

## **The role of genetic inheritance in how well children do in schools**

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It is widely accepted that the cultural and material benefits that children obtain from their parents play an important role in how well they do at school. However, there is a surprising disconnect between what most academics in education and what many academics in biology think about the role of genetic inheritance in many areas of human life, including how well children do in schools. What I want to do here is first to look at why there is this disconnect and then to examine the core issue of the role of genetic inheritance in school performance. As a result, I hope to show three things:

1. Education needs to stop putting its head in the sand about the possible role of genetic inheritance in school performance;
2. Genetic inheritance can play a significant role in how well children do in schools;
3. This does not mean that children's school performance is predetermined, i.e. fixed in advance.

### **Education needs to stop ignoring the possible role of genetics in school performance**

Ever since the publication of Darwin's momentous *On the Origin of Species* in 1859, biologists have accepted that inherited variation plays a central role in the evolution of the enormous number of traits exhibited by organisms. The early twentieth advances in genetics, followed by the mid-twentieth century advances of neo-Darwinism and the subsequent developments in molecular biology, have underlined this conclusion.

In the case of humans this means that just about everything of interest about us has an inherited component. It doesn't matter whether one is looking at height or weight or reaction time or longevity or the likelihood of developing heart disease or anything else, inheritance generally plays a role. And this is true too of such educationally significant factors as general intelligence, reading ability and examination success.

Many people – including parents and teachers – are happy to accept that children differ greatly in their abilities or potential (e.g. at music, mathematics or ball sports). However, educators have been reluctant, to put it mildly, to accept the mounting weight of evidence for the importance of genetic inheritance in school performance. There are a number of reasons for this reluctance – mostly understandable and indeed well-intentioned.

For one thing, there is a terrible legacy of genetics and human history. Various historians of science (e.g. Gould, 1981; Lewontin, 1991) have shown how genetics has been used, both consciously and unconsciously, in attempts to argue for the inferiority of women, of black people and of those not in the ruling classes. Faced with this legacy of sexism, racism and cultural imperialism, it is hardly surprising that educators, who by and large have liberal leanings and are in favour of social justice, have rejected genetics as a way of understanding what is important about humans. What has happened is that genetics, rather than the

misuse of genetics, has been rejected. It is as if books in general were rejected because some books are harmful. The reality, though, is that a better understanding of genetics, not the abandonment of genetics, is what is needed.

A second major reason for the widespread skepticism among educators concerning the importance of inheritance in educational attainment is because of the legacy of Cyril Burt (Figure 1). Cyril Burt (1883-1971) was an educational psychologist. Although there have been revisionist accounts, it is generally accepted that he systematically engaged in scientific fraud, falsely claiming to have collected data in his studies on the heritability of intelligence. However, what is beyond doubt is that the findings that he produced on the extent to which intelligence is inherited were and are consistently in line with other studies. In other words, even if we ignore all of Burt's work, there would be no effect on the conclusions to be reached from the literature.

A third major reason why educators have tended to ignore the ever-increasing growth in what is known about inheritance is, I believe, because of a widespread, often implicit, presumption that inheritance is to be equated with determinism. I shall deal with this misunderstanding below, but first I turn in a bit more detail to the role that inheritance plays in school performance.

### **Inheritance does play a role in how well children do in schools**

Let me explain a bit about how scientists decide whether or not inheritance plays a role in a trait. It doesn't matter whether we are talking about the height of plants, the milk yield of cows or the reading ability of children.

First, for the sake of clarification, by 'inheritance' we mean 'genetic inheritance'. Everyone realises, for example, that family background is important. If one is brought up in a home with lots of books and where reading is valued, it is hardly surprising that one is likely to do better at reading as a child than another child of the same age who has not enjoyed such benefits. Indeed, much of the skill in arriving at measures of 'heritability' – that is the extent to which genetics plays a role – is precisely to do with disentangling the effects of shared environments.

Without going into a full-scale statistical treatment of how biologists and statisticians determine the importance of genes for the expression of any trait, it should be clear that what one needs to do is:

- get reasonably objective measures of the trait in question. This is fairly easy for milk yields in cows; it's harder – but not impossible – for most things of educational interest such as reading ability or musicality.
- collect such data from a large number (ideally many thousands) of individuals.
- get some measure of the extent to which these individuals have similar genetic backgrounds.
- get some measure of the extent to which these individuals have similar environmental backgrounds.

