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Child cognitive development

Initial findings from the Millennium Cohort Study Age 11 survey

Introduction

At age 11, the Millennium Cohort Study (MCS) children were preparing for the next important phase of their education – secondary school. Inequalities in children's development and educational attainment are enduring priorities for policymakers and educators throughout the four UK countries. As the millennium children enter secondary education, it is important once again to gauge who is achieving a good level of development, and who is at risk.

The MCS has been measuring cohort members' verbal skills since age 3. In the Age 11 survey, new measures of memory and strategic thinking, and decision making and risk taking were introduced. Combined, these measures provide a comprehensive picture of the children's cognitive development at this age.

This briefing paper summarises scores for nearly 13,200 children on three different cognitive assessments:

- verbal ability
- memory and strategic thinking
- decision making and risk taking.

MCS Age 11 survey

The Millennium Cohort Study's (MCS) survey of 11-year-olds took place between January 2012 and February 2013. Trained fieldworkers conducted 13,287 interviews with the children and their parents/guardians. Data from this survey and previous MCS surveys are available to download from the UK Data Service.

Key findings

- Parents' qualifications remain the most powerful predictor of cognitive development across the board.
- Indian children[1] scored highest on all assessments, with White children also performing well. Pakistani and Bangladeshi 11-year-olds had the lowest overall performance.
- Pakistani and Bangladeshi children scored lowest on verbal skills. The gap between Pakistani and Bangladeshi children and other ethnic groups narrowed between ages 5 and 7, but had widened again at age 11.
- At age 11, boys are outperforming girls in verbal ability for the first time.

[1] In this briefing paper we employ Census categories, e.g. White, Mixed, Indian, Pakistani, Bangladeshi used by the Office for National Statistics. Black Caribbean and Black African are included in a single category, Black groups.

Verbal skills

Our verbal skills in childhood are an important measure of our 'crystallised intelligence' – that is, our ability to apply what we have previously learned and experienced to new situations. The MCS children's vocabulary and language development have been measured since age 3. At age 11, the cohort members completed an assessment of their verbal reasoning and knowledge. They were read sets of words and asked to say how the words were related. Each child was given a total score based on how many questions he or she answered correctly. The scores took into account their age and the difficulty of the set of questions they answered. Their scores ranged from 20 to 80 points.

The relationship between parents' qualifications and cohort members' scores was stronger than with any other factor. Children whose parents had a higher degree scored 62 points on average, which was nine points higher than those whose parents had no qualifications (who scored 53 points on average). This gap has persisted since age 3. Similarly, children with parents in professional or managerial occupations scored 61 points on average. This was five points more than children of manual workers, and six points more than those with unemployed parents.

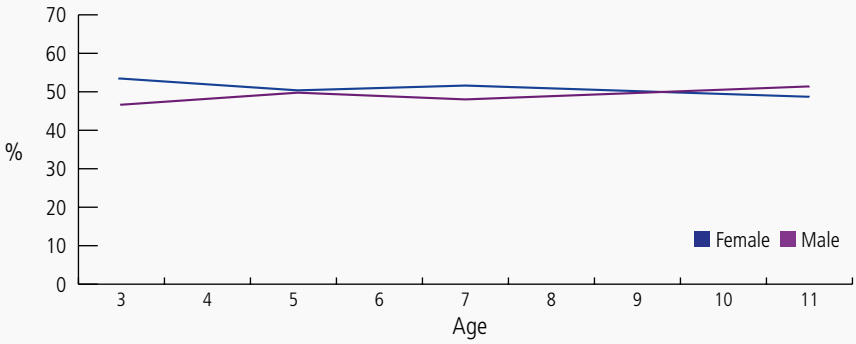
At age 11, boys scored, on average, one point more than girls (59 compared to 58). While only a small difference, it remained even when controlling for other factors, including country, ethnicity, parents' qualifications and social class. This is the first time MCS boys have outperformed girls in verbal ability tests.

There were also significant differences by ethnicity. Indian children were the highest achievers with an average score of 61, which was eight points higher than Pakistani and Bangladeshi children, who achieved the lowest average score (53 points). There were few differences between children from White, Mixed-ethnicity and Black groups.

