant pupils outside of Asia are those pupils of whom at least one parent was born in China, including Hong Kong, Macau and Taiwan. Inside of Asia, we treat Hong Kong, Macau and Taiwan as 'separate countries' and pupils were coded as 'Chinese immigrants' if at least one parent was born in another part of China than their current country of residence; and 2. native pupils (both parents born in country of residence). We combined all pupils living in Australia, Austria, New Zealand, Portugal, and Scotland into one non-Asian category and those living in Hong Kong, Macau, and Taiwan into the Asian category.

Our dependent variable is the PISA-measurement of *mathematical or reading literacy*. This literacy is measured through a number of items, testing not only the extent to which pupils possess basic mathematical or language knowledge, but also the ability to use this mathematical and language knowledge in encountering and dealing with everyday problems. We used the mean scores on general mathematical and reading literacy as our dependent variables. The OECD mean of these scores is 500, with a standard deviation of 100.

Learning time spent on math or reading. This is a combined scale made by us of total weekly hours spent on learning math or reading in regular lessons, out of school, and self study. *Importance of good notes*. This is a combined scale made by us of the importance of doing well in science, maths, and reading.

First and Second generation immigrants from China. We used information on the countries of birth of both respondents and their parents to construct two dichotomous variables. Pupils who were born in mainland China, Taiwan, Hong Kong or Macau instead of their residence country and of whom at least one of the parents was born in China as well, were defined as first-generation migrants. If the pupils were born in their residence country but at least one of the parents in one of these parts of China, they were coded as second-generation migrants. Natives are students of whom both parents were born in the current country of destination, treating Macau, Hong Kong, and Taiwan as separate countries.

Chinese language spoken at home. Variable based on students' report whether Chinese language is used at home.

We use the three indicators for parental background as constructed by the OECD (2007) that had the strongest explanatory power of educational achievement in

previous analyses of PISA data. These indicators are centralized with an average of zero and a standard deviation of 1.00 for the OECD countries. Adding more or other parental background indicators does not change the results. *PISA Index of cultural possessions at home*. This scale is based on the availability of the following items in the students' home: classic literature, books of poetry, and books of art. *PISA Index of educational resources at home*. This scale is based on the availability of the following items in the students' home: a desk to study at; a quiet place to study; a computer they can use for school work; educational software; their own calculator; books to help with their school work; and a dictionary. *PISA Index of economic, social and cultural status.* This scale combines parental educational level, parental occupational status and home possessions.

Results

Table 1 shows differences between the various combinations in math and reading scores, time spent on learning, and importance of good school notes. Table 2 shows that these differences in reading scores are influenced but not fully explained by differences in parental background characteristics and time spent on learning. These controls hardly change the differences in math scores, though.

The first hypothesis, derived from the higher transparency thesis, is confirmed by table 2. Chinese-speaking natives in Asia have higher math scores than their non-Chinese-speaking counterparts (560, 502). Moreover, Chinese-speaking first generation immigrants in Asia have higher math scores than non-Chinese-speaking first generation immigrants in Asia (550, 536) and Chinese-speaking second generation immigrants in Asia have higher math scores than non-Chinese-speaking second generation immigrants in Asia (562, 533).

The second hypothesis is confirmed by table 2 for the math scores of Chinese-speaking Chinese immigrants in non-Asian countries compared to non-Chinese-speaking Chinese immigrants in non-Asian countries (first generation 548, 535; second generation 577, 565).

According to table 2, the third hypothesis does not hold. Instead of having lower average math scores, second generation Chinese-speaking pupils in non-Asian countries have higher math scores than their first generation counterparts (577, 548). The third hypothesis is also not confirmed for the non-Chinese-speaking second and first generation immigrants in non-Asian countries (565, 535).

It is striking that some of these hypotheses also hold for reading performance. The necessity to memorize at least 3000 characters at a young age before one can read and write Chinese might increase the working memory of Chinese-speaking pupils (Hoosain, 1991) and thus reading scores.