It's the last two of these that are the most difficult to do and for this reason, a number of studies have relied on twin studies. Twin studies are of value because there are two sorts of twins – identical twins and non-identical twins. Non-identical twins are no more genetically similar than are any two non-twin siblings but, by virtue of having been born from the same pregnancy, they have shared an early environment that is more similar than that shared by non-twin siblings. Identical twins have an early environment that is at least as similar as that shared by non-identical twins; but in addition they are virtually identical genetically. What this means is that by looking at the extent to which monozygotic (identical) twins are more similar in certain traits than are dizygotic (non-identical) twins, one can obtain a measure of the heritability of the trait.

To give an extreme example: identical twins typically have very similar eye and hair colour – more similar than is the case for non-identical twins. We therefore conclude that eye and hair colour have high heritabilities. However, the language that identical twins speak best is no more similar than is the case for non-identical twins. (In most cases, of course, siblings, whether or not twins, have the same mother tongue but if they are separated at some point in their childhood – for example, because they are adopted by families in different countries – they may end up speaking different languages best.) We therefore conclude that the language one speaks best has a very low heritability.

There are various ways nowadays of calculating heritabilities and they give very similar values – which is encouraging from a scientific point of view. What is important is that virtually all human behaviours tend to have heritabilities of about 0.3 to 0.6 (Bouchard, 2014). Heritabilities lie between 0 (e.g., the language one speaks best) and 1 (e.g. eye colour). This means that human behaviours are moderately heritable – not as heritable as height (with a heritability in the West of about 0.9) but more so than religiosity (which has a heritability of about 0.1 to 0.2). Examples of human behaviours are such things as personality, intelligence, artistic interests and the chances of developing a psychiatric illness.

### **Children's school performance is not predetermined**

Despite the fact that intelligence, along with most other human behaviours, is moderately inheritable, this does *not* mean that intelligence itself or school performance more generally are predetermined. The way that heritabilities are calculated depends on the range of environmental variation that exists in the sample. This is why above I wrote that height has “a heritability in the West of about 0.9”. In the West, relatively few children are malnourished. Obviously, if you are malnourished you don't end up growing as tall, other things being equal, as you would otherwise. So, in the West the extent of relevant environmental variation for the determination of human height is quite small. Sadly, there are plenty of countries where this is not the case – where many children grow up malnourished. In such countries calculations of the heritability of height result in values that are smaller than they are in the West.

This simple but vital point about heritability calculations is all too often not understood. To repeat: values of the heritabilities of traits can vary greatly depending on the environment. And herein lies one of the crucial tasks of education, I would argue, from a social justice perspective. Just as we hold that no child, whatever their family circumstances, should be malnourished or fail to receive treatment for medical conditions (including those like short-sightedness that can damage their educational performance), so we need to develop our ways of teaching, including those that draw on new technologies, to minimise the deleterious effects of each child's circumstances.

Let me end with some crystal ball gazing. We are only just beginning to get to grips with how teachers should tackle such conditions as dyslexia, ADHD (Attention Deficit Hyperactivity Disorder) and dyspraxia. All such conditions will have both heritable and environmental components. It is possible that as we learn more about how schools can better teach children who manifest with such conditions, calculations of their heritabilities will reduce, as will educational inequalities. This will be good for the children concerned – and for society more generally.

### **What the research says**

- Genetic inheritance can influence how well children do in schools.
- Genetic as well as environmental diversity provides a challenge to teachers, but should not be seen as a deterministic constraint.

### **References**

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**Figure**



*Figure 1.* Cyril Burt, who probably falsified some of the data that helped lead to an acceptance of the role of inheritance in intelligence.  
[https://upload.wikimedia.org/wikipedia/commons/e/ee/Cyril\\_Burt\\_1930s.jpg](https://upload.wikimedia.org/wikipedia/commons/e/ee/Cyril_Burt_1930s.jpg) Attribution not required.