What works in gifted education?

a literature review

Gabriel Heller Sahlgren

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The decision to award funding for this research was inspired in part by the impressive and longstanding work of the Coram Tomorrow's Achievers charity in supporting very able children and their families in the UK. This report examines how similar children and young people are supported internationally and seeks to identify the lessons that can be learned from research into their experience. Accordingly it is dedicated to them.

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Executive summary

- The role of targeted education programmes in stimulating higher achievement among gifted children is a fiercely debated topic in education policy circles. Yet as governments tend to focus on increasing equity and raising achievement among low-performing pupils, gifted children are often largely ignored.
- This paper reviews the literature on what works in terms of raising the performance of gifted children, in order to draw policy conclusions of relevance for the development of effective interventions for such children.
- Most research is not sufficiently rigorous for the purposes of drawing policy conclusions regarding the characteristics of successful gifted education programmes. Also, we were not able to unearth a single rigorous study of the effectiveness or otherwise of specific strategies focused on helping talented pupils in practical areas, such as music.
- The rigorous evidence that does exist tends to find that neither gifted education programmes, nor streaming, as currently carried out, on average make much difference in terms of generating higher performance among gifted children.
- A couple of rigorous studies suggest that enrichment programmes, combined with self-directed/targeted instruction, have positive effects. This is supported by

cognitive research, which suggests that already high-performing individuals perform better using discovery-based pedagogy. Research also suggests gifted children tend to have the characteristics required to benefit from such pedagogy.

- This is an important contrast to the situation for most non-gifted children, among whom structured curriculum and pedagogy have strong positive effects in most settings. In that there is little rigorous evidence that these methods are superior for very able children, there appears little contradiction between these findings.
- Enrichment models predicated on self-directed/ individualised instruction thus appear most promising for realising the performance of gifted children. Accordingly, specific countries that have implemented models including these characteristics, such as Singapore, may be worth investigating in future research.
- It important to note that it is far from straightforward to identify gifted children due to measurement error and differential developmental speed. While there is no perfect solution to these problems, research suggests it is possible to decrease their importance by employing different identification metrics, local norms of what it means to be gifted, universal screening, and continuous reassessments.
- Nevertheless, given the relatively poor state of the research, our most important conclusion is that we should test different types of gifted education programmes – and ways of identifying gifted children – in a randomised fashion in English schools in order to find out what works here.

- We therefore believe there is a strong case for the government to fund the establishment of an independent organisation similar to the Education Endowment Foundation, with a remit to fund randomised trials investigating what works in gifted education specifically.

Introduction

The role of targeted education programmes in stimulating higher achievement among gifted children is a fiercely debated topic in education policy circles. An argument often made is that high-ability pupils are not appropriately challenged in mainstream English schools. Indeed, in 2013, Ofsted (2013: 7) found a 'discouraging picture of what it means to be one of the most able students in non-selective secondary schools in England'. As a result, since 2014, Ofsted has required inspectors to assess the quality of provision for more able students specifically. Yet, while government policy since 2010 has given attention to gifted underprivileged children, a focus regarded as crucial from a social mobility perspective, gifted children as such have not been high on the agenda (Koshy et al. 2018). Indeed, as governments in general tend to focus in particular on increasing equity and raising achievement among low-performing pupils, the needs of gifted children are often ignored in western countries.[1]

The consequences of doing so could be severe. Research suggests that high-performing pupils contribute disproportionally to countries' economic growth. Whereas a 10 percentage point increase in the share of pupils who reach basic skills in international tests is associated with an increase in the average per-capita annual growth rate of 0.3 percentage points, the same increase in the share of pupils

1 A non-UK example is Texas, where funding for gifted education declined in the aftermath of the No Child Left Behind Act, which gave schools strong incentives to focus more heavily on low-performing pupils (see Hodges 2018).

reaching superior levels of performance raises average per-capita annual growth rate by 1.3 percentage points (Hanushek and Woessmann 2012). In other words, the societal reward for finding out how to stimulate gifted children to reach their true potential could be significant indeed.

This paper carries out a review of the empirical research on gifted education provision worldwide, with the goal of understanding which approaches are most effective. The review focuses on research that is likely to be causal, which is crucial for the purposes of policy development where evidence that reliably separates causation from correlation is required to design new and more effective policies and interventions for gifted children. Such research is clearly required since children attending gifted education programmes are likely to perform better than other children because of pre-determined characteristics and other factors that do not necessarily have anything to do with the programme itself. Merely observing what certain schools or countries do in terms of gifted provision is therefore not sufficient if we are interested in finding out what works in the field.

Overall, the literature reveals a rather disappointing picture: there are only a few studies on the effects of gifted education from which it is possible to draw causal inferences – and all of these investigate the effects of American and European provision. We consequently know little about the efficacy or otherwise of gifted provision in countries with a very large share of high-performing pupils, such as Singapore, South Korea, and Japan. Moreover, most studies from which we can reliably draw causal inferences do not reveal that current gifted education programmes on average work as intended. This holds true both in studies analysing the benefits of gifted education programmes as such, as well as those which

analyse the benefits of selective schooling among high-achieving pupils more generally.

Focusing on the few studies that do find a positive impact of gifted education provision with specific pedagogical approaches, the common denominator appears to be a focus on enrichment in combination with independent learning. This is in sharp contrast to the general literature on the type of pedagogy that works in education for most children, which suggests more traditional and teacher-directed models are preferable to less structured ones. Yet it is in line with cognitive research, which finds that 'discovery-based' learning models do work to improve performance among expert learners, who have already acquired the knowledge and skills necessary to solve new problems by themselves in an efficient manner. Research also suggests gifted children tend to have the characteristics required to benefit from such pedagogy.

So far, enrichment/individualised models therefore appear the most promising avenue for realising the performance of gifted children. We note that this approach appears incorporated into the national gifted education programmes in some countries often highlighted in policy discussions, including Singapore.

Certainly, it is far from straightforward to identify gifted children due to measurement error and differential developmental speed. While there is no perfect solution to these problems, research suggests it is possible to decrease their importance by employing different identification metrics, local norms of what it means to be gifted, universal screening, and continuous reassessments.

Yet given the relatively poor state of research into effects of gifted programmes, the most important lesson from our review is the need to subject different gifted education

models – and different ways of identifying gifted children – to more rigorous research, preferably through the implementation of randomised experiments.

We therefore believe there is a strong case for the government to fund the establishment of an independent organisation similar to the Education Endowment Foundation, with a remit to fund randomised trials investigating what works in gifted education specifically.

Definitions

Since we seek to draw conclusions regarding the efficacy or otherwise from research on how to educate gifted children, it is important to define what is meant by 'gifted'. In general, the definition of 'gifted children' is quite broad internationally and includes intellectual, academic, and artistic areas. In England, gifted children are often defined as those 'with high intellectual ability who are seen by teachers and others in the educational environment to be capable of advanced work ' (Koshy et al. 2018: 75). A distinction has been made between 'gifted' pupils, who 'excel academically in one or more subjects such as history, science, and maths' – who tend to be characterised by their high levels of intelligence, metacognition (specifically thinking and transferring strategies), and creative thinking (Newman 2008; Robinson and Clinkenbeard 2008; Sekowski et al. 2009) – and 'talented' pupils, who 'are those with the ability to excel in practical skills such as sports, music, dance, and art (Koshy et al. 2018: 75).

In this paper, we focus our attention on 'gifted' pupils, as defined above. This is simply because quantitative research rarely analyses practical outcomes or longer-term effects of programmes focused on generating practical skills, making it difficult to find any studies of relevance to talented pupils. Indeed, we originally attempted to find relevant research analysing the effects of different programmes for 'talented' pupils, as defined above, but all methodologically sound research unveiled in the review process focused on pupils who are high achieving from an academic standpoint. Nevertheless,

our policy conclusions also speak to the lack of reliable research into the effects of targeted provision for talented pupils in practical fields.

