

# Identifying the link between socio-economic disadvantage and participation & attainment in science: An analysis of the England National Pupil Database (NPD)

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# SES and achievement

- Substantial and long-standing evidence of association between SES and educational achievement
  - White (1982) Traditional lit review
  - Sirin (2005) meta-analysis  $r=0.31$
  - True for a wide range of achievement measures, including Science achievement (Royal Society, 2008)
- Commissioned by EEF & Royal Society to:
  - Update evidence re. SES & science achievement
  - Support an EEF project funding round
  - Report to be published November (delayed)

# The current study: Three components

- **Analysis of NPD to:**
  - Compare the size of the EVER6 achievement gap from Foundation Stage (age 5) to the end of KS5 (age 18/19) using the most recent 2015 cross-sectional data;
  - Evaluate EVER6 gaps in progress (both in science and overall achievement) within each Key Stage;
  - Compare EVER6 gap in science to the size of the gap in other subjects and overall achievement;
  - For KS4 chart trends in the size of the EVER6 Science gap over time; breakdown science achievement by other student and school characteristics, e.g. by gender, ethnicity, school type and region.
- **Plus two Literature Review elements (causes & mediators + promising pedagogies/interventions)**

# SES measure used

- EVER6 – Entitled FSM any time last 6 years
- Has limitations, but used because:
  - Pupil based not area based;
  - The indicator for Pupil Premium (2015/16 £935 for every secondary and £1,320 for every primary pupil);
  - The measure used for reporting in the primary and secondary school performance tables;
  - Utilised by the EEF in their evaluations of interventions and outcomes.
- Identifies 28% of students age 4-16, though varies by year group

# Entitled to FSM and EVER6 percentages

Year group	Number students in year group	% Entitled in Jan. Census (FSM)	% entitled in last 6 years (EVER6)	Difference
Reception	635,812	19.0%	19.9%	1.0%
Y1	615,919	19.7%	24.0%	4.3%
Y2	596,582	20.0%	26.8%	6.8%
Y3	583,202	19.7%	28.6%	8.9%
Y4	571,297	19.0%	29.4%	10.4%
Y5	554,717	18.8%	30.3%	11.5%
Y6	535,033	18.5%	30.8%	12.3%
Y7	534,959	18.3%	30.8%	12.5%
Y8	545,967	17.7%	29.9%	12.2%
Y9	560,687	16.7%	28.7%	12.0%
Y10	567,412	15.9%	27.7%	11.8%
Y11	571,906	14.9%	26.6%	11.7%
<b>All pupils</b>	<b>6,873,493</b>	<b>18.2%</b>	<b>27.6%</b>	<b>9.4%</b>

# Science achievement outcomes

Key Stage	Age	Science achievement	
		Mean score	Threshold
KS1	7	Science TA (0-3) + Aggregate score across the 4 Science AT's	Level 2+ / 3+
KS2	11	Science TA (0-6)	Level 4+ / 5+
KS4	16		BTEC / OCR Applied Science
		Highest GCSE science points score	1+ GCSE science A*-G / A*-C
			Entered EBacc Science (& Pathway)
			Achieved 2+ GCSE sciences (A*-G)
		Ebacc science points score (Mean)	Achieved EBacc science (2+ A*-C)
KS5	18/19	Average A level points (Any science)	Entered any science A level
		Average A level points (Ebacc sciences)	Entered any Ebacc science A level
		Points score for Biology, Chemistry, Physics, Electronics, Env. Science, Geology, Psychology, Computing, Applied Science	Entry for Biology, Chemistry, Physics, Electronics, Env. Science, Geology, Psychology, Computing, Applied Science
		<b>Calculated for the 2012 Y11 cohort using three separate bases:</b>	
		All Y11 students in 2012 in MMSCH	551,333 (Ever6 proportion = 24.4%)
All Y11 students completing Level 3	342,703 (Ever6 proportion = 17.6%)		
All Y11 students completing A levels	216,273 (Ever6 proportion = 13.1%)		

# Effect size measures

- Comparisons across many scales
  - NC levels, KS2 test marks, GCSE points scores, A level grades, % L3+ at age 7, % EBacc science etc.
- Solution - Effect size measures
  - Continuous outcomes
    - Cohen's D
    - Gap expressed in SD units (sign immaterial)
  - Threshold Measures
    - Odds Ratio (OR)
    - EVER6 as the reference group (OR>1 indicates size of NonFSM advantage over EVER6)
- 'Effect' does not imply causality

