

Comments on

“Advanced Cognitive Skill Deserts in the U.S.”

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Brookings Papers on Economic Activity
Spring 2021 Conference

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There is a lot to like in this paper!

- Focus on adolescence
 - Useful antidote to the recent focus on early children
 - I looked forward to reading the “predecessors” to this paper
- Focus on the importance of geography
 - In line with other work emphasizing place (e.g., Opportunity Insights)
- Focus on “advanced” cognitive skills
 - Interesting and different than related work. But necessary?

Are “advanced cognitive skills” the key, conceptually or empirically?

- Cognitive skills?
 - How highly correlated is county-level % BA with county-level PIACC measure?
 - How about other proxies for socioeconomic status?
- Is the distinction “advanced” important empirically?
 - How important is it to consider the proportion in the top of the (national) distribution?
 - Empirically, the correlation between the average test scores in an area and the proportion scoring “advanced” is extremely high (e.g., NAEP, SEDA).
- Conceptually, what exactly do we mean by “advanced”?
 - How does this intersect with what we describe as general versus specific skills?
 - Does the argument require the return to cognitive skill to be nonlinear?

PIAAC – Example low difficulty numeracy item

Respondents are asked to type in a numerical response based on the graphic provided.


OECD PIAAC

Look at the thermometer. Using the number keys, type your answer to the question below.

If the temperature shown decreases by 30 degrees Celsius, what would the temperature be in degrees Celsius (°C)?

 °C

PIAAC – Example medium difficulty item


 OECD PIAAC

Look at the graph about the number of births. Click to answer the question below.


During which period(s) was there a decline in the number of births? Click all that apply.

- 1957 - 1967
- 1967 - 1977
- 1977 - 1987
- 1987 - 1997
- 1997 - 2007

The following graph shows the number of births in the United States from 1957 to 2007. Data are presented every 10 years.



Year	Number of Births
1957	4,300,000
1967	3,520,959
1977	3,326,632
1987	3,809,394
1997	3,880,894
2007	4,315,000



PIAAC – Example medium (level 4?) difficulty item

OECD PIAAC Section _4

Unit 11 - Question 1/1

Read the article about wind power stations. Using the number keys, type your answer to the question below.

How many wind power stations would be needed to replace the power generated by the nuclear reactor?

Wind Power Stations

In 2005, the Swedish government closed the last nuclear reactor at the Barsebäck power plant. The reactor had been generating an average energy output of 3,572 GWh of electrical energy per year.



Work continues in Sweden on installing large offshore wind farms using wind power stations. Each wind power station produces about 6,000 MWh of electrical energy per year.

For your information:

Electrical energy is measured in Watt hours (Wh)

1 kWh	= 1 kilo Wh	= 1,000 Wh
1 MWh	= 1 Mega Wh	= 1,000,000 Wh
1 GWh	= 1 Giga Wh	= 1,000,000,000 Wh

What happens in adolescence?

- The paper establishes that
 1. Cognitive ability is malleable
 2. There is substantial variation in children's advanced skills across counties as early as age 8 (grade 3)
 3. At the geographic level, variation in child skill is associated with measures of adult cognitive skill (and likely other measures like BA attainment, etc.)
 4. Correlation between child and adult skill increases during adolescence
- I agree with these findings at a broad level, but suggest caution with regard to some details

Statistical challenges of quantifying cognitive test score relationships

- Measurement error and scaling make it difficult to interpret magnitudes
 - change in variation of child ability
 - change in correlation btw child-adult skill
- Greater measurement error in early age exams would lead to larger measured correlation at older ages
- We use test scores as interval scales when they are really ordinal
 - Any monotonic transformation of the test score scale can be valid
 - Prior research suggests this could make a big difference in applied settings (Bond and Lang, 2013)

An simple example of scaling and the Black-White test score gap (Bond & Lang, 2013)