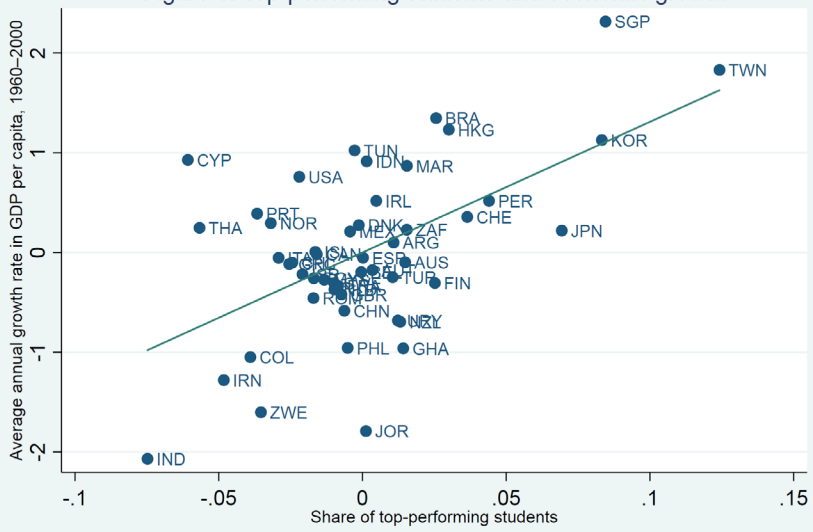
To ensure we do not miss important research, we use a broad definition of studies analysing 'gifted programmes': this includes targeted interventions for children identified as gifted, but also specific programmes or grouping policies aimed at high-performing pupils more generally. As discussed in the next section, improving attainment among high-performing pupils at this level appears to be key for generating higher economic prosperity in the future.

Background and theory

The aim behind gifted education programmes is to maximise the potential of the highest-attaining students – and the importance of doing so is highlighted by economic research. Indeed, a number of studies find a striking relationship between average test scores and economic growth, a relationship that appears to be causal (see Atherton et al. 2013; Balart et al. 2018; Hanushek and Kimko 2000; Hanushek and Woessmann 2012; Hanushek et al. 2017). However, Hanushek and Woessmann (2012) hone in on the relative contribution of high-achieving students specifically and find that they contribute disproportionately to the relationship between test scores and economic growth. Whereas a 10 percentage point increase in the share of pupils who reach basic skills in international tests (equivalent to a minimum of about 400 points in the PISA tests) is associated with an increase in countries' average per-capita annual growth of 0.3 percentage points, the same increase in the share of pupils reaching superior performance levels (equivalent to a minimum of 600 points in the PISA tests) raises average annual per-capita growth by 1.3 percentage points. Figure 1 shows the latter results graphically.[2]

2 We use the replication data from Hanushek and Woessmann (2012) for this analysis. The figure depicts an 'added-variable plot' after holding constant both the initial GDP per capita level and the share of pupils reaching basic skills.

Figure 1. Top-performing students and economic growth



The relationship is statistically significant at the 1% level

While there is a strong interaction effect between basic skills and top-level skills, suggesting the need of a workforce with at least basic skills to implement the innovations developed by the top performers (Hanushek and Woessmann 2012), this nevertheless indicates that economies could benefit enormously were we to realise the potential of gifted children.[3]

There is therefore little doubt about the importance of ensuring that gifted children receive the provision they need to realise their potential. However, it is far from clear what type of education they need – or, indeed, how best to identify such children in the first place.

Gifted education is predicated on the idea that high-ability children need different types of instruction or environments to flourish compared with other types of

3 Apart from the economic benefits, there may also be positive effects of doing so on non-economic, social outcomes, such as lower crime, improved health, and improved democracy (see McMahon 2010).

students. For this reason, a key component of many gifted education programmes is some form of ability grouping or differentiated instruction targeting their specific needs. In theory, selecting out 'gifted' students for specialist instruction and/or schooling could offer such children a better match in terms of provision/curriculum and help teachers adjust their instructional methods to the right level. More appropriate provision and/or more homogenous attainment-level grouping would avoid having to force these children to go through the same type of schooling as others. Furthermore, by grouping gifted children together, it may be possible to capitalise on peer effects, whether gifted children learn best from each other or in competition with each other (see de Waal 2015; Heller-Sahlgren 2015).

In terms of provision deemed to be suitable for gifted children, there are a plethora of approaches utilised (see VanTassel-Baska and Brown 2007). Most programmes are based on either acceleration, which is 'premised on the notion that gifted students acquire and comprehend information at a faster rate than their same-aged peers and involves moving students through the curriculum at a faster-than-normal pace', or enrichment, which 'involves students exploring traditional subject matter in greater depth than is typical in school or having students learn topics in disciplines that are not usually included in their school curriculum' (Worrell et al. 2018: 17). Some broad types of gifted education involve both instructional and curriculum interventions: the depth and complexity model, the differentiated instruction model, and the school-wide enrichment model. While these models differ in terms of their relative emphasis on pedagogy and curriculum, as Callahan et al. (2015: 140) point out, there are common prescriptions in all three models:

> The curricular modifications in these models specify guidelines for increased challenge through choice of content and skills to be offered to gifted students such as increased depth and complexity of ideas presented, greater abstractness of content, greater ambiguity (in the positive sense of seeing multiple points of view), more open-ended problem solving, inclusion of more complex and abstract concepts, addition of critical thinking skills beyond grade level, and use of more sophisticated and advanced resource materials. Instructional modifications include the creation of activities that require more independence in completion of tasks, less basic detail in presentation of content, assumptions of greater student ability to make connections, greater choices in product and paths to production, and accelerated pace of instruction. Common themes across curricular and instructional models targeting the education of gifted students include a focus on more complex concepts and principles within and across disciplines of study (advanced for grade level), stress on advanced processing skills, interdisciplinary thinking, and modification of content allowing advanced learners greater depth of learning.

In other words, the idea is that more stretching curricula combined with independent learning and problem solving are supposed to help gifted children reach their true potential.

Yet it is in fact unclear whether gifted programmes actually work as intended. First, it is not a priori clear that gifted pupils need other types of provision and/or environments compared with other pupils. For example, the interaction effect between the teaching environment and peer groups on achievement makes it very difficult to predict the total effects of grouping gifted children together and providing

special instruction (Heller-Sahlgren 2015). Theoretically, it is therefore far from clear that such grouping and instruction would generate benefits.

Second, even if gifted children need other types of provision and/or environments, it is also not clear if it is possible to identify who is gifted and who is not. Research suggests that a majority of children who perform in the top percentiles of their cohorts do not tend to remain there for more than one or two years. This is partly due to 'regression to the mean' – a statistical phenomenon that makes extreme performers at both ends of the ability distribution in one test tend to move toward the mean in the next test – as well as differential growth in ability over time (Lohman and Korb 2006). Certainly, this does not mean that all high-performing pupils will necessarily fall down the distribution in the future – as we discuss later in this report, there are ways to mitigate the problem in the process of identifying gifted pupils – but it does highlight the difficulties involved in identifying those who would theoretically benefit from instruction targeted specifically to gifted children. It also means that many children who are not defined as gifted may very well have the same potential as those who happen to be defined as such (Eyre 2010). In other words, the fact that it is difficult to accurately identify gifted children may potentially, at least to some extent, make targeted provision and curricula irrelevant – even if these features do in fact raise the performance of very able pupils who are correctly identified as such.