# NPD Results

Key		Science				Overall attainment			
Stage	Age	Measure (D/OR)	D	OR	VA	Measure (D/OR)	D	OR	VA
YR	5	-	-	-	-	EYFSP score / GLD	0.50	2.3	-
KS1	7	Science TA / Level 2+	0.43	2.6	0.26	KS1 avge. points / Level 2+ all subjects	0.51	2.6	0.21
KS2	11	Science TA / Level 4+	0.46	2.7	0.10	KS2 avge. points / Level 4+ all subjects	0.49	2.3	0.09
KS4	16	EBacc Points Score / Entered EBacc Science	0.63	3.0	0.26	Best 8 points score / 5+ A*-C incl. EM	0.71	3.1	0.32
KS5 (all Y11)	19	Entered any 'A' level science	-	2.9	-	3+ A level or equiv. (Level 3) passes	-	2.8	-
KS5 (L3 entrants)	19	Entered any 'A' level science		1.9	-		-	2.2	-
KS5 (A Levels)	19	Avge Sc. points / Entered any 'A' lev Sc.	0.30	1.3	0.08	Total A level points / 3+ A level passes	0.41	1.8	0.19



# Conclusions

- EVER6 achievement gaps in science are large (typically around 0.50 SD and OR= 2.5:1)
- Gap grows when pupils followed longitudinally within a Key Stage (particularly age 5-7 & 11-16)
- Biggest gap at the end of KS4 (EBacc science D= 0.63 SD and OR= 3:1)
- KS5 gaps largely driven by low attainment age 16 & low continuation in FTE Post-16. However still poorer progress 16-19 for those EVER6 who enter 'A' level.
- Science gaps broadly the same for other subjects & overall attainment, not a specific science issue, common drivers to EVER6 gaps in all subjects

# International PISA comparisons

- In last three PISA rounds England's avge. in science (& problem-solving) consistently and significantly above OECD avge.

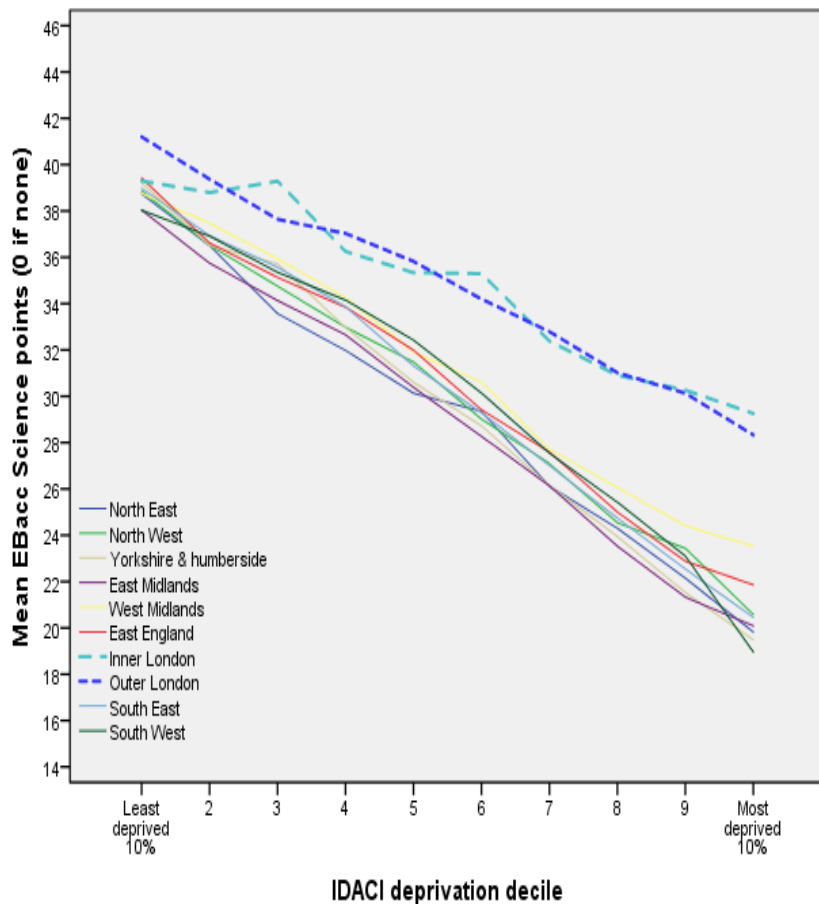
Year	Reading	Maths	Science
2006	496	495	516
2009	495	493	515
2012	500	495	516