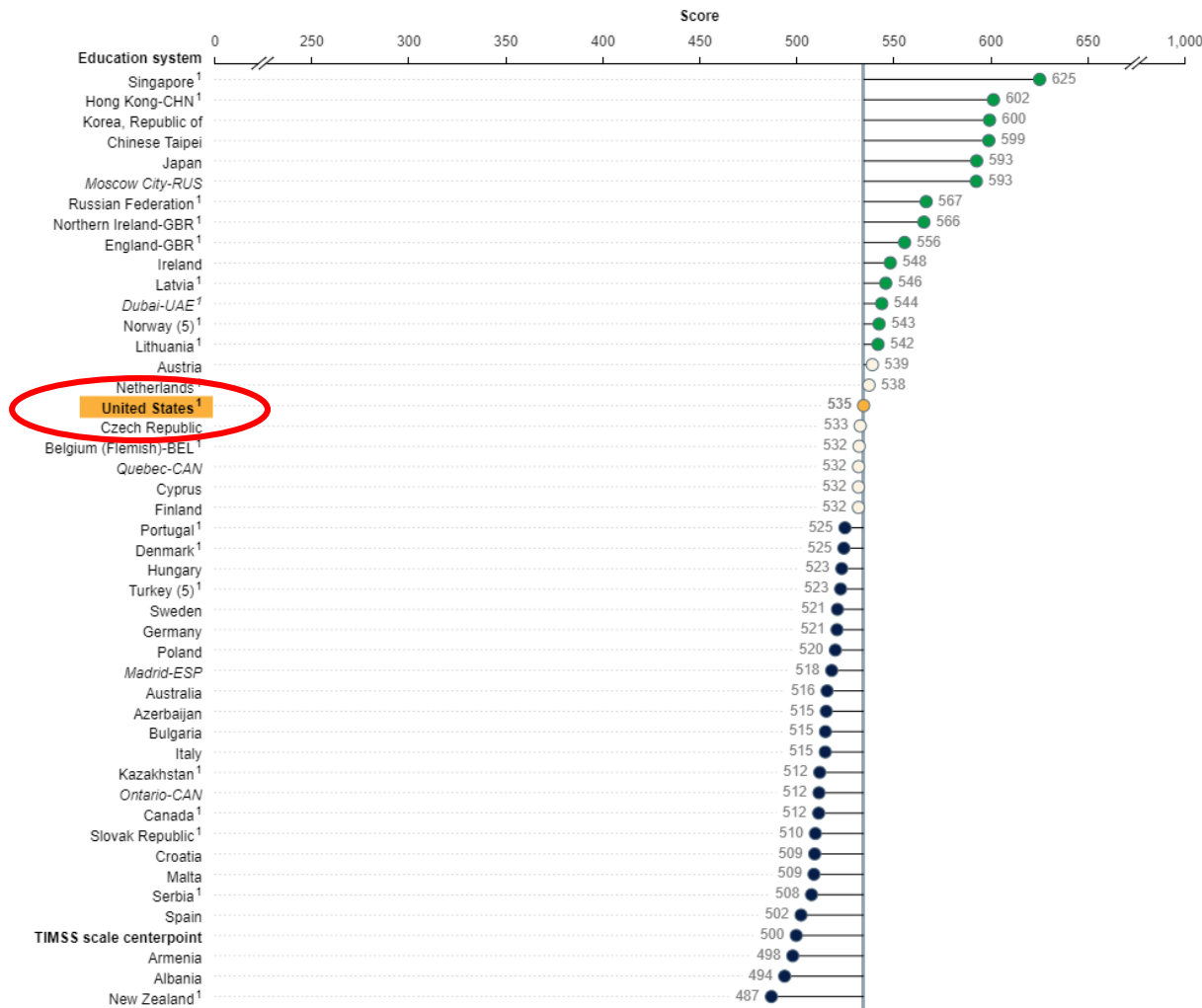
- As $\text{diff}(a,b)$ gets smaller, test score gap goes to 0
- Even worse when one considers changes over time
- Using ECLS-K, Bond and Lang (2013) study change in the B-W test score gap from K to Gr3
- Can range from 0 to 0.6 SD under reasonable transformations

Test of 3 progressively difficult skills (a, b and c)