Of course, as noted previously, the instructional and curriculum environment adopted through gifted education programmes is far from the only parameter affecting whether it works or not; the interactions between this environment, peer groups, and other factors are also likely to play an important role. To investigate whether gifted education

programmes work as intended, we turn to the empirical literature analysing the effects of such programmes. In the next section, we outline methodological considerations in our review of this literature.

Methodological considerations guiding the review

A key problem for studies seeking to establish whether specific types of gifted education or selective programmes work is that by definition children deemed to be gifted tend to be higher performing than other children, regardless of the type of programme they attend. This leads to a 'selection problem', which may make it look as if any given gifted provision or educational stream raises the performance of gifted children, even though it may have no causal impact whatsoever. Selection bias may be due to observable characteristics, such as prior achievement, or unobservable characteristics, such as parental motivation.

To be confident of the causal effects of a given programme, it is necessary to solve this selection problem – and the key is to obtain random variation in programme attendance. One way to do this is through randomised-controlled experiments, which are often considered the gold standard for estimating causal effects in the social sciences. In such an experiment, some participants would be allocated to one or more "treatment group(s)", to receive the type(s) of gifted education researchers want to know about, while other participants, allocated to a "control group", would not. Randomising allocation to these groups ensures that neither observable nor unobservable characteristics affect the likelihood of receiving treatment, which means that any selection bias is effectively evened out across the different groups (e.g. Heckman and Smith 1995). Certainly, randomised experiments are not

without their flaws (Deaton and Cartwright 2017), but they are a crucial tool when seeking to understand the causal effects of gifted education programmes.

Additional useful tools have, however, also emerged in the past decades – new quasi-experimental methods for obtaining causal estimates when analysing observational data. These methods differ in many respects, but they all have in common that they seek to obtain random variation in programme participation based on various forms of 'natural experiment' (see Angrist and Pischke 2008). If successful in this pursuit, such methods also allow researchers to study the causal effect of gifted education.

We therefore focus our review on research that uses experimental or reasonable quasi-experimental methods. Without such methods, it is simply impossible to ascribe any effects found in the research to the programme or intervention itself – so also making it impossible to draw conclusions regarding any specific policy lessons.

With these priorities in mind, the literature review was carried out using a range of search strategies to ensure targeted and thorough coverage of the evidence base. These included use of key education and economic databases; 'reference harvesting', i.e. trawling the reference lists within key reports, especially previous reviews; targeted Google Scholar searches; and hand-searches of key peer-reviewed journals.

What does the evidence say?

Having discussed theoretical considerations as well as the importance of methodology, this section delves deeper into the existing literature on the subject. Unfortunately, with a few exceptions, most of what we unveiled was relatively poor research, which ignores the methodological considerations outlined in the previous section, and therefore makes it difficult to draw reliable conclusions. Many studies do not even include a comparison group, without which it is impossible even to investigate whether or not there is a correlation between programme attendance and performance (e.g. Clark 2005; Feng 2004; Gavin et al. 2007; Wilkins et al. 2006). In most cases, the research has in fact been merely descriptive (Rogers 2007). It is therefore unsurprising that a review of the research dating back to 1990 found that 'research on the effects of gifted programs is still generally sparse, unsystematic, and far from conclusive' (Delcourt et al. 2007: 361). Illustrative of the state of affairs, a systematic review of gifted education programmes carried out in 2008 unveiled only four randomised experiments (Bailey et al. 2008) – two of which are of questionable relevance to boot.[4] We discuss the other two below.

Overall therefore, most research on the effects of gifted education programmes has not been rigorous enough to be

4 One study analysed a teacher programme with the aim of implementing an enrichment model for both gifted and non-gifted children in Peru, finding equal positive effects among non-gifted and gifted children (Blumen-Pardo 2002). Another study analysed the effects of analogy instruction among 63 gifted children in America, finding positive effects on metaphoric reasoning (Castillo 1998).

used for policy purposes. As Plucker and Callahan (2014: 393) argue: '[T]he bulk of the research in gifted education has been descriptive and correlational … [T]he lack of causal research leaves the field with considerable ambiguity about effective practices.'[5] At a general level, the methodology used in most research on gifted education programmes simply makes it impossible to draw reliable conclusions.

However, in recent years, researchers – and especially economists – have begun to utilise methods with which it is possible to separate causation from correlation. These studies analyse data from Europe or America exclusively. This is an important limitation given the interesting models of gifted education that exist in other parts of the world, especially in some Asian countries (see Phillipson et al. 2009; Yun Dai and Chih Kuo 2016).[6] Furthermore, the more rigorous research has not unveiled clear evidence that gifted education programmes in general, as currently carried out, work as intended.

For example, Welsch and Zimmer (2018) study the impact of attending gifted education programmes across American high schools on long-term outcomes. These programmes are characterised by advanced curriculum courses, dual enrolment at universities (during which high-school students take courses at university), ability grouping, in-class differentiation for gifted pupils, and additional distance learning. The authors find a positive correlation between attending these programmes on the probability of graduating from college, the probability of being employed, and earnings in the long term – but no bona fide, causal impact at all when

5 This includes studies that only are able to adjust for observable differences between pupils/classes/schools, however flexibly (e.g. Adelson et al. 2012; Preckel et al. 2017).

6 Phillipson et al. (2009) report a few studies analysing the effects of gifted education in East Asian countries and Singapore, but these are generally old and/or not sufficiently rigorous to be informative.

accounting for selection bias. In other words, the only reason gifted American youngsters do better in these programmes is because they are more gifted than youngsters who do not participate in such programmes.

Similarly, Bui et al. (2014) find no effect of attending gifted education programmes on test scores in a large urban school district in America, although there is some impact in science of being randomly allocated to a gifted education programme at "magnet" schools, which often offer specialised curricula. Yet the fact that children who are accepted through the assessment designed to test whether or not they are gifted do not benefit from acceptance to such programmes, and that children randomly selected (regardless of whether or not they are deemed to be gifted) do benefit, suggest this impact has little to tell us about the effect on gifted children per se.

The same applies to an American randomised experiment analysing the effects of tiered instruction in science, within the classroom, geared to advanced learners (gifted children), midrange-background knowledge learners, and lower-background knowledge learners. The results displayed no indication that advanced learners performed better with tiered instruction than with non-tiered instruction (Richards and Omdal 2007). Another randomised study also found no benefit to gifted children of early acceleration in mathematics in terms of performance at the end of secondary school (Ma 2005).[7]

However, some research offers slightly more positive findings among certain types of gifted pupils. For example, while Card and Giuliano (2014, 2016) find no general impact of American gifted education programmes on pupils admitted based on IQ tests, they do find positive effects on gifted disadvantaged

7 The latter is broadly supported by a non-randomised American study, which uses credible methods to analyse the effects of early acceleration (Clotfelter et al. 2015).

children admitted to the programmes based on their scoring the highest among their school/grade cohort in state-wide achievement tests in the previous year. Similar within-school, ability-grouping programmes have also generated positive effects on high-performing children in Kenya (Duflo et al. 2011), although such ability grouping does not appear to benefit high-achieving children in America (Figlio and Page 2002).[8] At best, this suggests that gifted education programmes may benefit some disadvantaged pupils, if they are accepted through regular tests rather than IQ tests.[9]

Yet other research indicates that the impact of school-level streaming more generally is ambiguous, with some research actually finding negative effects on pupil outcomes. The overall conclusion is generally that selective schooling appears to have little impact in developed-world settings, in the UK and elsewhere (e.g. Allensworth et al. 2017; Abdulkadiroğlu et al. 2014; Angrist and Rokkanen 2015; Barrow et al. 2016; Clark 2010), but sometimes more positive effects in settings in poorer countries – although the evidence is mixed here as well (e.g. Jackson 2010; Fabregas 2018; Lucas and Mbiti 2014; Pop-Eleches and Urquiola 2013). While most studies look at the short-run or medium-term impact of selective schooling, a few analyse the longer-term effects on labour-market outcomes. For example Dustmann et al. (2017) study the impact of attending a more advanced track in German middle schools on longer-term educational and labour-market outcomes, finding no evidence of any positive

8 We also note that a few randomised studies on ability grouping carried out in America in the 1960s and the 1970s suggests positive effects of within- and between-class grouping on high-ability pupils, while others merely display insignificant effects (see Steenbergen-Hu et al. 2016).

