Literacy Versus Ethnicity as a Proxy for National IQ

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This study converts literacy rates into IQ scores based on their relationship in countries for which both measures are available; and, validates the same for countries for which direct measurements of National IQ are not available. Two tests are performed: the first for the period 2009-2012 (using Lynn and Meisenberg's IQ data), and the second for the period 2013-2016 (using Altinok, Angrist and Patrinos' Scholastic Achievement data). In both tests, the literacy rate-based IQ scores outperform Lynn and Vanhanen's ethnicity-based interpolations of National IQ in explaining GDP per capita. Indeed, the literacy-based IQ scores reduce the explanatory power of the ethnicity-based IQ scores to marginal significance. These results question the continued use of ethnicity-based IQ data in transnational studies.

Keywords: IQ, IQ proxies, literacy rate

INTRODUCTION

As defined by the United Nations Educational, Scientific and Cultural Organization (UNESCO), literacy is the ability to read a simple sentence in any language. It, or something like it, has been periodically measured in almost all countries by census and large surveys, at least until universal literacy was achieved in particular countries. For prior times, literacy has been inferred from signatures, sale of written materials and other quantitative measures, as well as inferred using non-quantitative methods (Graff, 1987). By the end of the 19th Century, universal literacy was achieved in the countries of northern Europe and selected other countries. During the 20th Century, literacy rates increased in many other countries. Even so, universal literacy has not yet been achieved in many countries.

Figures 1 and 2 show the relationship between literacy rates and well-established measures of cognitive ability. Figure 1 gives the relationship between literacy rates from data collected during 2009 to 2012 and National IQ, for 94 countries. In this figure, National IQ is calculated as the weighted average of the IQ scores and internationally standardized Achievement Test (AT) scores converted to an IQ scale from Lynn and Meisenburg (L&M) (2010), with weights equal to the numbers of IQ and AT studies. Literacy rates are taken from UNESCO including its DHS surveys (Demographic and Health Survey), the World Bank, and other sources.

Figure 2 gives the relationship for literacy data collected during 2013 to 2016 and AT scores from Altinok, et al. (AA&P) (2018), for 131 countries. In both cases, there is a statistically significant positive correlation.

