

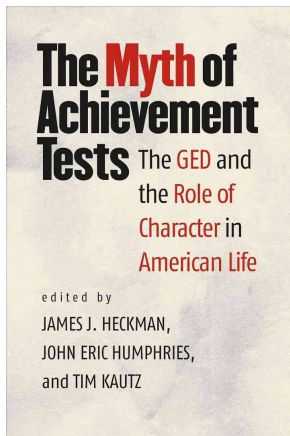
Advances in Measuring Non-Cognitive Skills

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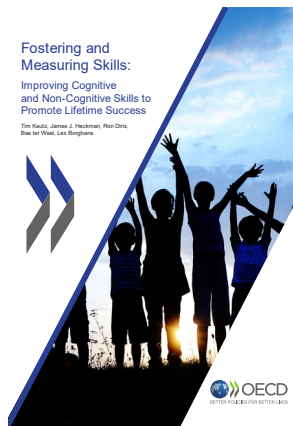
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- We have come to focus on achievement test scores to assess students, teachers, and schools (and even countries)
- Achievement tests miss important non-cognitive skills that can be shaped through interventions and required for success in school and beyond (Kautz, Heckman, Diris, ter Weel, and Borghans, 2014)
- Key policy-makers and organizations are planning to measure non-cognitive skills at a large-scale but there are challenges
- Recent advances in measurement provide some solutions to these challenges relevant for international use

- ① Why measure non-cognitive skills?
- ② Traditional approaches to measuring non-cognitive skills
- ③ Challenges and advances in measuring non-cognitive skills



James J. Heckman, John E. Humphries, and Tim Kautz (2014). *The Myth of Achievement Tests: The GED and the Role of Character in American Life*. Chicago, IL: University of Chicago Press.



Tim Kautz, James J. Heckman, Ron Diris, Bas ter Weel, Lex Borghans (2014). Fostering and Measuring Skills Improving Cognitive and Non-cognitive Skills to Promote Lifetime Success. *OECD Education Report*.

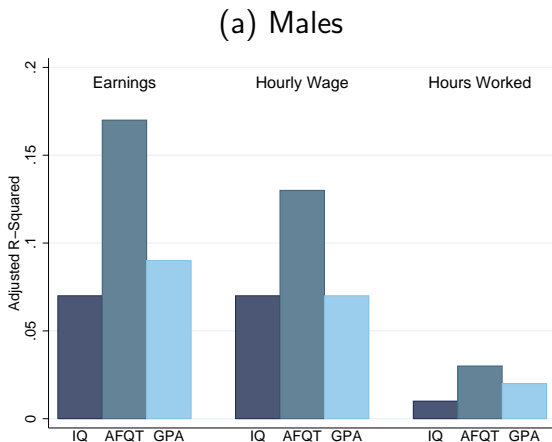
1. Why measure non-cognitive skills?

- 1 IQ and achievement tests miss important skills
- 2 Non-cognitive skills predict important long-term outcomes
- 3 Non-cognitive skills are malleable and can be improved through interventions

(1) IQ and Achievement tests miss non-cognitive skills

- We have come to place great emphasis on cognitive tests (Heckman and Kautz, 2014)
- But these tests are not all that predictive of later life outcomes

Figure 1: Validities of Cognitive Measures in Age-35 Labor Market Outcomes (Adjusted R-Squared)



Source: Heckman and Kautz (2012) using the National Longitudinal Survey of Youth (NLSY79)

(2) Non-cognitive skills predict important life outcomes

- A common measurement system is the “Big Five” (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism)
- Conscientiousness – the tendency to be organized and complete tasks – is the most predictive across a wide variety of outcomes

Figure 2: Association of the Big Five and Intelligence with Years of Schooling in GSOEP

