New evidence for differences in fluid intelligence between north and south Italy and against school resources as an explanation for the north–south IQ differential

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ABSTRACT

The north–south difference in Italy in PISA 2006 scores in reading comprehension, mathematical and science abilities of 15-year-olds has been attributed by Lynn (2010a) to a difference of approximately 10 IQ points in intelligence and by critics to differences in educational resources. New evidence for differences between north and south Italy in the PISA 2012 Creative Problem Solving test as a measure of fluid intelligence shows a 9.2 IQ point between the north–west and the south and confirms Lynn's theory. New data are presented for genetic differences between the populations of north and south Italy.

1. Introduction

It has been proposed by Lynn (2010a) that there is a north–south gradient of intelligence in Italy such that average IQs are approximately 10 IQ points higher in the north than that in the south. This conclusion was based largely on the 2006 PISA (Program for International Student Assessment) data for the reading comprehension, mathematical and science abilities of 15-year-olds in 52 countries and 12 Italian regions. The justification for the use of these scores as a proxy for intelligence has been given by Rindermann (2007, 2008), who has shown that they are highly correlated with IQs across nations. Lynn proposed that these north–south differences in IQs in Italy explain much of the differences in average incomes, literacy, education, stature, infant mortality and the numbers of individuals who have achieved eminence in the arts and sciences.

Lynn's thesis has been criticized by Beraldo (2010), Cornoldi, Belacchi, Giofre, Martini, and Tressoldi (2010), Felice and Giugliano (2011) and Cornoldi, Giofrè, and Martini (2013) on the grounds that the PISA scores for reading comprehension, mathematics and science are measures of educational attainment determined by differences in teaching quality and educational resources and cannot be used as measures of intelligence. These critics have been answered by Lynn (2010b), who gave data for Raven's Progressive Matrices and an Internet test showing IQs in the north approximately 10 points higher than in the south, and by Lynn (2012a) who presented data from PISA 2009 and from the INVALSI study of math and language abilities providing futher evidence for higher cognitive abilities in the north.

Lynn's thesis has also been criticized by Robinson, Saggino, and Tommasi (2011) on the grounds that tests reading and math show much smaller north–south differences and by D'Amico, Cardaci, Di Nuovo, and Naglieri (2012) that other cognitive tests show no north–south differences. In a more recent paper, Cornoldi et al. (2013) presented data showing that the north–south difference in PISA 2009 was smaller than in PISA 2006, which they attributed to an improvement in schools in the south, and they also presented data showing that

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north–south differences in language and math abilities in the INVALSI study varied among the second, fifth, sixth and tenth grade school students from − 0.03 to 0.33*d* (SD units) averaging 0.15 equivalent to 2.25 IQ points. Cornoldi et al. (2013, p. 29) conclude their discussion of the studies of north–south differences in Italy in intelligence and educational attainment by observing that "variations in the different studies are so high to legitimate radically different conclusions, suggesting that further evidence is needed to reach unquestionable conclusions."

Lynn (2010a) argued further that the north–south IQ differences in Italy are attributable in part to immigration from North Africa and the Middle East in the more southerly regions in historical times, and that the genetic legacy of this has been to reduce the IQs of the populations. This hypothesis has been supported by Templer (2012), who showed that there are significant genetic differences between north and south Italy with higher percentages of the population with black hair and eyes in the south indicating greater admixture of North African and Middle Eastern genes. This hypothesis has been further supported by Lynn (2012b) in a study showing that north–south differences in intelligence are also present in Spain with the north having higher IQs, educational attainment, per capita income, literacy, life expectancy and employment and lower frequencies of alleles of the Near East and North Africa.

In this paper, we present new data that provide a test of Lynn's (2010a) hypothesis that the north–south difference in Italy in PISA scores in reading comprehension, mathematical and science abilities of 15-year-olds are attributable to differences in intelligence and the competing hypothesis of critics that they are attributable to differences in educational resources, and of Lynn's hypothesis that the north–south difference in intelligence is attributable in part to greater genetic admixture in the south from Near East and North Africa.