As can be seen from table 1, the first hypothesis derived from the 'high vale of learning' thesis can be confirmed. Irrespective of whether they speak Chinese at home, first and second generation Chinese immigrants outside of Asia spend more hours learning math (Chinese-speaking 7.5, 8.0; non-Chinese-speaking 7.5, 7.7; natives 6.9) and attach a higher importance to obtaining good school notes (Chinese-speaking 8.6, 8.6; non-Chinese-speaking 8.1, 7.7; natives 7.1) than natives in non-Asian countries. With regard to hours learning reading, this hypothesis is only confirmed for the first generation (8.1, 8.2 versus 6.9).

The second hypothesis is also confirmed by table 1. The hours spent on learning math or reading are not higher for Chinese-speaking natives in Asian

countries (math 8.4, reading 7.6) than for Chinese-speaking first and second generation immigrants in non-Asian societies (math 8.6, 8.6; reading 8.1, 7.8), but the reading time of the first generation is significantly higher. Contrary to our hypothesis, the importance of good notes at school is significantly higher among Chinese-speaking immigrants outside of Asia (7.5, 8.0) than among Chinese-speaking natives in Asia (6.7).

The third hypothesis is only partly correct, as table 2 shows. Hours spent on learning math or reading and the estimated importance of good notes at school explains only partly the higher reading score in Asian and non-Asian countries, but not math scores.

Conclusion

Chinese-speaking 15-year-old pupils in- and outside of Asia have higher math and reading scores than comparable non-Chinese-speaking natives in- and outside of Asia. Our cross-national test excludes single country explanations, such as the Chinese 'selective immigrant' or the authoritarian Chinese educational system. The 'high value of learning' thesis explains partly the high reading performance. However, this high value thesis fails to explain math scores of Chinese pupils, and especially if they use the Chinese language at home. The higher transparency of Chinese numbers seems to be an additional explanation of these high math scores of Chinese-speaking pupils in- and outside of Asia, next to the increase in memorizing capacity by learning at least 3000 characters at a young age.

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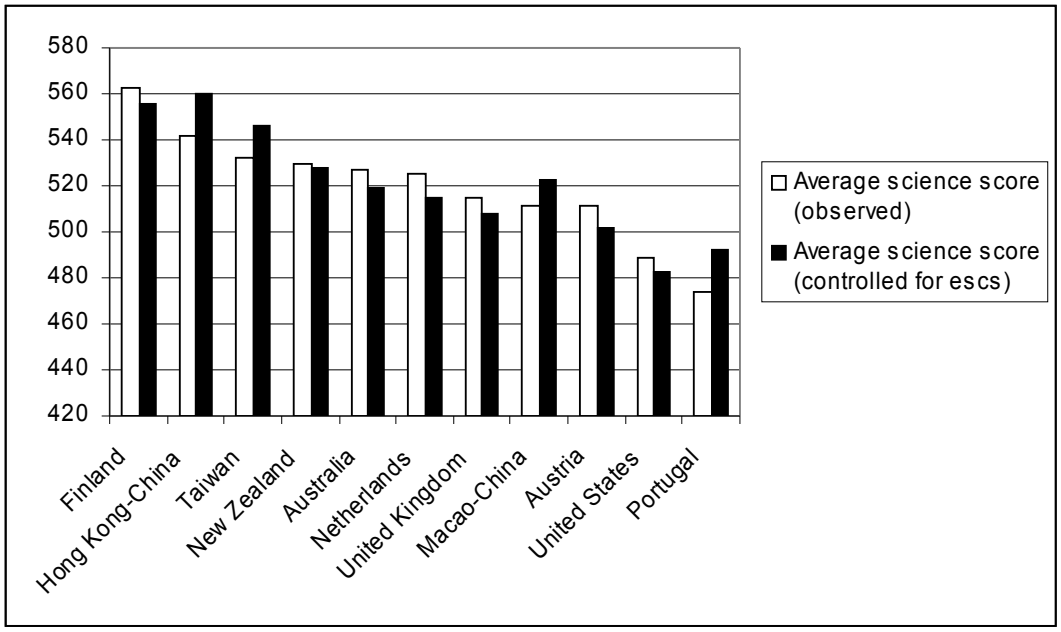

