"STEM Talent and Competitiveness: Evidence from a Professional Academy"

Ander Palacios-Saracho* Julene Palacios-Saracho

September 6, 2024

Short Abstract

Discovering and nurturing individuals with high potential to excel ("talent"), particularly in STEM fields, at an early stage is critical for scientific progress, innovation, and growth. These issues are also central to key debates in educational and public policy.

We report the results of repeated interventions conducted in a professional sports academy devoted to developing athletes. In this academy, coaches with varying degrees of *competitiveness* (Niederle and Vesterlund (2007)) are *randomly* assigned each year (from 2011 to 2023) to coach teams of subjects (men and women, ages 10-22, ≈25 subjects per team, 20 teams), each with different levels of competitiveness themselves. The initial results show that competitiveness is malleable, but only up to a certain age. Moreover, coaches with higher levels of competitiveness tend to increase their players' competitiveness after a certain age, and this leads to positive outcomes.

However, the main findings are both unexpected and unintended from the perspective of the academy, though they hold significant implications for educational and public policy. Specifically:

(1) Greater competitiveness in this setting *also* generates a strong and significant *improvement* in *academic* performance *before college*, particularly for students who struggled at baseline. For the pooled set of subjects, a one standard deviation increase in competitiveness results in a 0.171 standard deviation increase in test scores. Thus, competitiveness functions as a general non-cognitive skill that positively impacts schooling performance.

(2) A greater willingness to compete makes subjects *more likely* to *attend* university at age 18 and score higher on college entrance exams.

(3) Interestingly, when it comes to college choices, the response is not uniform: the greater preference for competition makes subjects more likely to *choose STEM degrees*. For example, those who become the more competitive subjects are 7.1 percentage points (or 12.6 percent) more likely to enroll in STEM fields.

(4) Women's responses in all of these dimensions are significantly greater than men's, across all ages.

---

* Corresponding Author: a.palaciossaracho@gmail.com . University of Deusto and University of Oxford.

Extended Abstract

We report on a study conducted between 2011 and 2023 involving over 500 individuals (men and women) identified as talented at the age of 10 and selected to join an academy focused on talent development in professional sports. This academy experimentally measures the *competitiveness* of these individuals annually before some transition to professional careers. Additionally, it assesses the competitiveness of their coaches (>55 coaches, with 1-3 per team), whose role is to mentor and train these individuals. The longitudinal dataset, which tracks individuals repeatedly throughout childhood and adolescence, includes detailed experimental measures of competitiveness, as well as demographic, behavioral (e.g., risk aversion, cognitive variables), and educational performance data.

A key advantage of this setting is the ability to study the effectiveness of "competitiveness interventions" in nurturing talent in a *causal manner*. This is possible because coaches with varying levels of competitiveness are assigned to different teams for *exogenous reasons*, year by year. As a result, subjects receive training from coaches with different competitiveness profiles, and this variation is exogenous.

We obtain two sets of results:

1. The first set (arguably more specific to this setting and possibly less relevant for the talent and human capital literature in economics) pertains to sports. In summary:

- Competitiveness influences both the selection of individuals at an early age (age 10) and their performance (from ages 10 to 22) through to professionalism.

- Subjects' preferences for competition are *malleable*, but only up to a certain age.

- While increases in competitiveness have *positive* effects after a certain age, they may have *negative* consequences in earlier years.

These findings highlight the importance of studying the impact of competitiveness on the processes of discovering and nurturing talent before individuals enter the professional market in this setting.

2. The second and main set of results pertains to the literature on talent and human capital formation. A critical aspect of this literature is identifying new interventions to nurture talent, measuring the effectiveness of these interventions, and exploring the interplay between talent and human capital accumulation. This paper relates to three strands of literature:

A. *Non-Cognitive Skills*. An extensive and important body of work by James Heckman and his coauthors demonstrates that skills accumulated in early childhood complement later learning and that non-cognitive skills are crucial in these dynamic complementarities. Much research emphasizes that the importance of non-cognitive skills arises from their complementarity with cognitive skills and attitudes toward learning. Non-cognitive skills not only predict achievement test scores but also influence other outcomes beyond their direct impact on these tests.

B. *Competitiveness*. This concept can be intuitively defined as a trait that captures an individual's attitude toward competition, a preference for competition, or simply a propensity to favor competitive environments or options. It is broadly recognized as an intangible skill that plays a key role in success, training, motivation, and decision-making. Modern research on competitiveness began with the influential paper by Niederle and Vesterlund (*QJE*, 2007). In recent years, competitiveness has been found to be an important determinant of various choices and outcomes, including labor market differences between men and women, post-compulsory education choices, job entry decisions, wage expectations, and health. It is relevant in many settings, including academic and professional fields, business, and entrepreneurship.