2. Methods

The OECD (2014) has recently published data for 2012 for the performance of 15-year-old students in the PISA Creative Problem Solving, a measure of the ability to solve problems in "non-routine situations" defined as "situations that require at least 30 minutes to find a good solution" (p. 26). The solution of these problems requires the ability "to think flexibly and creatively about how to overcome the barriers that stand in the way of a solution" (p. 26). A "ready-made strategy" or a mastery of facts and procedures is not sufficient for the solution of these problems. The Creative Problem Solving test assesses "students' general reasoning skills, their ability to regulate problem-solving processes, and their willingness to do so, by confronting students with problems that do not require expert knowledge to solve." The test measures the ability to solve problems in "situations that students may encounter outside of school as part of their everyday experience" (e.g., technology devices, unfamiliar spaces, food or drink) (p. 31) and "an individual's capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious" (p. 32) involving "scenarios related to real life problems" in the four areas described as technology, non-technology, personal and social. For example, in a technological problem, the student is given a technological device and has to figure out how it works and which buttons have to be pressed to change the volume or change the type of

music (e.g., "Describe how you could change the way the MP3 player works so that there is no need to have the bottom button," "Find whether each control influences temperature and humidity by changing the sliders" and "Use the controls to set the temperature and humidity to the target levels"). In a non-technological and social problem, the student is given a map showing travel time on each section of a road. An example item is "Pepi is at Sakharov and wants to travel to Emerald. He wants to complete his trip as quickly as possible. What is the shortest time for his trip?" In terms of Cattell's (1971) concepts of fluid and crystallized intelligence, the Creative Problem Solving test is a measure of fluid intelligence defined as the ability to think logically and solve problems in novel situations, independent of acquired knowledge, while the PISA tests of reading comprehension, mathematical and science abilities are measures of crystallized intelligence.

3. Results

The mean scores of student performance on the Creative Problem Solving test for five Italian macro-regions extracted from OECD (2014, Table v2.b2, p. 226) are given in Table 1. The five Italian macro-regions consist of the northeast (Bolzano, Emilia Romano, Friuli Venezia, Tentino and Veneto), the northwest (Liguria, Lombardy, Piedmont and Valle d'Aosta), the center (Marche, Lazio, Tuscany and Umbria), the south (Abruzzo, Campania, Molise and Puglia) and the South Islands (Sicily and Sardinia, and—curiously—Basilicata and Calabria).

Table 1 gives the mean scores, standard errors and standard deviations for the five Italian macro-regions in the PISA creative problem solving test, followed by the scores converted to "Greenwich IQs," calculated with the British mean = 517 and SD = 96 (the OECD average) equal to an IQ of 100 and SD = 15. The formula for the conversion to Greenwich IQs is thus $[(X − 517) / 96] \times 15 + 100$, where X is the PISA score. The right-hand column headed PISA-RMS 2006 gives the Greenwich IQs for approximately the same regions for the PISA 2006 results for reading, mathematics and science calculated from the data given in Lynn (2010a).

The OECD report states that the number of students tested in Italy was approximately 1,300 but does not give the numbers for the five regions, so it is not possible to calculate the statistical significance of the differences between the regions. Nevertheless, it will be seen that there are substantial differences of around 8 IQ points between the highest mean scores in the two northern regions and the lowest scores in the south and south islands.

Table 1
Mean scores, standard errors and standard deviations and Greenwich IQs in student performance in the Italian regions in the PISA creative problem solving test (PISA-CPS 2012) and Greenwich IQs in student performance in the PISA 2006 tests of reading, mathematics and science (PISA-RMS 2006).

Italian regions	Mean score (SE)	SD	PISA-CPS 2012	PISA-RMS 2006
Northeast	527 (6.4)	91	101.56	101.25
Northwest	533 (8.6)	83	102.50	99.00
Center	514 (10.8)	93	99.53	—
South	474 (8.4)	82	93.28	91.00
South Islands	486 (8.5)	90	95.15	90.30