Figure 1. An overview of countries' average science scores in PISA 2006, observed and controlled for their average parental socio-economic and cultural capital (escs). Source: OECD 2007

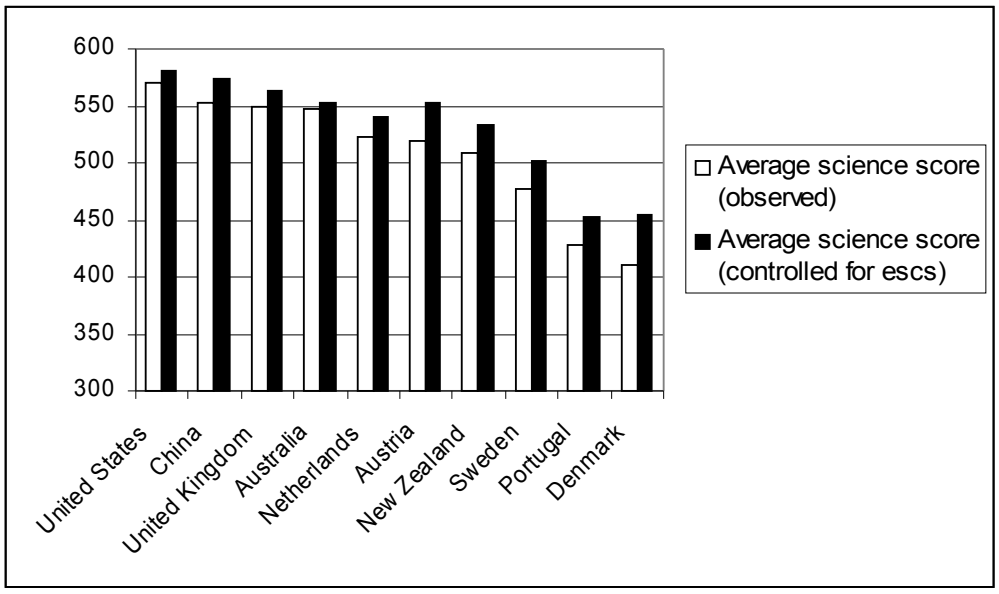

Figure 2. An overview of immigrant groups' average science scores in PISA 2006, observed and controlled for their average parental socio-economic and cultural capital (escs). Source: OECD 2007

Table 1: Math & reading scores, time spent on math and reading, and importance of good notes of natives and Chinese first and second generation immigrants in Asian and non-Asian countries

