

Over range of ADHD behavior, genes major force on reading achievement, environment on math

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Humans are not born as blank slates for nature to write on. Neither are they behaving on genes alone.

Research by Lee A. Thompson, chair of Case Western Reserve University's Psychological Sciences Department, and colleagues found that the link between Attention-Deficit/Hyperactivity Disorder (ADHD) and academic performance involves a complex interaction of genes and environment.

[Genetic influence](#) was found to be greater on reading than for math, while shared environment (e.g., the home and/or school environment the [twins](#) shared) influenced math more so than reading. The researchers don't know why.

Their study of twins, published in [Psychological Science](#), Vol. 21, was the first to look simultaneously at the genetic and environmental influences on [reading ability](#), mathematics ability, and the continuum of ADHD behavior.

"The majority of the twins used in the study don't have ADHD," Thompson said. "We are looking at the continuum of the behavioral symptoms of ADHD - looking at individual differences - not a disorder with an arbitrary cutoff."

This type of continuum is a normal distribution or bell curve, with scores symmetrically distributed about the average and getting much less frequent the farther away a score is from the average. Disability is usually classified as the lower extreme on the normal distribution.

The symptoms of ADHD, according to Thompson, can be described with such a continuum, as can reading and mathematics ability. Only a small percent of individuals fall below the common medical cutoff between ability and disability.

For what we refer to as gifted or disabled, Thompson points out, "There is no difference in cause, just different expression of achievement."

Thompson collaborated with Sara Hart, a graduate student at the Florida Center for Reading Research, and Stephen Petrill, a professor at the Ohio State University, in analyzing 271 pairs of ten-year-old identical and fraternal twins.

The twins were selected from the Western Reserve Reading and Mathematics Project, a study that began in 2002 with kindergarten and first grade-age twins and has collected data yearly about their math and reading ability.

The study focused on two ADHD symptoms: inattention and hyperactivity, which are viewed as extremes of their respective attention and activity continuums.

As part of the study, the mother of the twins rated each child on 18 items such as the child's ability to listen when spoken to, play quietly, and sit still, to assess attention and activity levels. A researcher testing each twins' mathematics and reading ability also rated the twins each year on their attention to tasks and level of hyperactivity.

The researchers assessed reading ability by evaluating the twins' recognition and pronunciation of words and passage comprehension.

They measured the twins' capacity for mathematics by focusing on the twin's ability to solve problems, understanding of concepts, computational skills, and the number of computations completed in 3 minutes.

Researchers analyzed the data from three perspectives: one looked at the overall ADHD behavior, one at the level of attention, and at the activity level.

They then determined the similarities in genetic and environmental influence between ADHD symptoms and reading and between the symptoms and mathematics.

To do so, researchers looked at the variance and covariance of ADHD symptoms and academic ability. Variance measures the individual differences on a given trait within a population and covariance is a measure of how much two traits are related. These measures were broken down into identified components: additive genetic effects, shared environment and non-shared environment.

Using quantitative analysis of the components, the researchers found that there are some general genes that influence the symptoms of ADHD simultaneously with reading and mathematics ability and some genes that influence each specifically.

This study also found that both inattention and hyperactivity were related to academics.

"If we have this much overlap between genes that affect behaviors of ADHD and academic achievement," Thompson said, "it gives validity to

the relation of ADHD behaviors and poor academics."

But genes are not everything, Thompson adds.

There are different approaches for interventions that can be taken based on the extent of environmental influence on ADHD behavior, reading ability, and mathematics ability across the entire continuum of expression.

Future research, the study notes, should focus on the underlying connection between ADHD symptoms and poor academic achievement in order to identify the influences that may alter these often co-occurring outcomes.

More information: S Hart et al. Exploring How Symptoms of Attention-Deficit/Hyperactivity Disorder Are Related to Reading and Mathematics Performance: General Genes, General Environments. *Psychological Science*. [DOI:10.1177/0956797610386617](https://doi.org/10.1177/0956797610386617) (2010).

Provided by Case Western Reserve University

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