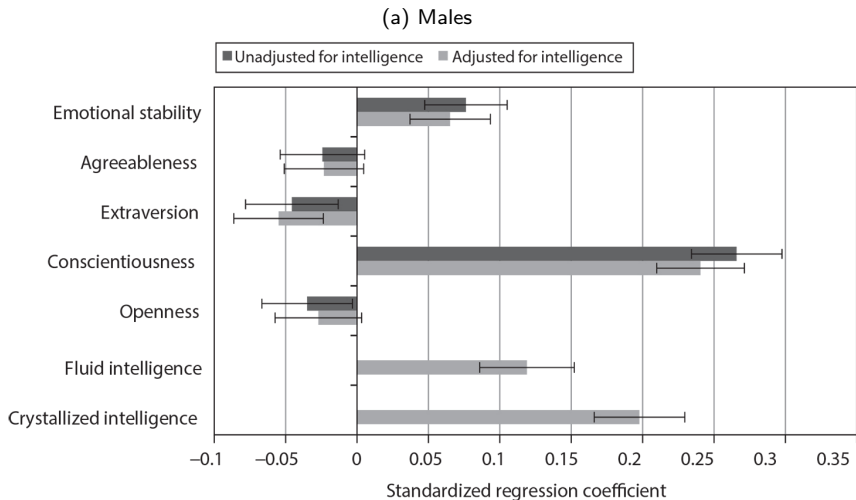
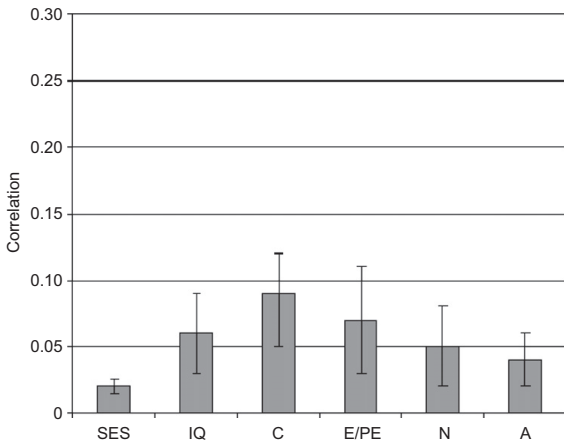


Figure 3: Correlations of Mortality with Non-Cognitive Skills, IQ, and Socioeconomic Status (SES)



Source: Roberts, Kuncel, Shiner, Caspi, and Goldberg (2007).

(3) Non-cognitive skills are malleable and can be improved through interventions

- IQ becomes relatively rank stable by age 10 while non-cognitive skills are more variable (Almlund, Duckworth, Heckman, and Kautz, 2011)
- Neuroscience shows that this malleability is associated with the slow development of the prefrontal cortex (Walsh, 2005)
- Consistent with review of the intervention literature (Kautz, Heckman, Diris, ter Weel, and Borghans, 2014)
 - Only interventions that started before age 3 had a long-term effect on IQ
 - Many interventions starting after age 3 have effectively improved outcomes by improving non-cognitive skills
 - Adolescent interventions that teach personality skills in the workplace (or specific context) are promising

2. Traditional approaches to measuring non-cognitive skills

- Self-reports are a primary method of measuring non-cognitive skills
- The “Big Five” is a relatively well-accepted taxonomy

Table 1: The Big Five Traits

OCEAN

	Trait	Definition of Trait
I.	<u>O</u> penness to Experience	The tendency to be open to new aesthetic, cultural, or intellectual experiences.
II.	<u>C</u> onscientiousness	The tendency to be organized, responsible, and hardworking.
III.	<u>E</u> xtraversion	An orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability.
IV.	<u>A</u> greeableness	The tendency to act in a cooperative, unselfish manner.
V.	<u>N</u> euroticism	Neuroticism is a chronic level of emotional instability and proneness to psychological distress. Emotional stability is predictability and consistency in emotional reactions, with absence of rapid mood changes.