FIGURE 1
ADULT LITERACY RATE (%) VERSUS L&M NATIONAL IQ

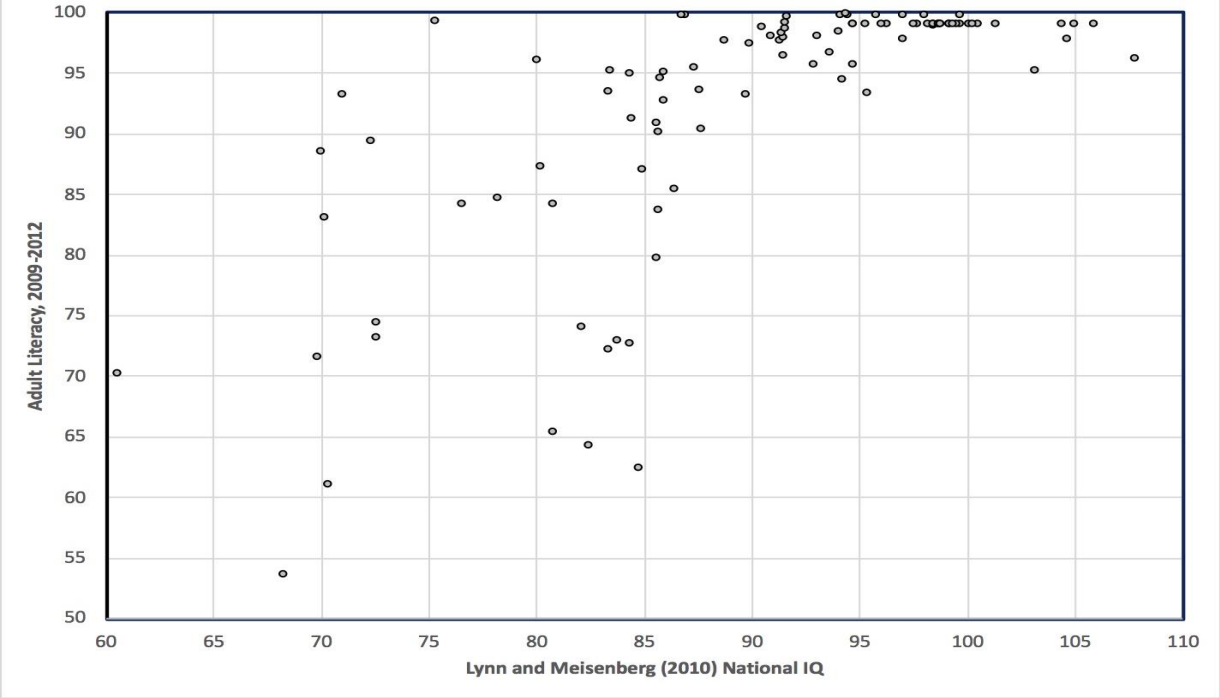
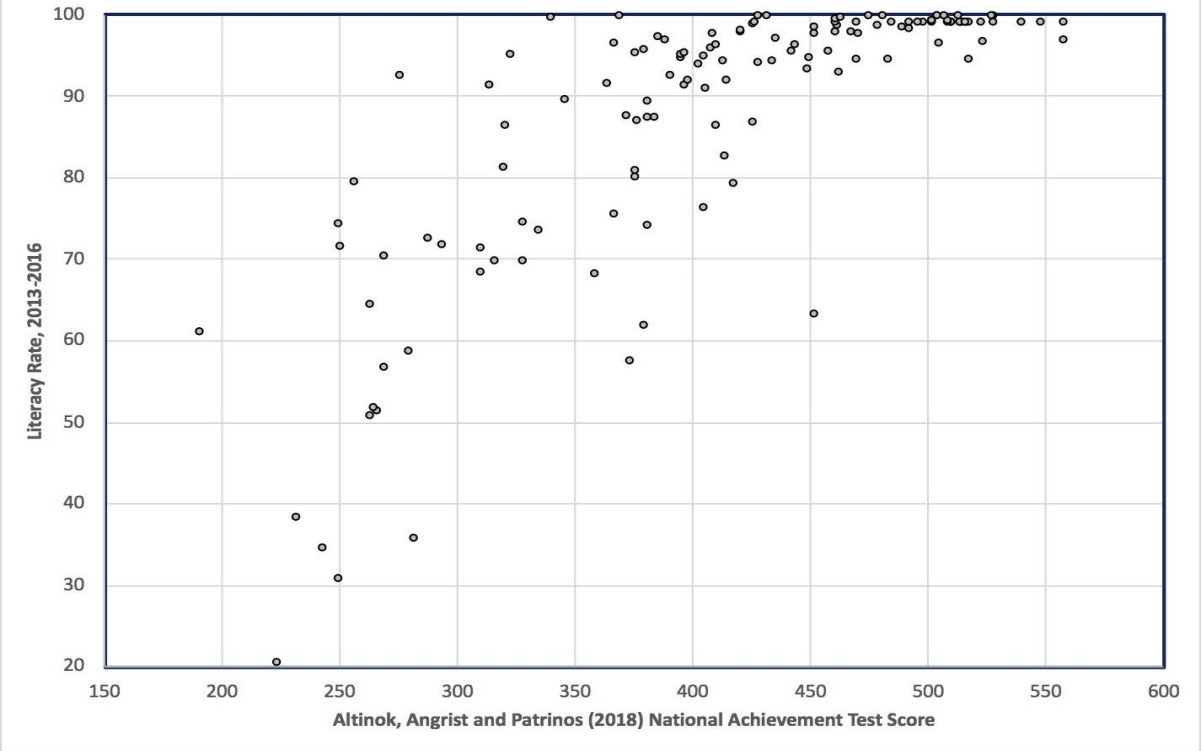


FIGURE 2
LITERACY RATE (%) VERSUS AA&P NATIONAL ACHIEVEMENT TEST SCORE



While National IQ has been validated as a predictor of many variables of interest (Lynn and Vanhanen, 2012), National IQs are missing for many countries even when IQ data are supplemented by achievement test (AT) results (Hanushek and Woessmann, 2015, Rindermann, 2018). Lynn and Vanhanen (L&V) (2002) use ethnic origins to interpolate IQ for countries for which National IQ is not directly observed. Their data, including the interpolations, have been widely used in subsequent research.