9 A recent second-order meta-analysis only found a couple of old meta-analyses – which all apart from one were of low quality – analysing studies carried out in the 1980s and 1990s. Again, it is difficult to draw strong causal conclusions from these studies given the importance of sound methodology to do so (see Steenbergen-Hu et al. 2016).

effects. Similarly, while Clark and Del Bono (2016) find positive effects on long-term educational outcomes, they find essentially no labour-market effects of attending grammar schools in a specific UK district among people born in the 1950s, apart from a weakly statistically significant positive impact on female incomes that appears to operate via lower fertility. On the other hand, evidence from Barbados shows positive effects of selective schooling on long-term outcomes, although the effects among girls dominate here as well (Beuermann and Jackson 2018). By itself, selective education is therefore unlikely to benefit gifted pupils, at least in a developed country setting.[10]

Nevertheless, two recent, rigorous studies are noteworthy. These do find positive effects of certain programmes on gifted pupils' performance. Indeed, Booij et al. (2016, 2017) show that an enrichment programme at Dutch secondary schools – which pulled gifted children out of regular classroom teaching in order to give them time to work on self-selected projects – had a considerable positive impact on their performance.

In the first study, the authors analysed children on the borderline between being accepted onto the programme and not being accepted. The study looked at results for one prestigious secondary school only. The programme is based on the ideas of Renzulli (1976), who advanced an enrichment model together with a degree of self-directed learning. Pupils who qualify for the programme – based on their performance on a test measuring both cognitive and non-cognitive skills – are allowed to pursue their own self-selected projects in exchange for a minimum of two hours of classroom teaching per week.

10 While most of the studies reviewed focus on 'marginal pupils' – that is, those that just get in to a gifted programme or selective school and those who just missed out on a place – the evidence that does analyse pupils from the whole ability range do not find any general effects on short-term outcomes either and only positive effects on longer-term outcomes among girls (see Angrist and Rokkanen 2015; Beuermann and Jackson 2018.

The school provides the necessary facilities, such as rooms and computers. Teachers are allowed to deny pupils their right to trade in their lessons, but need reasons to do so. The pupils are supervised throughout the project, which lasts for a school year, by special coaches, who provide hands-off supervisions. At the beginning of the school year, pupils begin developing their projects, which they then present at the end of the year to teachers, parents, and other pupils. About 25 per cent of the children in the school get accepted to the programme, most of whom tend to be in the top 4 per cent of the ability distribution in the country.

The authors find that pupils who just qualified for the programme perform radically better in secondary school than pupils who just missed out. The effect size amounts to the equivalent of about 35 PISA points on average.[11] Pupils undergoing the programme also tend to choose more challenging curricula. Participation increases the number of science subjects taken by 0.76, and the likelihood of their choosing advanced mathematics by 18 percentage points. In other words, the gifted education programme both improved performance and induced children to pursue more difficult subjects. Moreover, the effects appear to carry over to university where the pupils who have undergone the programme choose to study courses that have higher average starting salaries.

In the second study, the authors introduced a very similar programme in three large non-selective Dutch schools as a randomised experiment. The main difference is that pupils were accepted on the basis of their grades in the first term, rather than on a specific test, although they were not told about the existence of the programme beforehand. About

11 These effects apply to subjectively determined grades but they are similar, and in fact slightly larger, when focusing on the effects on standardised test results.

18 per cent of the pupils in the schools qualified. In order to analyse the effects of attending the programme among a broader set of pupils, rather than just those who were close to the admissions cut-off, the authors also use another method by which it is possible to study whether the effects differ across the ability distribution. The results again show positive effects, although smaller on average than in the first study (equivalent to about 20 PISA points). However, the authors also show that the effects increase in magnitude among pupils who were already high performing. In other words, the programme appears to work especially well among the most high-achieving pupils. This chimes well with the authors' first study, which focused on pupils in a very prestigious school.

The idea that enrichment models and less structured teaching methods can raise performance among gifted children is further supported by a recent study from America. In this study, the authors devised a randomised experiment among gifted primary-school (year 3) pupils in more than 200 American classrooms, which gave the pupils access to instructional units in poetry and research skills for one year. In contrast to the Dutch studies, therefore, the control group in this study underwent some form of gifted education as well, although not the same type as those in the treatment group (Callahan et al. 2015).

The intervention in the study was based on the CLEAR model for gifted education, which includes content and instructional differentiation for the children deemed to be gifted, allowing 'teachings to provide instruction that guides students in developing and carrying out projects on topics of their own choosing, using the methods and tools of professionals in a field of study' (Callahan et al. 2015: 144). The model emphasises deep understanding of principles and skills in a discipline, which tend to be at a level higher than would be

appropriate for non-gifted children of the same age. Both the units delivered enshrined these principles to varying degrees.

While the units were designed for primary-school children and therefore clearly more structured than the almost entirely discovery-based learning in the Dutch studies of secondary-school children – there were more assessments, for example – they do give pupils considerable opportunities for independent learning. Indeed, the unit in research skills is concluded with pupils designing and carrying out a complete research project, which they then present in front of other children, parents, and teachers.

The authors find that children who underwent the CLEAR modules, rather than the instruction given in the control groups, performed considerably better on a test delivered following the conclusion of the intervention. The effect size varies depending on cohort and module, but appears to be equivalent in magnitude to about 50–100 PISA points. While we cannot say anything about the longer-term effects, the experiment clearly indicates that modules based on the CLEAR model have promise as a way to raise performance among primary-school children in comparison with other American gifted education programmes.

Broadly speaking, the recent Dutch and American research discussed above is also supported by some older randomised experiments conducted in the US, most of which analyse only relatively few pupils overall. Coleman (1983) finds positive effects of a pull-out, self-directed learning programme, lasting for three hours a week, on the writing abilities of gifted children in years 2 and 3 after nine weeks. Parke (1983) finds positive effects arising from an independent learning mathematics programme for achievement in mathematics among gifted primary-school pupils. Reis et al. (2005) find consistently positive effects among high-achieving pupils

from an individualised enrichment programme that replaced more traditional instruction for part of the day. Stoddard and Renzulli (1983) find positive effects on writing quality from both pull-out and in-class enrichment programmes designed to stimulate individual involvement.[12]

Research therefore suggests that programmes that combine ability grouping with specifically targeted and individualised instruction, may offer a promising venue for gifted education programmes more generally.

This idea is further supported by cognitive research, which suggests that more individualised, 'discovery-based' teaching methods benefit expert learners only. This is because expert learners have already stored the information and knowledge necessary to solve problems by themselves efficiently in their long-term memory, which they then can easily transfer to their working memory when needed. However, this is not the case among non-expert learners, who first need to obtain the relevant knowledge and information and transfer it from their working memory to their long-term memory in order to remember it – which is most efficiently done through guided, structured repetition. Among non-expert learners, guided and teacher-led instruction as well as features of educational systems often associated with more regimented systems, such as memorisation, repetition, and drill, are therefore far superior to discovery-based learning. Yet, among expert learners, discovery-based methods appear to be preferable (e.g. Clark et al. 2012; Kirschner et al. 2006; Sweller et al. 2007).