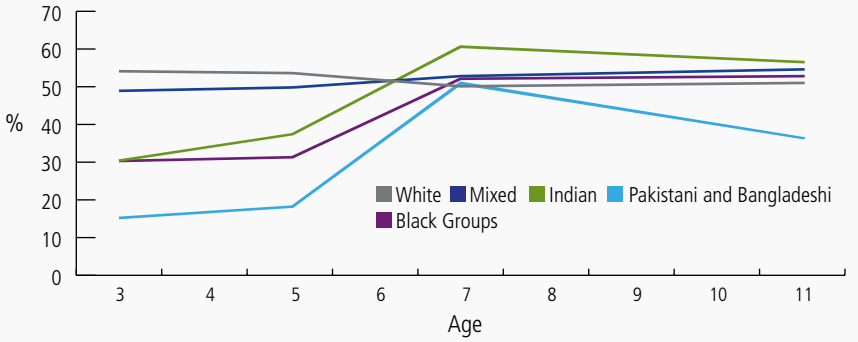
Ethnic differences in verbal ability have changed throughout childhood. At ages 3 and 5, White and Mixed-ethnicity children scored significantly higher than all other groups. By age 7, ethnic differences had become much smaller, however it was Indian children who achieved the highest

Figure 1: Verbal skills scores as percentiles at ages 3, 5, 7 and 11 by sex, ethnicity and parental qualifications

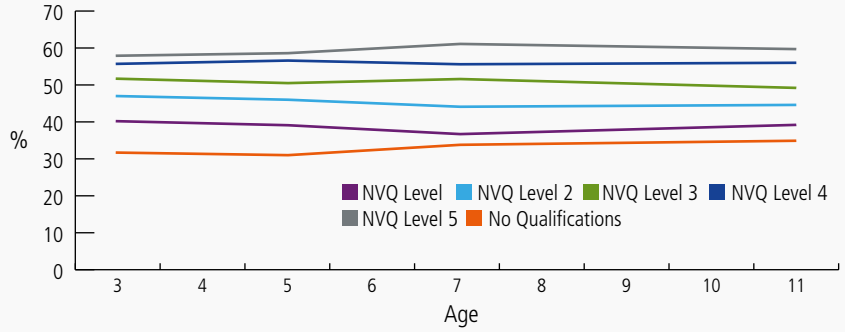
Sex



Ethnicity



Parental qualifications



The British Ability Scales – Verbal Similarities

In this assessment, the interviewer reads three words to the child and the child must say how the words are related. For example, the interviewer might say "banana, apple and orange" and the child would respond that these are all fruit.

There are a total of 37 sets of words in the assessment. If a child answers multiple sets incorrectly, the interviewer moves on to an easier set or ends the assessment.

In Wales, children were given the option of completing the assessment in Welsh, but only 13 out of 1,810 chose to do so.

scores overall. Pakistani and Bangladeshi children have scored persistently lower than all other groups since age 3. The gap between Pakistani and Bangladeshi children and other ethnic groups narrowed considerably between ages 5 and 7, but has once again widened dramatically at age 11.

Spatial working memory and strategic thinking

Spatial working memory and strategic thinking measure our 'fluid intelligence' – that is, our ability to reason and solve problems without prior knowledge or experience. At age 11, cohort members' memory and problem-solving ability were tested for the first time. The children were asked to find a token hidden under one of a number of boxes, and scored on their ability to do so quickly, strategically and without error.

Once again, parents' qualifications were most strongly associated with children's development in this area. Children whose parents had no qualifications made 43 errors on average – 13 more than those whose parents had a higher degree (30 errors). These children were also least likely to adopt a strategic approach to the task, and took the longest to find the tokens. There was a similar, although slightly smaller, gap between children of the lowest and highest social classes.

White and Indian children made fewer mistakes than those from other ethnic groups, however there was little difference among White, Mixed-ethnicity and Indian children in strategy or speed. Pakistani and Bangladeshi, and Black children made more errors, had poorer use of strategy and completed the task more slowly than those from other ethnic groups.

On average, boys made one more mistake than girls. However, there were no differences between boys and girls in use of strategy or speed.

Decision making and risk taking

At age 11, the MCS children's decision-making ability and risk taking were assessed for the first time. Children were asked to bet points on whether a yellow token was under a red or blue box. They were given scores for:

- the quality of their decisions (that is, how often they chose the more likely option)
- how long they took to choose a colour
- how impulsive they were in placing their bets
- their risk aversion (that is, how many of their total points they bet overall)
- their risk adjustment (that is, whether they adjusted their bets based on the likelihood they would be right).