		Math score	Reading score	Time spent on math	Time spent on reading	Impor-tance good notes
Chinese-speaking natives in Asia	Mean	562[b]	515[b]	8,4[b]	7,6[b]	6,7[b]
	Std. Dev.	91	77	2,4	1,9	1,6
	N	11755	11755	11734	11732	10959
Chinese-speaking first generation Chinese immigrants in Asia	Mean	523[ab]	506[a]	8,3[b]	8,0[ab]	7,0[a]
	Std. Dev.	82	76	2,1	2,0	1,5
	N	1637	1637	1632	1634	1070
Chinese-speaking second generation Chinese immigrants in Asia	Mean	540[ab]	513[b]	8,5[ab]	8,0[ab]	6,8[ab]
	Std. Dev.	80	73	2,0	1,9	1,5
	N	3473	3473	3469	3466	2340
Chinese-speaking first generation Chinese immigrants outside of Asia	Mean	561[b]	524[b]	8,6[b]	8,1[ab]	7,5[ab]
	Std. Dev.	89	106	2,3	2,1	1,5
	N	175	175	175	175	153
Chinese-speaking Second generation Chinese immigrants outside of Asia	Mean	583[b]	560[ab]	8,6[b]	7,8	8,0[ab]
	Std. Dev.	76	75	1,9	1,7	1,1
	N	62	62	62	62	60
No-Chinese-speaking first generation Chinese immigrants in Asia	Mean	504[a]	486[ab]	8,4[b]	8,3[ab]	6,9
	Std. Dev.	74	67	2,3	2,2	1,4
	N	164	164	164	164	103
No-Chinese-speaking second generation Chinese immigrants in Asia	Mean	513[a]	493[a]	8,5[b]	8,1[ab]	6,9
	Std. Dev.	86	83	2,3	2,1	1,3
	N	135	135	133	133	85
No-Chinese-speaking first generation Chinese immigrants outside of Asia	Mean	548[b]	528	8,1[b]	8,2[ab]	7,5[ab]
	Std. Dev.	108	126	2,0	2,5	1,8
	N	50	50	50	50	45
No-Chinese-speaking second generation Chinese immigrants outside of Asia	Mean	565[b]	553[ab]	7,7[ab]	7,3	7,7[ab]
	Std. Dev.	84	86	1,8	1,9	1,1
	N	78	78	78	78	76
No-Chinese-speaking natives in Asia	Mean	494[ab]	465[ab]	7,6[ab]	7,3[ab]	6,6[b]
	Std. Dev.	97	84	2,7	2,2	1,8
	N	501	501	498	499	464
No-Chinese-speaking natives outside of Asia	Mean	509[a]	504[a]	7,1[a]	6,9[a]	6,9[a]
	Std. Dev.	86	94	1,8	1,7	1,5
	N	25931	25931	25697	25696	22006
Total	Mean	526	508	7,6	7,2	6,9
	Std. Dev.	90	88	2,1	1,9	1,6
	N	43961	43961	43692	43689	37361

Source: PISA 2006. Natives are those pupils of whom both parents were born in the test country. First generation pupils were born in China instead of their current country of residence and at least one of their parents was born in China as well. Second generation pupils were born in the test country but at least one of their parents were born in China. [a] Significant difference with Chinese-speaking natives in Asia. [b] Significant difference with no-Chinese-speaking natives outside of Asia

Table 2: Math and reading score, controlled for cultural possessions at home, home educational resources, and index of economic, social and cultural status, and for time spent on learning reading and math

Controlled for	Cultural possessions at home, home educational resources, economic, social & cultural status, and time spent on learning reading and math	
	Math score	Reading score
Chinese-speaking natives in Asia	560 [b]	514 [b]
Chinese-speaking first generation Chinese immigrants in Asia	550 [ab]	532 [ab]
Chinese-speaking second generation Chinese immigrants in Asia	562 [b]	534 [ab]
Chinese-speaking first generation Chinese immigrants outside of Asia	548 [ab]	511
Chinese-speaking Second generation Chinese immigrants outside of Asia	577 [b]	555 [ab]
No-Chinese-speaking first generation Chinese immigrants in Asia	536 [ab]	516 [b]
No-Chinese-speaking second generation Chinese immigrants in Asia	533 [ab]	513
No-Chinese-speaking first generation Chinese immigrants outside of Asia	535 [ab]	513 [a]
No-Chinese-speaking second generation Chinese immigrants outside of Asia	565 [b]	554 [ab]
No-Chinese-speaking natives in Asia	502 [a]	474 [ab]
No-Chinese-speaking natives outside of Asia	507 [a]	503

Source: PISA 2006. Math & reading sores corrected with GLM. [a] Significant difference with Chinese-speaking natives in Asia. [b] Significant difference with no-Chinese-speaking natives outside of Asia

Appendix: Information about the PISA data

Table I: Mean Scores on the five plausible math and reading scores, total time devoted to math and reading, and importance of good notes for native pupils and Chinese immigrant pupils, N of cell & standard deviation