Among the proxies for National IQ that have been proposed have been results of the International Mathematical Olympiad (Rindermann, 2011), the capabilities of agencies responsible for national economic statistics as assessed by the World Bank (Kodilla-Tedika, et al., 2017), "middle responding" in opinion surveys (Minkov, 2017), and national average scores on the Graduate Management Admission Test (GMAT) (Thies, 2019). Given the problems of proxy data, it would be useful to have a diverse set of proxies from which a combined proxy could be formed, including in particular proxies from the left as well as the right tail of the distribution of intelligence.

LITERACY RATES AND IQ

The ability of people to attain literacy quickly can be taken as evidence of fluid intelligence. Indeed, universal literacy was achieved in the 19th Century where it was achieved, largely prior to compulsory education. On the other hand, the attainment of literacy only after four to six years of school – while perhaps a measure of crystalized intelligence – is not an indication of a high level of fluid intelligence. Smith-Greenway (2015), examining 31 surveys of literacy in Sub-Sahara African countries, finds that many people are literate even though they report that they had not attended school. Conversely, she finds that many people are illiterate even though they report that they had attended school for one or more years. As would be expected, she finds that literacy increases with years of school, but falls short of 100 percent even with four years of school. This discussion of how people attain literacy suggests that literacy might not reveal much about IQ once an entire population attains literacy through extended compulsory education, but may be informative prior to extended compulsory education.

Other than observing a positive correlation between literacy rates and measures of cognitive ability, about all that can be said of the relation is that there is a ceiling, at least at a literacy rate of 100 percent; and, that extrapolation downward beyond the mass of data lacks theoretical justification. A number of "S"-type curves can be posited to fit the empirical relationship. A particularly simple one is a linear relation between the literacy rate truncated at a minimum value and also at a maximum value, relative to a measure of cognitive ability. That is, IQ or AT = $a + b$Literacy Rate subject to a minimum value of MIN and a maximum value of MAX; where a, b, MIN and MAX are parameters to be estimated.

Table 1 reports the results of regressions of National IQ and AT scores against the truncated literacy rates of countries. The data are as described in Figures 1 and 2. In both regressions, the parameters MIN and MAX were determined by coarse grid searches. That MAX is set at 97 percent, as opposed to 100 percent, indicates that no difference in National IQ or AT score attaches to variation in literacy rates above 97 percent. That MIN is set at 45 percent, as opposed to zero or some other small number, might simply reflect that there is, nowadays, an insufficient number of observations of literacy rates below 45 percent to make an inference about National IQ or AT score.

Given the parameters MIN and MAX, both regressions indicate that cognitive ability is significantly correlated with literacy rates, with about half of the variation in cognitive ability explained by the relationship.

TABLE 1
REGRESSIONS OF COGNITIVE ABILITY[a] AGAINST LITERACY RATE[b]

	A	B
Constant	7.8320	7.8320
	(0.2730)	(0.2730)
Literacy rate	0.6704	4.6412
	(9.2565)	(14.3471)
R^2	47.2%	60.4%
No. of countries	97	136

[a]Column A - IQ (L&M 2010), Column B - AT (AA&P 2018)
[b]Column A - 2009-12, Column B - 2013-16, both truncated at (45,97)
t-statistics in parentheses

VALIDATION

As mentioned above, National IQs are missing for many countries, even when Achievement Tests are used to infer National IQs. Column A of Table 2 presents the results of a regression of the natural logarithm of GDP per capita against L&V's ethnicity-based interpolations of National IQ. The values of GDP per capita are the averages of the International Monetary Fund and World Bank estimates for 2012, on a PPP (or "international dollar") basis, or a CIA Factbook estimate if necessary. The sample consists of all countries for which L&V's National IQ is an ethnicity-based interpolation and for which literacy data are available, a total of 72 countries. Almost all of these countries are small or developing countries. Notice that the L&V ethnicity-based data are shown to be significantly correlated with GDP.