- I see myself as someone who tends to be lazy
- Rating scale: 1 – “strongly agree”, 5 – “strongly disagree”

3. Challenges and advances in measuring non-cognitive skills

- All psychological measurements are based on performance on a task (Heckman and Kautz, 2012)
- An interpretive problem lies at the heart of any psychological measurement system for any particular trait
- It is necessary to standardize for incentives and the effects of other traits in performing a task

Figure 4: Determinants of Task Performance

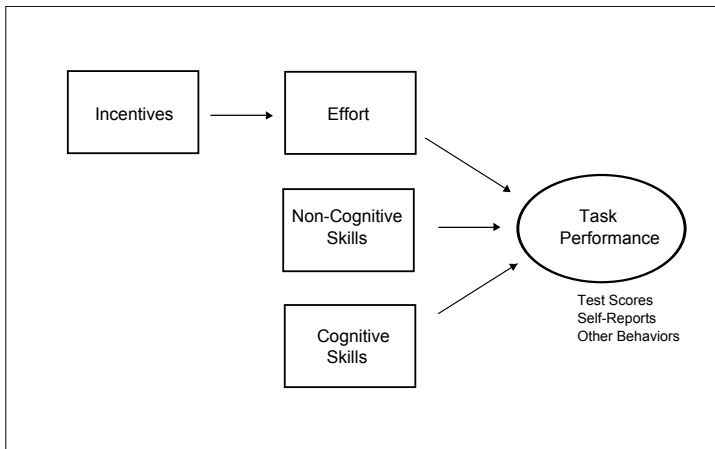
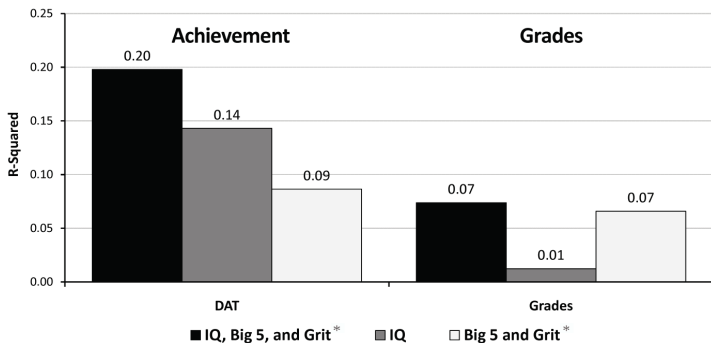


Figure 5: Decomposing Variance Explained for Achievement Tests and Grades into IQ and Character: Stella Maris Secondary School, Maastricht, Holland

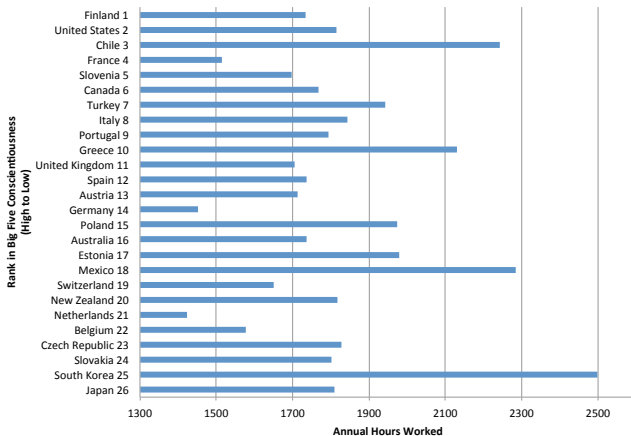


Source: Borghans, Golsteyn, Heckman, and Humphries (2011). *Note:* Grit is a measure of persistence on tasks (Duckworth, Peterson, Matthews, and Kelly, 2007).

- Can boost IQ by 15 points by giving candies for correct answers — the Black/White gap in IQ in U.S
- Segal (2012) shows that introducing performance-based cash incentives in a low-stakes administration of a measure of IQ increases performance substantially among roughly one-third of participants.

- Respondents rate themselves relative to their peers rather than the population at large
- Reference bias can be especially problematic if comparing across different contexts (e.g. between countries and schools)
- A form of a situation (peer group) affecting measurement

Figure 6: National Rank in Big Five Conscientiousness and Average Annual Hours Worked



Source: The Conscientiousness ranks come from Schmitt, Allik, McCrae, and Benet-Martínez (2007). These measures were taken in 2001 (Schmitt, 2002). The hours worked estimates come from Organisation of Economic Cooperation and Development (2001). Notes: Several countries are omitted due to lack of data.