		Math score	Reading score	Math Learning time	Reading learning time	Importance good notes for school
Europe (Austria, Portugal, Scotland)						
No Chinese-speaking						
Mean	native	498	493	7,1	6,6	6,9
N		11283	11283	11169	11169	9604
Std. Deviation		87	94	1,9	1,7	1,6
Mean	1st generation	493	411	8,4	9,2	6,2
N		11	11	11	11	11
Std. Deviation		108	125	2,00	3,4	2,4
Mean	2d generation	523	523	7,6	6,5	7,8
N		12	12	12	12	12
Std. Deviation		85	86	1,4	1,9	0,9
Chinese Language speaking						
Mean	native	537	531	12,0	5,0	6,0
N		1	1	1	1	1
Mean	1st generation	533	575	6,5	6,5	7,5
N		4	4	4	4	4
Std. Deviation		41	146	1,3	2,9	1,0
Mean	2d generation	498	513	7,0	5,0	6,0
N		1	1	1	1	1
Australia & New Zealand						
No Chinese-speaking						
Mean	native	517	513	7,1	7,1	7,0
N		14648	14648	14528	14527	12402
Std. Deviation		85	93	1,7	1,7	1,5
Mean	1st generation	564	562	8,0	8,0	7,9
N		39	39	39	39	34
Std. Deviation		105	107	2.0	2,2	1,3
Mean	2d generation	573	557	7,8	7,4	7,7
N		66	66	66	66	64
Std. Deviation		84	86	1,8	1,8	1,1
Chinese Language speaking						
Mean	native	591	507	7,8	7,8	5,2
N		6	6	6	6	6
Std. Deviation		93	102	2,8	2,8	2,6
Mean	1st generation	561	523	8,6	8,2	7,6
N		164	164	164	164	142
Std. Deviation		90	106	2,3	2,0	1,4
Mean	2d generation	585	560	8,6	7,9	8,0
N		61	61	61	61	59
Std. Deviation		76	75	1,9	1,7	1,1
Hong Kong						
No Chinese-speaking						
Mean	native	492	491	8,5	7,9	7,0
N		100	100	100	100	73
Std. Deviation		99	84	2,5	2,1	1,7
Mean	1st generation	488	491	8,1	7,9	6,9
N		50	50	50	50	32
Std. Deviation		77	73	2,5	2,4	1,4

Mean	2d generation	490	489	9,2	8,6	6,8
N		33	33	32	32	24
Std. Deviation		101	95	2,6	2,1	1,4
Chinese Language speaking						
Mean	native	563	546	8,8	7,8	6,8
N		2317	2317	2315	2314	1988
Std. Deviation		86	75	2,2	1,9	1,6
Mean	1st generation	528	520	8,2	8,0	7,1
N		964	964	963	963	645
Std. Deviation		84	76	2,1	2,0	1,5
Mean	2d generation	562	553	8,7	7,9	6,9
N		1013	1013	1012	1012	849
Std. Deviation		86	72	2,1	1,9	1,6
N		4477	4477	4472	4471	3611
Std. Deviation		88	76	2,1	1,9	1,6
Macau						
No Chinese-speaking						
Mean	native	453	438	7,9	7,7	6,7
N		34	34	34	34	26
Std. Deviation		73	81	3,0	2,7	1,8
Mean	1st generation	511	485	8,6	8,4	6,9
N		114	114	114	114	71
Std. Deviation		72	65	2,2	2,1	1,4
Mean	2d generation	520	494	8,3	8,0	6,9
N		102	102	101	101	61
Std. Deviation		80	80	2,2	2,1	1,3
Chinese Language speaking						
Mean	native	522	485	8,6	8,0	6,7
N		1186	1186	1179	1179	748
Std. Deviation		82	78	2,2	2,1	1,5
Mean	1st generation	516	486	8,5	8,0	6,9
N		673	673	669	671	425
Std. Deviation		79	71	2,2	2,0	1,4
Mean	2d generation	531	496	8,5	8,0	6,8
N		2460	2460	2457	2454	1491
Std. Deviation		77	68	2,0	1,9	1,5
Taiwan						
No Chinese-speaking						
Mean	native	498	460	7,4	7,1	6,5
N		367	367	364	365	365
Std. Deviation		97	83	2,7	2,2	1,8
Chinese Language						
Mean	native	568	510	8,2	7,5	6,7
N		8252	8252	8240	8239	8223
Std. Deviation		92	75	2,4	2,0	1,6

Source: PISA 2006. Natives are those pupils of whom both parents were born in the test country. First generation pupils were born in China instead of their current country of residence and at least one of their parents was born in China as well. Second generation pupils were born in the test country but at least one of their parents were born in China.