TABLE 2
REGRESSIONS OF GDP PER CAPITA (PPP BASIS)[a] AGAINST COGNITIVE ABILITY WHERE L&V (2002) IQ IS AN ETHNICITY-BASED INTERPOLATION

	A	B
Constant	4.6373	2.3933
	(6.6280)	(3.8700)
L&V (2002) IQ	0.0523	0.0167
	(5.6134)	(1.9296)
IQ based on literacy 2009-12		0.0601
		(7.1987)
R^2	30.7%	60.2%
No. of countries	72	72

	C	D
Constant	4.8986	4.1325
	(12.6805)	(7.8292)
L&V (2002) IQ	0.0102	0.0174
	(10.1008)	(2.0779)
AT based on literacy 2013-16		0.0088
		(7.3489)
R^2	58.6%	61.0%
No. of countries	73	73

[a]Columns A and B - 2012, Columns C and D - 2016 (natural logarithm of average of IMF and World Bank, or else CIA Factbook)
t-statistics in parentheses

Column B presents the results of a regression in which the predicted value of National IQ based on the country's literacy rate measured during 2009-12 (per the regression reported in Column A of Table 1) is included as an additional explanatory variable. The literacy-based IQ estimate enters the regression significantly and with the expected sign. It substantially increases the explanatory power of the regression as measured by R^2. What is more, including the literacy-based IQ estimate substantially reduces the significance of the ethnicity-based interpolations of IQ.

Columns C and D of Table 2 repeat the exercise reported in Columns A and B, using 2016 GDP per capita and AT scores based on literacy rates measured during 2013-16 (per the regression reported in Column B of Table 1). Column C reports the simple regression of GDP per capita on the ethnicity-based interpolations of National IQ. These interpolations perform well in predicting GDP per capita. This result is impressive since these GDP data are many years following the study by L&V. This seems to be strong evidence that ethnicity is a determinate of National IQ and, therefore, of GDP. However, the ethnicity-based interpolations are again greatly reduced in significance upon the introduction of the literacy-based estimate of cognitive ability.

CONCLUSION

Literacy rates are strongly correlated with well-established measures of cognitive ability at least in the range (45, 97) with recent data. Literacy rates are available for many small and developing countries for which National IQ and scholastic achievement data are often unavailable. Literacy rates can therefore be used – perhaps in conjunction with other proxies – to estimate National IQ in the absence of direct measures. With the diverse set of proxies that have now been developed, there is no longer any justification for using ethnicity-based interpolations.

REFERENCES

Altinok, N., Angrist, N., & Patrinos, H.A. (2018). *Global Data Set on Education Quality (1965–2015)*. World Bank Education Global Practice Group.

Graff, H.J. (1987). *The Legacies of Literacy: Continuities and. Contradictions in Western Culture and Society*. Bloomington, IN: Indiana University Press.

Hanushek, E.rA., & Woessmann, L. (2015). *The Knowledge Capital of Nations: Education and the Economics of Growth.* Cambridge, MA: MIT Press.

Kodilla-Tedika, O., Asongu, S., & Asia-Dimbu, F. (2017). Statistics and Intelligence in Developing Countries: A Note. *Journal of Biosocial Science*, *49*(3), 309–21.

Lynn, R., & Meisenberg, G. (2010). National IQs calculated and validated for 108 Nations. *Intelligence, 38*(4), 353–360.
Lynn, R., & Vanhanen, T. (2002). *IQ and the Wealth of Nations*. Westport, CT: Praeger.
Lynn, R., & Vanhanen, T. (2012). National IQs: A review of their educational, cognitive, economic, political, demographic, sociological, epidemiological, geographic and climatic correlates. *Intelligence*, *40*(2), 226–34.
Minkov, M. (2017). Middle responding: An unobtrusive measure of national cognitive ability and personality. *Personality and Individual Differences*, *113*, 187–192.
Rindermann, H. (2011). Results in the International Mathematical Olympiad (IMO) as indicators of the Intellectual Classes' Cognitive Ability Level. In A. Ziegler, & C. Perleth (Eds.), *Excellence: Essays in Honour of Kurt A. Heller* (pp. 303–321). Berlin: Lit Verlag.
Rindermann, H. (2018). *Cognitive Capitalism: Human Capital and the Wellbeing of Nations*. New York: Cambridge University Press.
Smith-Greenaway, E. (2015). Educational attainment and adult literacy: A descriptive account of 31 Sub-Saharan African countries. *Demographic Research*, *11*(33), 1015–34.
Thies, C.F. (2019). GMAT Scores as a Proxy for National IQ. *Journal of Organizational Psychology*, *19*(1), 95–101.