The evidence on gifted education programmes from the Netherlands and America is consistent with this research:

12 Lynch and Mills (1990) find positive effects of an enrichment programme in mathematics, but not in reading, yet it was provided outside of normal class hours so it is difficult to know if any effects are due to the mode of teaching or whether it is merely due to the participants receiving additional instruction.

able and talented children are likely to have already acquired the knowledge and skills necessary to learn more effectively in a more independent manner than what is traditionally is offered in the classroom.

Indeed, gifted children do tend to stand out in terms of their ability to utilise their knowledge and skills in contexts different from the ones in which they learned them, as well as the speed with which they process information and solve problems. They also have more schemas compared with other children, which means they can transfer information and knowledge from their long-term memory to their working memory with relative ease (Robinson and Clinkenbeard 2008; Porath 2006; Sekowski et al. 2009). For this reason, it is reasonable to describe gifted children as 'embryonic experts' (Eyre 2017: 5). It is therefore not surprising that less regimented methods predicated on more pupil-driven instruction appear to work among gifted children specifically.

This also means that it is possible to square the positive impact of discovery-based learning among gifted children with the more general literature, which finds that more traditional, structured educational models are superior to less structured ones for the purposes of improving the attainment among pupils in general and especially disadvantaged ones (e.g. Angrist et al. 2013; Bietenback 2014; Dynarski et al. 2018; Haeck et al. 2014; Lavy 2015; Schwerdt and Wuppermann 2011).[13]

13 Certainly, some research also suggests this applies to pupils at the top of the performance distribution (e.g. Haeck et al. 2014). This indicates that it is not merely individualised practices that generate higher performance in the studies on gifted children cited above, but the enrichment and ability grouping features as well. Interestingly, however, Bietenback (2014) shows that more individualised practices are superior for the purposes of generating reasoning skills, in contrast to their impact on factual knowledge and routine problems – and, arguably, the potential for marginal gains among gifted children are likely to be larger for the former than the latter. Regardless, we merely note that most research on effective teaching practices in general does not contradict the findings of the rigorous research discussed above showing the positive effects of some gifted education programmes.

An important example worth commenting on in this context is 'direct instruction', a type of teaching characterised by ability grouping in combination with very structured curricula and pedagogy, which appears to benefit children in many settings (see Coughlin 2011; Stockard et al. 2018).[14] Yet, in fact, there is very little research analysing benefits of this method to gifted children. Coughlin (2011) refers to a couple of studies supposedly analysing effects of direct instruction on 'average- or high-achieving' students, but it turns out only one of these analyses effects on high-achieving children. This study is also of poor quality and it is impossible to rule out that the findings are determined by things other than the pedagogical intervention (see Ginn et al. 2002). In contrast, one randomised experiment not surveyed by Coughlin (2011) suggests that combining self-directed, individualised learning with direct instruction is preferable to using direct instruction alone for high-performing pupils (Reis et al. 2005).[15]

We therefore conclude that the evidence base in favour of direct instruction for gifted children is essentially non-existent. Although more research is necessary to investigate the relative effects of such instruction on gifted children compared with more individualised approaches, it should be noted that the research, as it exists today, is in general not inconsistent with the findings in support of more individualised instruction in gifted programmes.

14 Although many of the studies analysing the effects of direct instruction are not of high quality, the effect size does not seem to depend on methodological choices (Stockard et al. 2018).

15 Of course, some forms of gifted education predicated on more individualised instruction may also benefit some non-gifted pupils, if combined with direct instruction. Indeed, the randomised experiment cited tended to find positive effects of the enrichment model when combined with direct instruction for both high-ability and medium-ability pupils (although the positive effects appeared generally larger among high-ability pupils). This was not generally the case for low-ability pupils, who in some cases performed worse as a result of the intervention (Reis et al. 2005).

Overall, therefore, it is difficult to draw clear conclusions from most available research on the effects of gifted/selective education. Most studies do not utilise a sufficiently strong methodology to account for selection into the different programmes – and many of those that do find little evidence that current gifted education programmes, or selective education in general, help high-achieving pupils to realise their potential. However, the methodologically sound studies that do find a positive impact suggests that enrichment programmes, combined with targeted/individualised instruction, may work especially well, a finding that also chimes well with cognitive research on the beneficial effects of discovery methods among expert learners. Interestingly, however, this finding is contrary to the existing evidence base on what works in education more generally, which tends to show that traditional, more structured ways of working are preferable to individualised, student-centred models. In other words, it does appear as if gifted children may very well require different types of instruction to flourish than non-gifted children.

Policy lessons and pointers to future research

What policy lessons should we draw from the literature review in the previous section? As highlighted, unfortunately, the field is replete with studies that are not sufficient for drawing conclusions from a methodological standpoint. This also makes it very difficult to say anything definitive about the specific policy ingredients necessary to maximise such programmes' potential for raising gifted children's performance. Only a few rigorous studies exist, and as noted earlier we were not able to unearth a single sound study analysing the effectiveness or otherwise of strategies focused on helping talented pupils in practical areas, such as music.

We therefore believe the most important lesson from our review is to advance more research devoted to finding out how to best promote the education of gifted and talented children, for the explicit purpose of informing policymaking. We need to test different types of gifted education programmes on a smaller scale, in a randomised fashion, in English schools, before we attempt to scale up any specific model.

One way to advance such an agenda is for the government to fund the establishment of an independent organisation with a remit to fund randomised trials investigating what works in gifted education specifically. Such an organisation could be modelled on the Education Endowment Foundation, which was established under the governance of the Sutton

Trust with public money in 2011 to investigate effective interventions to support disadvantaged children and promote social mobility. Given the economic importance of high-performing pupils, we believe there is a strong case for setting up a similar institution devoted to research and the promotion of effective instructional interventions for gifted students, and new and more reliable ways of assessing who qualifies for such and is suited for such interventions.

Still, despite the limited evidence base, we have found that some approaches appear more promising than others. Focusing on the rigorous research only, the evidence points to beneficial effects of enrichment curricula combined with strong opportunities for independent learning. While we do not believe there is sufficient evidence from these studies to advocate any specific national approach to gifted education in England, they do indicate what types of programmes should be further tested and scrutinised through randomised trials.

Interestingly, the types of instructional and curricular models that the research finds to work also appear to be well incorporated into national programmes for gifted education in some of the countries often highlighted in policy discussions.[16]

One important example is Singapore, where gifted children are selected through a two-stage process in primary school and then grouped into separate schools/streams that provide enrichment and individualised study options, provided by specifically selected and appropriately trained teachers (MoE 2017; Neihart and See Tan 2016). The programme is highly selective, identifying the top 1 per cent of pupils in each cohort, with all pupils being screened in year 3. The

16 In England, the national policy developed in the past decades appears to have had little impact on practices in schools, which is most likely due to the fact that implementation has been left to schools without any monitoring controls (Koshy et al. 2018).

selected pupils attend an enrichment programme focused on 'giving breadth and depth to core curriculum content with emphasis placed on critical and creative thinking, inquiry, and problem-solving' (Yeo and Pfeiffer 2018: 66). Since 2004, the programme has allowed gifted pupils to skip their O-level examinations (broadly equivalent to GCSEs), and pursue A-level studies immediately instead. They are also allowed 'to have more time to engage in broader learning experiences and to pursue an area of interest and talent in greater depth' (Phillipson et al. 2009: 1446). In other words, the Singaporean model of gifted education does appear to include features that the rigorous research finds raises the performance of gifted children.

Certainly, it is important to stress that there is no methodologically sound research on whether Singapore's model actually provides tangible benefits for the children accepted, but given the research highlighted in the previous section, it is worth exploring the characteristics of this model further in future research. Devising a randomised trial in English schools following an in-depth investigation of the characteristics of the system would both enable us to do so and investigate to what extent the Singaporean model would work in the English context specifically.