Table II presents the Cronbach's alpha for the scales *Total learning time math or reading* and *Importance good notes for school*. Both the Cronbach's alpha for the total scale and the Cronbach's alpha if a particular item would be deleted from the scale are shown. Moreover, this Cronbach's alpha is computed for each country and their natives and Chinese immigrants separately. As we can see from the table, self study is the most important variable of the scale *total learning time math* and the *total learning time reading* scale. The scales have acceptable Cronbach's alphas in all

combinations of countries, Chinese immigrants and natives, although they are not very high. Doing well in math is the most important item in the scale *Importance good notes for school*. However, the scale has acceptable Cronbach's alphas in all combinations of countries, Chinese immigrants and natives. Hong Kong, though, can be seen as the exception since performing well in language is not fitting well in the scale. More generally speaking, *Importance good notes for school* refers mostly to math.

Table II: Cronbach's Alpha (for the total scale and if the item deleted) of the three scales for each country and their natives and Chinese immigrants separately

	Europe		Australia & New Zealand		Hong Kong		Macau		Taiwan
	native	Immigrant from China	native	Immigrant from China	native	Immigrant from China	native	Immigrant from China	
Math									
regular lessons	.41	.64	.48	.56	.46	.41	.36	.40	.48
out of school	.53	-.04	.44	.38	.44	.50	.46	.39	.55
self study	.30	-.02	.09	.12	.25	.23	.16	.08	.40
Total	.52	.36	.45	.49	.49	.49	.43	.40	.58
Language									
regular lessons	.45	.88	.52	.47	.57	.46	.54	.50	.31
out of school	.40	.74	.39	.24	.30	.40	.34	.31	.44
self study	.22	.59	.06	.21	.08	.11	.06	.08	-.01
Total	.46	.82	.44	.42	.42	.43	.43	.41	.36
Do well in									
Science	.45	.66	.54	.40	.40	.53	.43	.35	.38
Maths	.05	.35	.20	.19	-.16	-.01	.13	.02	.17
Language	.42	.67	.47	.43	.52	.49	.50	.58	.61
Total	.41	.67	.50	.43	.37	.44	.47	.45	.51

Source: PISA 2006.

Table III: Cultural Possessions at home, Home educational resources, Index of economic, social & cultural status of natives and Chinese first and second generation immigrants in Asian and non-Asian countries

	Cultural possessions at home	Home educational resources	Index of economic, social & cultural status
Chinese-speaking natives in Asia	0,04	-0,32	-0,28
Chinese-speaking first generation Chinese immigrants in Asia	-0,51	-0,25	-1,13
Chinese-speaking second generation Chinese immigrants in Asia	-0,44	-0,34	-1,01
Chinese-speaking first generation Chinese immigrants outside of Asia	-0,15	0,13	0,19
Chinese-speaking Second generation Chinese immigrants outside of Asia	-0,33	0,07	-0,14
No-Chinese-speaking first generation Chinese immigrants in Asia	-0,58	-0,50	-1,19
No-Chinese-speaking second generation Chinese immigrants in Asia	-0,30	-0,44	-0,86
No-Chinese-speaking first generation Chinese immigrants outside of Asia	0,02	0,12	0,35
No-Chinese-speaking second generation Chinese immigrants outside of Asia	-0,33	0,06	-0,10
No-Chinese-speaking natives in Asia	-0,10	-0,45	-0,39
No-Chinese-speaking natives outside of Asia	-0,08	0,11	0,05
Total	-0,10	-0,07	-0,18

Source: PISA 2006