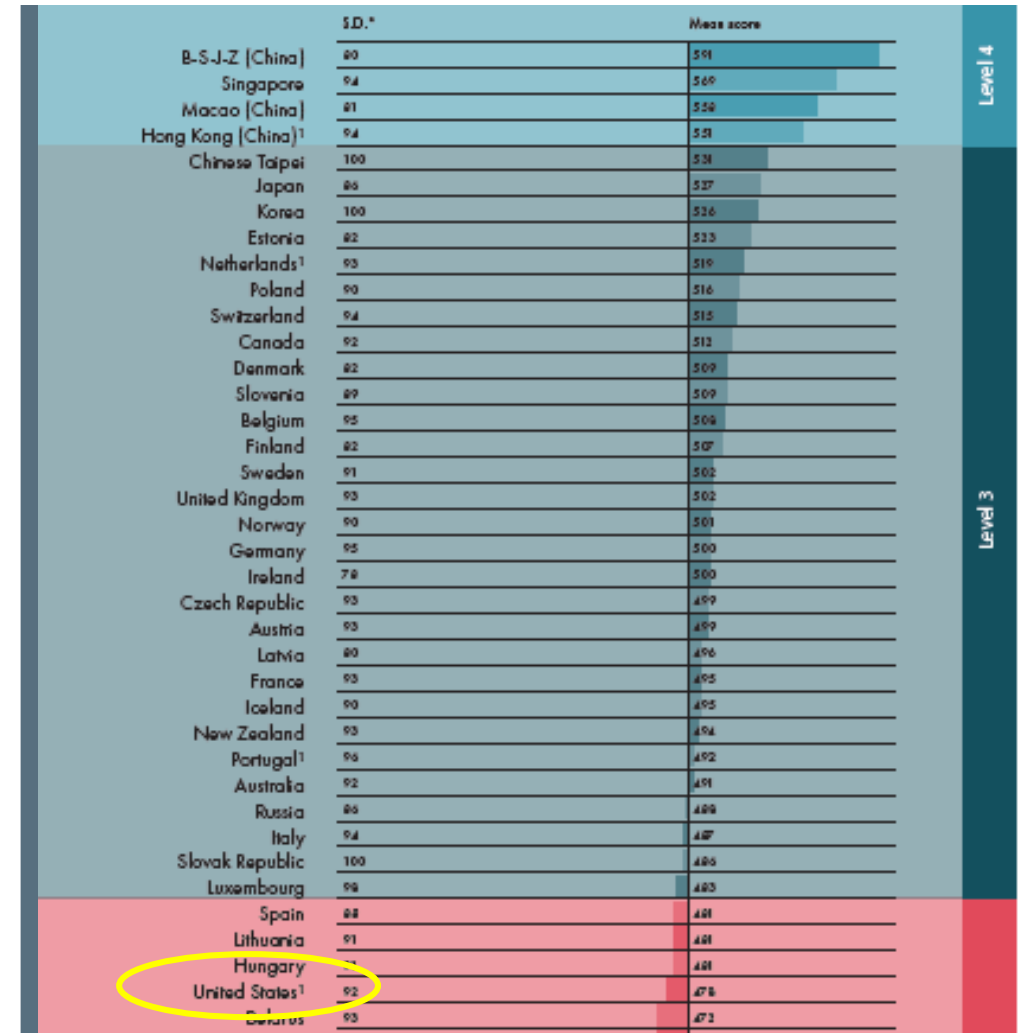
Child	Race	Score, t=1	Score, t=2
1	Black	0	1
2	Black	2	3
3	White	1	2
4	White	2	3
Gap	Raw	0.5	0.5
	St Dev	0.60	

Yet, relative to other countries, U.S. academic performance declines with age (consistent with paper)

9-year-olds (TIMSS)



15-year-olds (PISA)



What causes the correlation to increase in adolescence?

- Factors in the school system
 - Teacher quality, accountability, funding
 - Note: assumes these factors have differential “effect” on older vs. younger children
- Factors outside the school system
 - Lots of changes taking place in adolescence beyond pruning of synapses in the frontal lobe and myelination 😊
 - James Coleman, ***The Adolescent Society*** (1961)
 - “...an adolescent culture which shows little interest in education and focuses the attention of teenagers on cars, dates, sports, popular music, and other matters just as unrelated to school”

How can we learn more about this critical period?

- Look at developmental trajectories separately by gender, socioeconomic status, race and region
 - Evidence that boys are more susceptible to environmental influences
 - Separate in-home vs. out-of-home factors?
- Deeper dive into certain geographic areas exhibiting unexpected patterns
 - Southern border
- Experimental evaluations of interventions targeted on adolescents

Some exploratory analyses with county-level data

Outcome = gaps in mean scores, standardized metric, common across all counties (source: SEDA)

	Male-Female Gap		White-Black Gap	
	Math	ELA	Math	ELA
Fraction with BA+	0.017	-0.17	1.24	1.15
	(0.001)	(0.038)	(0.19)	(0.20)
Grade	-0.015	-0.016	-0.009	0.001
	(0.041)	(0.002)	(0.003)	(0.004)
Grade * BA+	0.011	0.016	0.027	-0.003
	(0.007)	(0.007)	(0.017)	(0.018)
Constant	0.06	-0.11	0.46	0.42
	(0.01)	(0.01)	(0.04)	(0.04)

- Boys performance declines relative to girls from grades 3-8
- Decline is largest in counties with lower educational attainment
- White-Black gap is larger in counties with higher educational attainment
- No clear patterns by grade

Potential Solutions

- Consider interventions outside as well as inside formal schooling
- Think harder about how we define advanced skills, and how this intersects with what we think of as general versus specific skills
- Growing evidence on the benefits of career-technical education in high school (in short-to-medium run)