C. *Physical Exercise and Educational Achievements: Complements or Substitutes?* A growing concern in education policy across many countries is that physical education is no longer considered a critical component of schooling. The lack of physical activity may contribute to poor health, obesity, and, importantly, a *decline* in academic performance (U.S. Department of Health and Human Services, 2010). Physical activity can improve academic performance by enhancing psychological health, fostering habit formation, and promoting changes in the brain that support cognitive function and learning. Consistent with these mechanisms, Cappelen et al. (*Journal of Political Economy*, 2024, forthcoming) report results from a randomized controlled trial (RCT) showing that incentivizing physical exercise improves academic performance among college students. It turns out that the intervention not only increases physical activity, as expected, but more importantly, generates a strong and significant *improvement in academic performance*, particularly for students with poorer lifestyle habits.

From the perspective of these three literatures, we investigate whether an intervention that focuses on a non-cognitive skill (willingness to compete) and involves physical activity can impact academic performance (without increasing physical activity). Moreover, we examine to what extent this effect occurs, for whom it is most pronounced, when, and whether it is uniform across genders and fields of study in college. The results show that:

(1) A greater competitiveness in this setting *also* generates a strong and significant *improvement* in *academic* performance *before college*, particularly for students who struggled at baseline. For the pooled set of subjects, a one standard deviation increase in competitiveness results in a 0.171 standard deviation increase in test scores.

(2) A greater willingness to compete makes subjects *more likely* to *attend* university at age 18 and score higher on college entrance exams.

(3) Interestingly, when it comes to college choices, the response is not uniform: the greater preference for competition makes subjects more likely to *choose STEM degrees*. For example, those who become the more competitive subjects are 7.1 percentage points (or 12.6 percent) more likely to enroll in STEM fields.

(4) Women's responses in all of these dimensions are significantly greater than men's, across all ages.

Finally, we note that these results were both unexpected and unintended from the perspective of the academy, whose sole goal was to improve athletic talent. However, the fact that we can demonstrate a strong causal effect of this intervention on academic performance and college enrollment—particularly for women and in the choice of STEM degrees—indicates its potential for informing educational and public policy.

Given the critical importance of education and human capital in our complex society, we believe these findings offer a promising avenue for future policy interventions. Several open questions remain, especially regarding women and STEM fields.

SELECTED REFERENCES

Cappelen, Alexander W., Gary Charness, Mathias Ekström, Uri Gneezy, Bertil Tungodden. "Exercise Improves Academic Performance" *Journal of Political Economy*, 2024, forthcoming.

Cunha, Favio, James J. Heckman and Susanne M. Schennach. 2010. "Estimating the Technology of Cognitive and Non-Cognitive Skill Formation." *Econometrica* 78 (3): 883–931.

Heckman, J. J., Jagelka, T., & Kautz, T. 2021. Some Contributions of Economics to the Study of Personality. In O. P. John & R. W. Robins (Eds.), *Handbook of Personality: Theory and Research*, pp. 853–92. Guilford Press.

Heckman, James J., Jora Stixrud and Sergio Urzua. 2006. "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior." *Journal of Labor Economics* 24, 411–482.

Heckman, James J. and Tim Kautz. 2012. "Hard Evidence on Soft Skills." *Labour Economics* 19(4): 451–464.

Heckman, James J. and Tim Kautz. 2014. "Fostering and Measuring skills: Interventions that Improve Character and Cognition." In J. J. Heckman, J. E. Humphries, and T. Kautz (Eds.), *The Myth of Achievement Tests: The GED and the Role of Character in American Life*, pp. 341–430. University of Chicago Press

Kautz, Tim, James J. Heckman, R. Diris, B. ter Weel, L. Borghans. 2014. *Fostering and Measuring Skills: Improving Cognitive and Non-Cognitive Skills to Promote Lifetime Success* (OECD, Paris, France).

Kautz, Tim and Wladimir Zanoni. 2023. "Measuring and Fostering Non-Cognitive Skills in Adolescence: Evidence from Chicago Public Schools and the One Goal Program." *Journal of Human Capital*, forthcoming

Lüthi, Samuel and Stefan C. Wolter. 2023. "Is being competitive always an advantage? Competitiveness, gender, and labour market success." *Labour Economics* 85, 102457.

Niederle, M. and L. Vesterlund. 2007. "Do Women Shy Away from Competition? Do Men Compete Too Much?" *Quarterly Journal of Economics* 122 (3): 1067–101.

Niederle, M. and L. Vesterlund. 2011. "Gender and Competition." *Annual Review of Economics* 3 (1): 601–30.

Niederle, M. 2017. "A Gender Agenda: A Progress Report on Competitiveness." *American Economic Review: Papers & Proceedings* 107(5): 115–119

U.S. Department of Health and Human Services. (2010). *The Association between School-Based Physical Activity, Including Physical Education, and Academic Performance.* Atlanta, GA.