This also applies to other high-performing Asian countries' approaches to gifted education provision, which are often highlighted as role models by countries in the West. Singapore's model appears to be similar in some respects to those in Hong Kong, South Korea, and Taiwan (see Cho and Suh 2016; Kao 2012; Phillipson et al. 2009; Yun Dai and Chih Kuo 2016).

The Singaporean model differs, however, from the provision in mainland China, where there is no national policy guiding the provision of gifted education, despite the fact that such education has been developed there for decades. Perhaps

due to the lack of institutionalisation, gifted education has also generally only been available to a limited number of students in certain urban areas there – with a focus mostly on acceleration rather than enrichment (see Zhang 2017).

Similarly, in Japan, there is no formal programme for gifted students, which is probably because selection of gifted students is inconsistent with the strong egalitarianism permeating Japanese culture. Since 2005, there has been an emphasis on nurturing gifted pupils through specific extracurricular activities, but these are almost exclusively restricted to science and technology (Sumida 2013). Less formal provision is provided in other subjects and contexts (Phillipson et al. 2009).

In other words, the rigorous evidence appears to support some Asian countries' provision more than others, but we still know very little about the relative effectiveness of the different models. Pursuing case-study research to identify the models' most important characteristics, for the purposes of devising relevant trials in the English context, is therefore likely to be a fruitful exercise.

For the purposes of identifying gifted pupils, we also want to highlight the apparent need to use a multi-pronged approach combined with universal screening. As noted in the section on methodology, identifying gifted children is not at all straightforward due to measurement error and differential developmental speed. Using different metrics and local norms of what it means to be gifted makes it possible to decrease the problem of measurement error, while continuous reassessments of all pupils enable authorities to pick up changes in the gifted population over time. Universal screening also ensures that pupils who are less likely to be referred by parents and teachers, such as minority pupils, are more likely to enter such programmes. The identification instruments do

not necessarily have to be performance based. For example, a newer approach to identifying gifted children is to subject all young pupils to a challenging curriculum in order to identify whether some of them have more potential than is normally the case (see Card and Giuliano 2016; Lohman and Korb 2006; Worrell et al. 2018). Nevertheless, again, we emphasise the need for more research in this field – supported by the new institutional framework suggested – before we draw strong conclusions for the English policy context.

Conclusion

The role of gifted education provision has for long been a fiercely debated topic in education policy circles. Yet as governments focus on increasing equity and raising achievement among low-performing pupils especially, gifted children from most backgrounds are often ignored. This is not desirable from a societal perspective. Moreover, high-performing pupils appear to contribute disproportionately to countries' economic growth, making it important to devise public policy to maximise their potential.

This paper has carried out a review of the empirical research on gifted education provision, with the goal of understanding what approaches are most likely to be effective. Overall, the review revealed a rather disappointing picture: there are few studies on the effects of gifted education from which it is possible to draw causal inferences. In relation to the effectiveness or otherwise of specific strategies focused on helping talented pupils in practical areas, such as art or music, we were not able to unearth a single rigorous study.

The few rigorous studies of gifted academic education that do exist all investigate American and European provision. Moreover, these studies do not generally reveal that current gifted education provision on average work as intended. This holds true both for studies analysing the benefits of specific programmes as well as studies analysing the benefits of selective schooling for high-performing pupils more generally.

The exception to this appears to be programmes that combine a focus on enrichment in combination with independent learning. This contrasts with the more general evidence, which suggests more traditional and teacher-directed models are preferable to less structured ones on average. But it is supported by cognitive research, which finds that discovery-based learning models improve performance among expert learners – and gifted children have many of the characteristics of such learners.

So far, enrichment/individualised provision models therefore appear the most promising avenue for realising the performance of gifted children. Interestingly, this approach does appear to be incorporated into the national gifted education programmes in some countries often highlighted in policy discussions, including Singapore.

Certainly, it is important to note that it is far from straightforward to identify gifted children due to measurement error and differential developmental speed. However, research suggests it is possible to decrease these problems by employing different identification metrics, local norms of what it means to be gifted, universal screening, and continuous reassessment.

Nevertheless, given the relatively poor state of the research, our most important policy lesson is to test different types of gifted education programmes – and ways to identify gifted children – on a smaller scale, in a randomised fashion, in English schools, in order to find out what works here. We therefore believe the government should fund the establishment of an independent organisation similar to the Education Endowment Foundation, with a remit to fund randomised trials investigating what works in gifted education specifically. Such an evidence-based approach would allow us to draw much more robust policy conclusions than is currently possible.

References

Abdulkadiroğlu, Atila, Joshua Angrist, and Parag Pathak. 2014. "The Elite Illusion: Achievement Effects at Boston and New York Exam Schools." *Econometrica* 82(1):137-196.

Adelson, Jill L., D. B. McCoach, and M. K. Gavin. 2012. "Examining the Effects of Gifted Programming in Mathematics and Reading Using the ECLS-K." *Gifted Education Quarterly* 56(1):25-39.

Allensworth, Elaine M., Paul T. Moore, Lauren Sartain, and Marisa de la Torre. 2017. "The Educational Benefits of Attending Higher Performing Schools: Evidence From Chicago High Schools." *Educational Evaluation and Policy Analysis* 39(2):175-197.

Angrist, Joshua D., Parag A. Pathak, and Christopher R. Walters. 2013. "Explaining Charter School Effectiveness." *American Economic Journal: Applied Economics* 5(4):1-27.

Angrist, Joshua D. and Jörn-Steffen Pischke. 2008. *Most Harmless Econometrics: An Empiricist's Companion.* Princeton: Princeton University Press.

Angrist, Joshua D. and Miikka Rokkanen. 2015. "Wanna Get Away? Regression Discontinuity Estimation of Exam School Effects Away From the Cutoff." *Journal of the American Statistical Association* 110(512):1331-1344.

Atherton, Paul, Simon Appleton, and Michael Bleaney. 2013. "International School Test Scores and Economic Growth." *Bulletin of Economic Research* 65(1):82-90.

Bailey, Richard, Gemma Pearce, Carrie Winstanley, Margaret Sutherland, Chris Smith, Niamh Stack, and Matt Dickenson. 2008. "A systematic review of interventions aimed at improving

the educational achievement of pupils identified as gifted and talented." EPPI Centre, Institute of Education, London.

Balart, Pau, Matthijs Oosterveen, and Dinand Webbink. 2018. "Test scores, noncognitive skills and economic growth." *Economics of Education Review* 134-153.

Barrow, Lisa, Lauren Sartain, and Marisa de la Torre. 2017. "The Role of Selective High Schools in Equalizing Educational Outcomes: Using Place-Based Affirmative Action to Estimate Heterogeneous Effects by Neighborhood Socioeconomic Status." Working Paper, Federal Reserve Bank of Chicago.

Barrow, Lisa, Lauren Sartain, and Marisa de la Torre. 2016. "The Role of Selective High Schools in Equalizing Educational Outcomes: Heterogeneous Effects by Neighborhood Socioeconomic Status." FRB of Chicago Working Paper No. WP-2016-17, Federal Reserve Bank of Chicago, Chicago, lL.

Beuermann, Diether W. and C. K. Jackson. 2018. "Do Parents Know Best? The Short and Long-Run Effects of Attending The Schools that Parents Prefer." Working Paper, Northwestern University, Evanston, lL.

Bietenback, Jan. 2014. "Teacher practices and cognitive skills." *Labour Economics* 30:143-153.

Blumen-Pardo, Sheyla. 2002. "Effects of a Teacher Training Workshop on Creativity, Cognition, and School Achievement in Gifted and Non-gifted Second-grade Students in Lima, Peru." *High Ability Studies* 13(1):47-58.