Children whose parents had higher degrees made better quality decisions, were faster, and took fewer risks than children whose parents had no qualifications. However, the most striking difference was that children of the most qualified parents scored twice as high on risk adjustment as children of the least qualified parents. There was a similar difference between children whose parents were professionals or managers, and those whose parents were unemployed.

Indian children made the best quality decisions of any ethnic group, choosing the most likely option 83 per cent of the time. Black children were the least likely to do so, at just 76 per cent of the time. White children took fewer risks than children from all other ethnic groups. The largest ethnic differences were in the children's ability to adjust their risk taking – Indian children were best at adjusting, and had risk-adjustment scores that were twice as high as Black children, who were poorest at adjusting risk. Boys were much more impulsive and took more risks than girls.

Surprisingly, risk taking did not appear to be linked to many risky or antisocial behaviours, such as smoking, drinking or vandalism, once family background was taken into account. However, children who admitted that they had been noisy or rude in public were slightly more likely to take risks with their bets than children who had not behaved in this way.

Cambridge Neuropsychological Test Automated Battery (CANTAB) Spatial Working Memory Task

In this computer-based assessment, the child is asked to find tokens hidden in boxes. There are 12 trials, starting off with four boxes, progressing to six and finally eight boxes. Each trial consists of a number of turns (four, six or eight – depending on the number of boxes). Within each trial the token is hidden under a different box at each turn.

During each turn, the child must remember not to open a box they have previously found to be empty. Over the course of each trial, the child must remember not open a box in which they found a token on a previous turn.

The children were given scores based on how many mistakes they made, their use of strategy to find the tokens, and how long it took them to complete each trial.

CANTAB Gambling Task

In this computer-based assessment, the child is presented with 10 boxes, some red and some blue, and told that there is a yellow token under one box. At the start of the assessment, the child is given 100 points. Each time the child is presented with a new set of 10 boxes, he or she must decide how many points to bet on whether the token is under a red or blue box.

Each new set of boxes has a different mix of red and blue, changing the likelihood that the token is under one colour or the other. For example, the child might be presented first with six red and four blue boxes, giving them a 60/40 chance of guessing correctly. In the next set, there might be eight red boxes and two blue boxes, which would make it even safer to bet on red.

The child is presented with 36 sets of boxes in total. For the first 18 sets of boxes, the child is allowed to bet 5 per cent of his or her points at first. After two seconds, the number of points the child is allowed to bet jumps to 25 per cent, then 50 per cent, then 75, and finally 95 per cent. This means the child has to wait longer to place a larger bet. For the next 18 sets of boxes, the allowance is reversed. The child starts by being able to bet 95 per cent of his or her points, and this allowance then decreases.

Conclusions

Parents' education level is the most powerful predictor of children's cognitive development at age 11, and the wide achievement gap between the children of the highest and lowest-qualified parents has been a persistent one. Sex differences were generally small, although boys were found to be much more impulsive and prone to taking risks. Pakistani and Bangladeshi children had poorer verbal knowledge and along with Black children achieved comparatively lower scores on many aspects of the memory and decision-making assessments. Many of these differences remained once socio-economic circumstances were taken into account.

Future research

The age 11 MCS data provide researchers with an invaluable resource to study inequalities in cognitive development as children enter secondary school. The rich information available at this age will allow researchers to get closer to identifying the underlying causes of these inequalities.

Cognitive measures are a great strength of the British birth cohort studies. The MCS age 11 data provides a unique opportunity to compare the development of the millennium children to that of the generations before them.

About the Millennium Cohort Study

The Millennium Cohort Study is following around 19,000 children born in the UK between September 2000 and January 2002. The study is funded by the Economic and Social Research Council and government departments, and is managed by the Centre for Longitudinal Studies at the Institute of Education, London.

The five surveys of cohort members conducted so far – at ages 9 months and 3, 5, 7 and 11 years – have built up a uniquely detailed portrait of the children of the new century. The study has collected information on diverse aspects of their lives, including behaviour, cognitive development, health, schooling, housing and parents' employment and education.

The MCS has had a significant impact on UK policy, in areas such as breastfeeding, immunisation and child poverty. It will continue to provide a vital source of evidence for policymakers addressing social challenges for many years to come.

Further information

The material in this briefing has been drawn from Sullivan, A. and Brown, M. (2014) Cognitive development. In Platt, L. (ed) *Millennium Cohort Study Age 11 Survey Initial Findings*. London: Centre for Longitudinal Studies.

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