*Notes: Red= <OECD average; no colour= not sig.diff. from OECD average; Green= >OECD average. The average for OECD countries varies, in 2012 was 496 for reading; 494 for mathematics and 501 for science. PISA primary focus 2006=science, 2009=reading ; 2012=maths.*

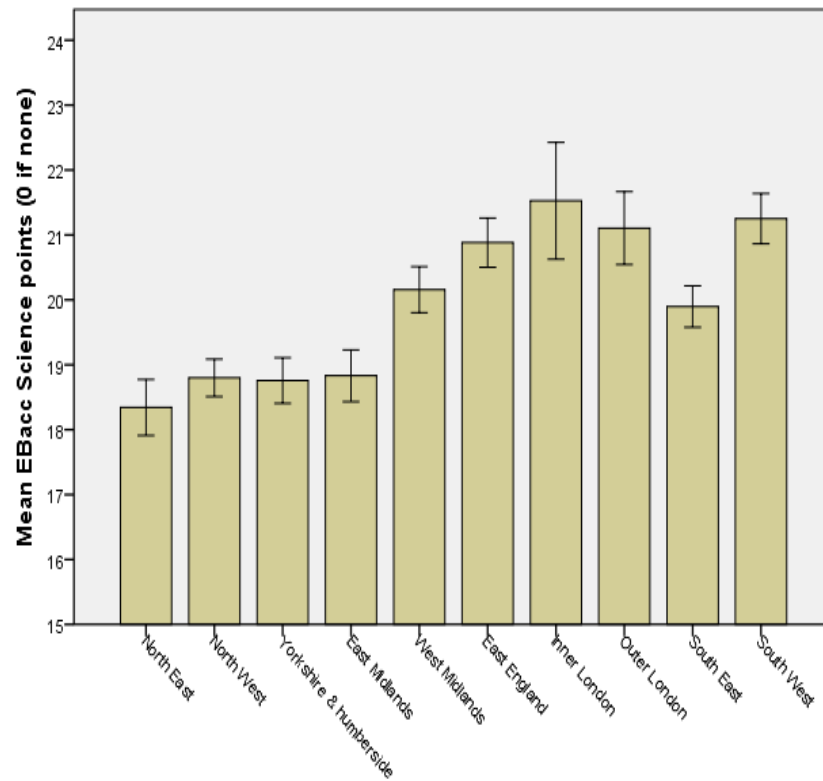
- England has a relatively large difference between the score points of the 5<sup>th</sup>-95<sup>th</sup> percentile, only 8/64 countries wider distn.
- But directly assessed the SES achievement gap, though large, is typical of the international avge. for reading (Jerrim, 2012) and mathematics (DFE, 2014) e.g. ESCS explains 14.6% of maths score variance for OECD, 12.4% for England.

# KS4 Ebacc science score by region & SES

## All students



## WBRI EVER6 Only



Gap reduces from 9 Ebacc points (1.5 grades in each science GCSE) to 2 points (0.3 of a grade)

# Policy implications

- The earliest measure of science achievement, at age 7, is strongly predictive of later science achievement (e.g.  $r=0.60$  with age 11 science), and poor pupils fall further behind over time
- But age 7 science is itself strongly predicted by pupil's Early Years Foundation Stage Profile (EYFSP) score at age 5 ( $r=0.57$  with KS1 Science and  $r=0.68$  KS1 APS).
- Suggests interventions to close later science achievement gaps should focus on learning gaps in the earliest years at school
  - **Low SES** fewer home educational resources, less supportive HLE, poorer access to high quality child care & pre-schools, struggle with reading & maths to build vocabulary, general knowledge, scientific concepts etc. (Sylva, 2014; Morgan et al, 2016).
  - **Supports Policies like:** EY Pupil Premium, free nursery places for disadvantaged 2yr olds, increasing number qualified staff in EY etc.

# References

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End of Presentation