Booij, Adam, Ferry Haan, and Erik Plug. 2016. "Enriching Students Pays Off: Evidence from an Individualized Gifted and Talented Program in Secondary Education." IZA Discussion Paper No. 9757, Bonn.

Booij, Adam, Ferry Haan, and Erik Plug. 2017. "Can Gifted and Talented Education Raise the Academic Achievement of All High-Achieving Students?" IZA Discussion Paper No. 10836, Bonn.

Bui, Sa A., Steven G. Craig, and Scott A. Imberman. 2014. "Is Gifted Education a Bright Idea? Assessing the Impact of Gifted and Talented Programs on Students." *American Economic Journal: Economic Policy* 6(3):30-62.

Callahan, Carolyn M., Tonya R. Moon, Sarah Oh, Amy P. Azano, and Emily P. Hailey. 2015. "What Works in Gifted Education: Documenting the Effects of an Integrated Curricular/ Instructional Model for Gifted Students." *American Educational Research Journal* 52(1):137-167.

Card, David and Laura Giuliano. 2016. "Can Tracking Raise the Test Scores of High-Ability Minority Students?" *American Economic Review* 106(10):2783-2816.

Card, David and Laura Giuliano. 2014. "Can Tracking Raise the Test Scores of High-Ability Minority Students?" NBER Working Paper No. 20453, National Bureau of Economic Research, Cambridge, MA.

Castillo, Lisa C. 1998. "The effect of analogy instruction on young children's metaphor comprehension." *Roeper Review* 21(1):27-31.

Cho, Seokchee and Yewon Suh. 2016. "Korean Gifted Education: Domain Specific Developmental Focus." *Turkish Journal of Giftedness and Education* 6(1):3-13.

Clark, Linda. 2005. "Gifted and growing." *Educational Leadership* 63(3):55-60.

Clark, Damon. 2010. "Selective Schools and Academic Achievement." *B.E. Journal of Economic Analysis & Policy* 10(1):1935-1682.

Clark, Damon and Emilia Del Bono. 2016. "The Long-Run Effects of Attending an Elite School: Evidence from the United Kingdom." *American Economic Journal: Applied Economics* 8(1):150-176.

Clark, Richard E., Paul A. Kirschner, and Paul Sweller. 2012. "Putting Students on the Path to Learning: The Case for Fully Guided Instruction." *American Educator*, Spring, pp. 6-11.

Clotfelter, Charles T., Helen F. Ladd, and Jacob L. Vigdor. 2015. "The Aftermath of Accelerating Algebra: Evidence from District Policy Initiatives." *Journal of Human Resources* 50(1):159-188.

Coleman, Dona R. 1983. "Effects of the Use of a Writing Scale by Gifted Primary Students." *Gifted Child Quarterly* 27(3):114-121.

Coughlin, Cristy. 2011. "Research Syntheses of Direct Instruction Outcomes: A 'Tertiary Review'." Report, National Institute for Direct Instruction, Eugene, OR.

de Waal, Anastasia. 2015. *The Ins and Outs of Selective Secondary Schools*. London: Civitas.

Deaton, Angus and Nancy Cartwright. 2017. "Understanding and misunderstanding randomized controlled trials." *Social Science & Medicine*.

Delcourt, Marcia A. B., Dewey, G. Cornell, and Marc D. Goldberg. 2007. "Cognitive and Affective Learning Outcomes of Gifted Elementary School Students." *Gifted Child Quarterly* 51(4):359-381.

Duflo, Esther, Pascaline Dupas, and Michael Kremer. 2011. "Peer Effects, Teacher Incentives, and the Impact of Tracking: Evidence from a Randomized Evaluation in Kenya." *American Economic Review* 101(5):1739-1774.

Dustmann, Christian, Patrick A. Puhani, and Uta Schönberg. 2017. "The Long-term Effects of Early Track Choice." *Economic Journal* 127(603):1348-1380.

Dynarski, Susan, Daniel Hubbard, Brian Jacob, and Silvia Robles. 2018. "Estimating the Effects of a Large For-Profit Charter School Operator." NBER Working Paper No. 24428, National Bureau of Economic Research, Cambridge, MA.

Eyre, Deborah. 2010. "Room at the Top: Inclusive education for high performance." Report, Policy Exchange, London.

Eyre, Deborah. 2017. "What Really Works in Gifted and Talented Education." Report, National Academy for Gifted and Talented Youth, London.

Fabregas, Raissa. 2018. "A Better School but a Worse Position? The Effects of Marginal Middle School Admissions in Mexico City." Working Paper, Harvard University, Cambridge, MA.

Feng, Annie X., Joyce VanTassel-Baska, Chwee Quek, Wenyu Bai, and Barbara O'Neill. 2004. "A longitudinal assessment of gifted students' learning using the integrated curriculum model (ICM): Impacts and perceptions of the William and Mary language arts and science curriculum." *Roper Review* 27(2):78-83.

Figlio, David and Marianne E. Page. 2002. "School Choice and the Distributional Effects of Ability Tracking: Does Separation Increase Equality?" *Journal of Urban Economics* 51(3):497-514.

Gavin, M. K., Tutita M. Casa, Jill L. Adelson, Susan R. Carroll, Linda Jensen Sheffield, and Anne M. Spinelli. 2007. "Project M3: Mentoring Mathematical Minds - A Research-Based Curriculum for Talented Elementary Students." *Journal of Advanced Academics* 18(4):566-585.

Ginn, Peggy V., Marie C. Keel, and Laura D. Fredrick. 2002. "Using Reasoning and Writing With Gifted Fifth-Grade Students." *Journal of Direct Instruction* 41-47.

Haeck, Catherine, Pierre Lefebvre, and Philip M. Merrigan. 2014. "The distributional impacts of a universal school reform on mathematical achievements: A natural experiment from Canada." *Economics of Education Review* 41:137-160.

Hanushek, Eric A. and Dennis D. Kimko. 2000. "Schooling, Labor-Force Quality, and the Growth of Nations." *American Economic Review* 90(5):1184-1208.

Hanushek, Eric A., Jens Ruhose, and Ludger Woessmann. 2017. "Economic Gains from Educational Reform by US States." *Journal of Human Capital* 11(4):447-486.

Hanushek, Eric A. and Ludger Woessmann. 2012. "Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation." *Journal of Economic Growth* 17:267-321.

Heckman, James J. and Jeffrey A. Smith. 1995. "Assessing the Case for Social Experiments." *Journal of Economic Perspectives* 9(2):85-110.

Heller-Sahlgren, Gabriel. 2015. "Olika barn leka bäst? Kamrateffekter och utbildningspolitiska implikationer för Sverige." IFN Policy Paper nr 72, Research Institute of Industrial Economics, Stockholm.

Hodges, Jaret. 2018. "Assessing the Influence of No Child Left Behind on Gifted Education Funding in Texas: A Descriptive Study." *Journal of Advanced Academics*.

Jackson, C. K. 2010. "Do Students Benefit from Attending Better Schools? Evidence from Rulebased Student Assignments in Trinidad and Tobago." *Economic Journal* 130(549):1399-1429.

Kao, Chen-yao. 2012. "The Educational Predicament Confronting Taiwan's Gifted Programs: An Evaluation of Current Practices and Future Challenges." *Roeper Review* 34(4):234-243.

Kirschner, Paul A., John Sweller, and Richard E. Clark. 2006. "Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching." *Educational Psychologist* 41(2):75-86.

Koshy, Valsa, Carole Portman Smith, and Ronald Casey. 2018. "England Policy in Gifted Education: Current Problems and Promising Directions." *Gifted Child Today* 41(2).

