

Science for Environment Policy

Green spaces linked to improved cognitive development in schoolchildren

Exposure of primary schoolchildren to outdoor green spaces is linked to an improvement in their cognitive development, finds a new study, which is the first of its kind. The association may be partly explained by reductions in traffic-related air pollution (TRAP) near green areas.

Approximately half of the global population live in cities, and it is projected that by 2030, three of every five persons (60%) will live in urban areas worldwide. Yet urban areas are characterised by increased levels of pollutants and fewer green spaces. Several studies have linked exposure to [urban](#) green spaces to improved physical and [mental health](#) and wellbeing¹.

Children may be particularly susceptible to the psychological effects of the urban environment, as key cognitive traits are developed during infancy and childhood.

Researchers have now investigated the association between exposure to green spaces and memory and attention in children. They also evaluated the role of TRAP as one of the potential mechanisms underlying this association. This new study took place in the context of the EU-funded Barcelona [BREATHE](#) project² which investigates the possible effects of TRAP on brain development in children.

In the 36 primary schools taking part in BREATHE, 58% of children aged 7–10 (2 623) agreed to participate. Children were evaluated four times every three months over a year, using computerised tests to assess their working memory and attention, both of which grow steadily during adolescence. The 'greenness' around each child's home address, within and near their school and along their commute to school was measured using satellite imagery and the Normalized Difference Vegetation Index, a measure of greenness based on reflected light. The values were combined with variables such as time spent in school or at home to estimate each child's total exposure to greenness. Models were constructed to evaluate the association between green spaces and cognitive development. The [research leading to the methodology](#) (PHENOTYPE) used in this study to assess exposure to green spaces received funding from the Commission's Seventh Framework Programme³.

The researchers found that a higher level of exposure to green spaces was associated with improved cognitive development. More specifically, this consisted of a median score of 5% improvement in working memory, 6% increase in superior working memory, and a 1% reduction in inattentiveness. This was attributable specifically for greenness within and near schools. There was no association between residential surrounding greenness and cognitive measurements.

The researchers also investigated whether reduced levels of TRAP could explain the association between green spaces and cognitive development. High-quality data on exposure to the air pollutant elemental carbon (EC) — a tracer of road traffic emissions — in the schools was available through BREATHE. Previous analyses had found lower levels of EC in schools with higher greenness. Adding TRAP exposure to the models explained 20–65 % of the association between school greenness and change in cognitive development. The researchers theorise other mechanisms may include lower exposure to ambient noise and increased physical activity associated with green spaces.

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1. <http://ec.europa.eu/environment/europeangreencapital/space-increase-happiness/>

2. The BBrain dEvelopment and Air pollUtion ultrafine particles in scHool childrEn (BREATHE) was supported by the European Research Council. See: www.cordis.europa.eu/project/rcn/99632_en.html

3. Positive Health Effects of the Natural Outdoor environment in Typical Populations in different regions in Europe (PHENOTYPE) project was funded through the European Commission Seventh Framework Programme. See: <http://www.staffs.ac.uk/research>

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(continued)

The study provides evidence that targeted interventions such as improving greenness in schools could have significant effects on children's cognitive development. Based on their study, the authors suggest that if schools with the lowest levels of greenness increased this resource to be on a par with schools with the highest greenness, the number of children with impaired superior working memory development would decrease by 8.8%. The improved cognitive development in children could lead to improved mental capabilities for the rest of their lives.

Since this was the first epidemiological study to report on the impact of exposure to green space on cognitive development in schoolchildren, further research is needed to investigate the robustness of these findings. Additional research should explore if similar effects are found during other periods of cognitive development in children, such as prenatal and preschool periods.



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