- Anchoring vignettes are an additional question that helps to standardize the situation
- Describe a situation and ask the respondent to rate performance

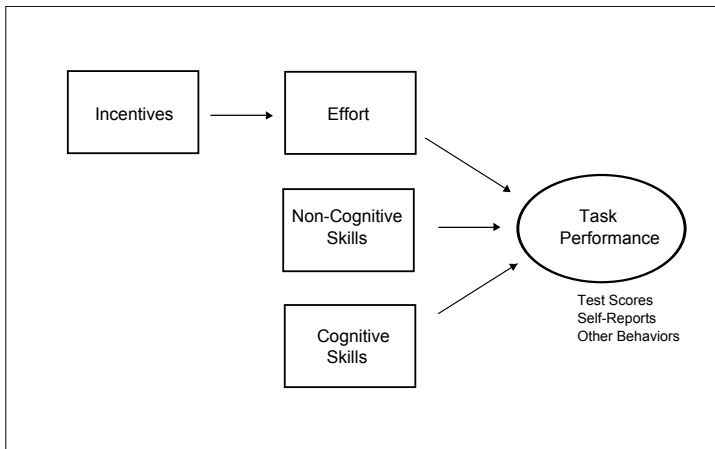
“Aline leaves her belongings in a mess, hates cleaning the house, and usually doesn’t complete her homework.”

How organized do you think Aline is?

(1) Not at all (2) A little (3) Moderately (4) Very much (5)
Completely

- Kyllonen and Bertling (2013) demonstrates that including anchoring vignettes changes a cross-country relationship between teacher support and achievement from -0.45 to 0.29 in PISA 2012

Figure 7: Determinants of Task Performance

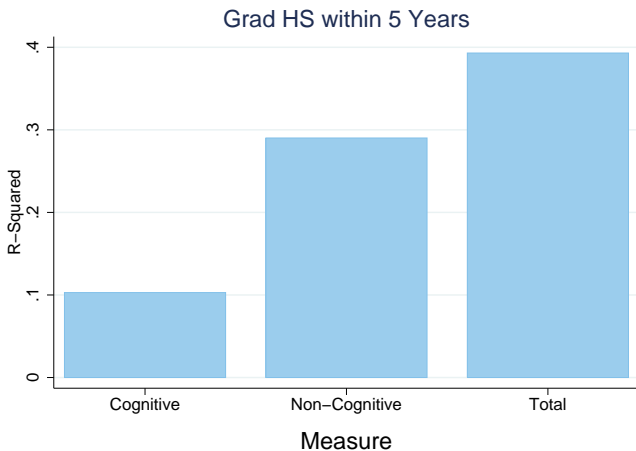


- Measures traditionally viewed as “outcomes” contain information on non-cognitive skills
- “Real-world” non-cognitive skill measures: grades, absences, credits earned, disciplinary infractions
- Highly predictive of later behavior

Table 2: Predictive Validity (R^2) from Ninth-Grade Measures on Various Outcomes

Outcome	Ninth-Grade Measure					
	Explore Test	GPA	Credits	Absences	Discipline	All
ACT Score (Grade 11)	0.78	0.22	0.05	0.10	0.02	0.79
GPA (Grade 11)	0.21	0.49	0.28	0.20	0.05	0.52
Absences (Grade 11)	0.09	0.22	0.12	0.35	0.03	0.39
Arrested within 4 Years	0.06	0.14	0.12	0.10	0.10	0.20
Grad HS within 5 Years	0.11	0.35	0.36	0.23	0.06	0.41
Enroll College within 6 Years	0.15	0.20	0.16	0.12	0.03	0.25
Grad College within 10 Years	0.17	0.17	0.07	0.09	0.01	0.23

Figure 8: Predictive Validity of Cognitive and Non-Cognitive Skill for High School Graduation



- Non-cognitive skills predict outcomes and are malleable
- There are challenges with implementing traditional measures of non-cognitive skills at scale
- Recent advances suggest some promising methods to address the challenges

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