Lavy, Victor. 2015. "What makes an effective teacher? Quasi-experimental evidence." *CESifo Economic Studies* 61(1):88-125.

Lohman, David F. and Katrina A. Korb. 2006. "Gifted Today but Not Tomorrow? Longitudinal Changes in Ability and Achievement during Elementary School." *Journal for the Education of the Gifted* 29(4):451-484.

Lucas, Adrienne M. and Isaac M. Mbiti. 2014. "Effects of School Quality on Student Achievement: Discontinuity Evidence from Kenya." *American Economic Journal: Applied Economics* 6(3):234-23.

Lynch, Sharon and Carol J. Mills. 1990. "The Skills Reinforcement Project (SRP): An Academic Program for High Potential Minority Youth." *Journal for the Education of the Gifted* 13:363-379.

Ma, Xin. 2005. "A longitudinal assessment of early acceleration of students in mathematics on growth in mathematics achievement." *Developmental Review* 25(1):104-131.

McMahon, Walter W. 2010. 'The External Benefits of Education' in Brewer, Dominic and PatrickJ. McEwan (eds), *The Economics of Education*. Oxford: Elsevier.

MoE. 2017. "Gifted Education Programme." Ministry of Education, Singapore.

Neihart, Maureen and Liang See Tan 2016. "Gifted Education in Singapore." Pp. 77-96 in *Gifted Education in Asia: Problems and Prospects*, edited by David Yun Dai and Ching Chih Kuo. Charlotte, NC: Information Age Publishing.

Newman, Tina M. 2008. "Assessment of Giftedness in School-Age Children Using Measures of Intelligence or Cognitive Abilities." Pp. 161-176 in *Handbook of Giftedness in Children*, edited by Steven I. Pfeiffer. Boston, MA: Springer.

Ofsted. 2013. "The most able students: Are they doing as well as they should in our non-selective schools?" Reference no: 130118, London.

Parke, Beverly N. 1983. "Use of Self-Instructional Materials With Gifted Primary-Aged Students." *Gifted Child Quarterly* 27(1):39-34.

Phillipson, N. S., Jiannong Shi, Guofeng Zhang, Den-Mo Tsai, Chwee Geok Quek, Nobutaka Matsumura, and Seokhee Cho. 2009.

"Recent Developments in Gifted Education in East Asia." Pp. 1427-1461 in *International Handbook on Giftedness*, edited by Larisa V Shavinina. Dordrecht: Springer.

Plucker, Jonathan A. and Carolyn M. Callahan. 2014. "Research on Giftedness and Gifted Education: Status of the Field and Considerations for the Future." *Exceptional Children* 80(4):390-406.

Pop-Eleches, Christian and Miguel Urquiola. 2013. "Going to a Better School: Effects and Behavioral Responses." *American Economic Review* 103(4):1289-1324.

Porath, Marion. 2006. "A developmental view of giftedness." *High Ability Studies* 17(2):139-144.

Preckel, Franzis, Isabelle Schmidt, Eva Stumpf, Monika Motschenbacher, Katharina Vogl, Vsevolod Scherrer, and Wolfgang Schneider. 2017. "High-Ability Grouping: Benefits for Gifted Students' Achievement Development Without Costs in Academic Self-Concept." *Child Development*.

Reis, Sally M., Rebecca D. Eckert, Fredric J. Schreiber, Joan Jacobs, Christine Briggs, E. J. Gubbins, Michael Coyne, and Lisa Muller. 2005. "The Schoolwide Enrichment Model Reading Study." Report, University of Connecticut, The National Research Center on the Gifted and Talented, Storrs, CT.

Renzulli, Joseph S. 1976. "The Enrichment Triad Model: a Guide for Developing Defensible Programs for the Gifted and Talented." *Gifted Child Quarterly* 20(3):303-306.

Richards, M. R. E. and Stuart N. Omdal. 2007. "Effects of Tiered Instruction on Academic Performance in a Secondary Science Course." *Journal of Advanced Academics* 18(3):424-453.

Robinson, Ann and Pamela R. Clinkenbeard. 2008. "History of Giftedness: Perspectives from the Past Presage Modern Scholarship." in *Handbook of Giftedness in Children*, edited by Steven I. Pfeiffer. Boston, MA: Springer.

Rogers, Karen B. 2007. "Lessons Learned About Educating the Gifted and Talented: A Synthesis of the Research on Educational Practice." *Gifted Child Quarterly* 51(4):382-296.

Schwerdt, Guido and Amelie C. Wuppermann. 2011. "Is traditional teaching all that bad? A within-student between-subject approach." *Economics of Education Review* 30(2):365-379.

Sekowski, Andrzej, Malgorzata Siekanska, and Waldemar Klinkosz 2009. "On Individual Differences in Giftedness." Pp. 467-485 in *International Handbook on Giftedness*, edited by Larisa V Shavinina. Dordrecht: Springer.

Steenbergen-Hu, Saiying, Matthew C. Makel, and Paula Olszewski-Kubilius. 2016. "What One Hundred Years of Research Says About the Effects of Ability Grouping and Acceleration on K–12 Students' Academic Achievement: Findings of Two Second-Order Meta-Analyses." *Review of Educational Research* 86(4):849-899.

Stockard, Jean, Timothy W. Wood, Cristy Coughlin, and Caitlin R. Koury. 2018. "The Effectiveness of Direct Instruction Curricula: A Meta-Analysis of a Half Century of Research." *Review of Educational Research* 10.3102/0034654317751919.

Stoddard, Elizabeth P. and Joseph S. Renzulli. 1983. "Improving the Writing Skills of Talent Pool Students." *Gifted Education Quarterly* 27(1):21-27.

Sumida, Manabu. 2013. "Emerging Trends in Japan in Education of the Gifted: A Focus on Science Education." *Journal for the Education of the Gifted* 36(3):277-289.

Sweller, John, Paul A. Kirschner, and Richard E. Clark. 2007. "Why Minimally Guided Teaching Techniques Do Not Work: A Reply to Commentaries." *Educational Psychologist* 42(2):115-121.

VanTassel-Baska, Joyce and Elissa F. Brown. 2007. "Toward Best Practice: An Analysis of the Efficacy of Curriculum Models in Gifted Education." *Gifted Education Quarterly* 51(4):342-358.

Welsch, David M. and David M. Zimmer. 2018. "Do High School Gifted Programs Lead to Later-in-Life Success?" *Journal of Labor Research* 39(2):201-218.

Wilkins, Michelle, Jesse Wllkins, and Tamra Oliver. 2006. "Differentiating the Curriculum for Elementary Gifted Mathematics Students." *Teaching Children Mathematics* 13(1):6-13.

Worrell, Frank C., Rena F. Subotnik, Paula Olszewski-Kubilius, and Dante D. Dixson. 2018. "Gifted Students." *Annual Review of Psychology*.

Yeo, Lay See and Steven I. Pfeiffer. 2018. "Counseling gifted children in Singapore: Implications for evidence-based treatment with a multicultural population." *Gifted Education International* 34(1):64-75.

Yun Dai, David and Ching Chih Kuo, eds. 2016. *Gifted Education in Asia: Problems and Prospects*. Charlotte, NC: Information Age Publishing.

Zhang, Zhitian. 2017. "Gifted education in China." *Cogent Education* 4:1-12.

The role of targeted education programmes in stimulating higher achievement among gifted children is a hotly debated topic in education-policy circles. Yet as governments tend to focus on increasing equity and raising achievement among low-performing pupils especially, gifted children are often largely ignored.

In this report, CfEE lead economist, Gabriel Heller Sahlgren examines the faltering progress of gifted education research towards policy-conclusive answers to the question what works in gifted education; what makes it so difficult to answer; and important new research suggesting ways forward, and country systems we might learn from.

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